European Gas Market Liberalisation

Competition versus security of supply?

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1. In search of an optimal market design

1.1 So far so good?

In the 1980s and 1990s, the privatisation and liberalisation of European gas markets emerged on to the political agenda. Back then, "many of the established actors in European gas industry still regarded the introduction of liberalisation as the equivalent of the end of civilisation" (Stern, 1998: 91). Ever since, attempts to liberalise European gas markets have faced strong opposition and resistance from the industry, and industry-oriented governments[2], desiring to maintain the existing market organisation. Initially ambitious regulatory targets set by the European Commission eventually boiled down to a very basic introduction of competition and liberalisation in the form of the first Gas Directive. Nevertheless, this European gas reform marks the starting point for restructuring the gas sector and its economic governance. European gas markets have gone through profound restructuring processes in the last 10 years. In 1998, the European gas market resembled a patchwork of national markets with highly heterogeneous regulatory regimes.[3] Since then, a European gas market reform has attempted to integrate and harmonise gas markets while allowing country-specific solutions that take account of different national characteristics. In early 2000, the European Commission (EC) expressed the over-optimistic expectation of reaching full liberalisation by 2004. Two years later, the European gas market reform was described as a 'patchy process' (EC Inform-Energy, 2002: 16). In 2007, the EC officially spoke out about what many observers had been claiming for years: that European gas markets lacked competition, cross-border integration and harmonisation. Due to the discretion allowed within the European framework regulation, member states could largely choose

which regulatory instruments they would apply. As a consequence, the reform brought about a 'divergent convergence' of regulatory regimes, which now functions as a framework for natural gas market organisation in the European Union. The evolution of regulatory regimes has been mainly documented by the Commission's benchmarking reports, and a comparative academic analysis is lacking. So far, it has been mainly the legal aspects of the gas reform that have been subject to research (Cameron, 2002; Hancher, 2003) and there have been single country studies (e.g. Arentsen and Künneke, 2003; Mez, 2003; Arentsen, 2004; Finon and Midttun, 2004; Helm, 2004; Lohmann, 2006; Cavaliere, 2007).

The European gas market reform was introduced with the aim of completing the European internal market and enhancing the economic competitiveness of the European Union by promoting efficiency gains and affordable energy prices within the gas sector. To achieve these goals, the European Union followed a public policy approach that is based on the structure-conduct-performance paradigm of industrial organisation (Bain, 1968; Scherer and Ross, 1990). According to the neoclassical assumption underpinning the paradigm, a regulation-for-competition[4] approach is expected to induce a more competitive industry structure, which will create incentives to change business conduct, and finally to result in efficient economic performance. In neoclassical economic theory, economic performance is largely measured in terms of optimal use of resources (efficiency) and prices, and does not necessarily safeguard public service obligations. Neoclassical theory perceives that 'the invisible hand of the market' will ensure that supply satisfies demand. Nevertheless, alongside these first-order economic goals, such as prices and efficiency, second-order goals related to the fulfilment of public obligations (PSOs) have received increasing attention on the political agenda. In the gas sector, the most prominent PSOs are related to environmental and security of supply concerns. The availability of affordable gas is not only pivotal for the gas sector, but also the central focus within this analysis. Security of supply concerns can either be related to immediate security measures in response to supply disruptions, due to technically or politically induced emergencies, or understood as long-term issues which might be a result of a lack of investment in import facilities and transmission networks within Europe (Luciani, 2004). The overall reform objectives now incorporate both first- and second- order goals but, as yet, there is no theory-guided empirical test to assess whether the reform goals have been achieved.

The liberalisation of natural gas markets has seen a clash of industry visions on how to ideally structure the market to optimise social welfare (Morrision, 2005). As such, the benefits of the liberalisation policy are highly contested. Traditionalists are in favour of the pre-liberalisation model, in which vertically integrated natural gas utilities formed, often territorially fragmented,

monopolistic or oligopolistic markets. Central network coordination by a single firm predominated. Liberals, conversely, advocate a competition-based market model, encompassing third party access and ownership-unbundled utilities. The idea of market integration and harmonisation is often challenged by reform opponents who raise the fundamental question as to why natural gas market regulation should be harmonised in the first place. At the Flame conference in Amsterdam at the beginning of 2005, the CEO of Wintershall, Reinier Zwitserloot, rejected what he labelled the 'Einheitswurst'[5] of a single European regulation (Lohmann, 2006: xviii). His position was based on the argument that regulatory instruments induce different effects in different countries and that this is most commonly linked to the political request for country-specific regulatory solutions. Certainly, characteristics of national gas markets such as market size, existing networks or import infrastructure and market structure do matter. One of the several reasons why the EU voted for a framework regulation as the main legal instrument for the European gas market liberalisation was to ensure that national characteristics could be taken into account in setting up an appropriate regulatory regime. In general, the European Commission did not take a dogmatic view in this regard but, at the same time, it did advocate the idea of liberal market integration which necessitates a certain degree of harmonisation to enable the interoperability of European gas markets. Consequently, the EC did not directly prescribe a coherent best-practice model, but instead expressed preferences with regard to individual regulatory instruments. Proponents such as the Commission argue in line with the structure-conduct-performance paradigm (section 2.2.5) when claiming that liberalised markets reduce monopoly rents while assuming consumer demand will ensure the necessary infrastructure being in place in a timely manner.[6] In contrast, opponents argued that liberalised markets do not provide sufficient incentives to ensure an adequate level of investments. As a result, this view suggests, underinvestment might result in a failure to meet the security of supply obligation that regulatory authorities are supposed to guarantee. Another prominent argument against the breaking up of integrated energy companies is related to the evolving demand-side competition that is a characteristic of the political economy of international energy markets (Birol, 2008). The concentration of reserves in a few gas-producing countries coupled with the growing demand in consuming countries increases the negotiating power of the natural gas exporting companies vis-à-vis importing companies. On this basis, it is argued, a fragmented market structure with relatively small companies purchasing smaller volumes will probably result in less favourable contracts and prices (General Energy Council of the Netherlands, 2005). This has led to a call to maintain, or create, market power through national or European champions. In practice, regulatory choices often fail to reflect optimal

solutions, or the position of either the traditionalist or the liberal groups, but are compromises between the conflicting views. When discussing a recent US electricity regulation, Morison concluded that the ability to reach consensus on a single industry vision is pivotal in establishing a coherent regulation (2005: 15). In the future, such a third, more consensual, option could lie between fragmented competitive market and unregulated monopolistic market designs: a regulated oligopoly.[7]

Practitioners involved in energy governance as well as academics often admit to a shared endeavour: they are all in search of an optimal market design. Initially, it was experiences stemming from the gas reforms in the United Kingdom and the United States that inspired market designers (International Energy Agency, 2000). However, due to the severe malfunctions and overall complexity of the European gas reform, observers felt a growing uncertainty as to whether the UK regulatory regime was appropriate as a raw model for direct application in other European countries. In general, only a few market design elements are discussed in the media[8] (International Gas Union, 2006: 18) even though regulatory regimes consist of a wide range of elements. More-specialised elements of regulatory regimes are the subject of workshops organised, for instance, in the context of the Madrid Forum or by other supplementary regulatory bodies and related associations. Experiences of energy market reforms have also taught that "nearly all market reform initiatives have had to go through redesigns and/or realignments – what Joskow (2006) refers to as 'reform of the reforms' – to address deficiencies in their original structures" (Sioshansi, 2006: 63). As our analysis will show, the EU gas reform shares this fate and newly established regulatory regimes undergo refinement and redesign. This thesis aims to contribute to the understanding of the evolution and redesign of the European gas reform and the effects on economic performance by referring to new institutional approaches within regulatory studies. Ultimately, the dissertation offers an academic viewpoint on the claims that opponents and proponents of European gas market liberalisation advance, and in so doing it tries to widen the scope of ongoing political debates.

1.2 Economic governance: the modernised theory of the state meets the extended theory of the firm

1.2.1 European governance in flux

Across the advanced capitalist world, state control has been considerably transformed: from government to governance[9] (Treib, Bähr and Falkner, 2007). The transformation of both states and markets has been a complex, interlinked process resulting in changes in governance and its modes that have affected

both the economic and political spheres. From the 1980s onwards, state-owned utilities have increasingly been perceived as less efficient than privately-owned ones.[10] Moreover, exploding public spending provided a tailwind for the New Public Management movement that promoted the rolling back of the state, or at least the redefinition of its functions. Whereas, formerly, the welfare state emphasised redistribution and taxation, the evolving regulatory state shifted its core functions to redistribution, stabilisation and regulation (Moran, 2002; Jordana and Levi-Faur, 2004; Scott, 2004; Prinz, Steenge et al. 2005; Christensen and Lærgreid, 2007). The promotion of market privatisation and liberalisation resulted in a global wave of regulatory reforms (Jordana and Levi-Faur, 2004). Before long, practitioners and scholars realised that rather than a process of liberalisation (in the sense of the state not interfering) being initiated, in effect a process of re-regulation was under way.[11] Christensen and Lærgreid succinctly summarised this as: "the state is kept at arms length from direct participation in the economy but has a well developed regulatory role" (2007: 11). On the basis of the single European Act (1987) and the agreement to create a European Economic Area in 1992, the European Union pursued European market integration and harmonisation alongside an initially ambitious liberalisation agenda (Jabko, 2004). The common market policy implied profound changes to economic governance in the European Union. Vertical decision-making gradually shifted from national to supranational coordination, resulting in multilevel governance (Bressers and Kuks, 2003). Horizontally, non-state actors became increasingly involved in policy formulation processes on all levels (Kohler-Koch, 1999; Warntjen and Wonka, 2004). Instead of traditional command-style policies, regulation became increasingly important as a mode of governance (Follesdale, Wessel and Wouters, 2008). Academics have argued that the rise of regulation in the European Union was abetted by the weakness of command and the lack of budgetary decision power within the EU institutions (Majone, 1998; Moran, 2002). To date, a more-comprehensive explanation for the rise of regulation in the European Union is lacking. Nevertheless, once Majone had postulated the idea of the European regulatory state[12], scholars of various disciplines have tried to capture what has replaced statutory state regulation in the European Union (Majone, 1998).

1.2.2 *Theoretical responses to changes in the economic governance in utilities*

The recent transformation of state control and markets has profoundly influenced the development of regulatory studies. Governance phenomena have challenged the existing theoretical approaches within social sciences. While economics has always had a strong stake in regulation theory, political science (including public administration) has discovered an interest in regulatory issues and placed

them on its research agenda. To explain this development, Braithwaite et al. divide the genesis of regulatory studies into a phase before and a phase after governance (Braithwaite, Coglianese et al., 2007). Historically, "regulation as a subject of social science grew out of a convergence of many streams of other fields" (ibid: 1) such as law, economics, sociology and criminology. The first wave of regulatory studies tried to explain the evolution of regulatory agencies in the United States and is strongly related to the anti-trust, privatisation and liberalisation measures seen during the 1920s and 1930s. Economic theory tried to capture related phenomena and several theoretical responses such as self-interest and public interest theories emerged. Genoud as well as Christensen and Lærgreid offer a consolidated review of regulation theories and of theories applied to regulation (Genoud, 2001; Christensen and Lærgreid, 2007). In the second generation of regulatory studies, the notion of economic governance has evolved in parallel with the wave of privatisation and liberalisation[13] seen since the 1980s. This triggered additional responses from political scientists inspired by governance theory and from a second generation of New Institutional Economists. In the next section, we will concentrate on these new responses and show how their evolution has been a critical response to limitations perceived in earlier regulatory schools and in what way they promise to advance the study of regulation.

Regulatory studies are characterised by theory pluralism (see section 2.2.2) and do not share any coherent understanding of what economic governance is and what it is not. This is historically related to the fact that the subject drew from theories from different disciplines with different assumptions, concepts, research interests and methods. Today, the dialogue between the disciplines is still limited – mostly due to the fact that they live in different academic spheres – each with its own journals, conferences and professional networks. Nevertheless, mutual recognition and inspiration among the disciplines is slowly growing. This history is reflected in the different perceptions of economic governance and its institutional changes. We will contrast the distinct notions found in the fields of political science and of New Institutional Economics (NIE). In very general terms, economic governance can be understood as a decision-making process that directly influences the economic activity of a certain territory or scope (e.g. an economic sector). The literature distinguishes between decision-making processes that are primarily economic or political, and that take place in the political and/or economic spheres.[14] Political science approaches differentiate the territorial dimension of the concept, and distinguish between economic governance within international regimes, regional economic areas, and national and sub-national settings. In this interpretation, economic governance is perceived as the governance of the economy, or a specific economic sector,

within a particular territory with the participation of public and private actors. In this sense, it is a sector-differentiating interpretation to which the governance approach in the modernised theory of the state (Schneider, 2004: 25) can be applied. In contrast, NIE economists in general, and first-generation transaction costs proponents in particular, have traditionally restricted governance to the economic world of firms and markets.[15] The theory of the firm was originally formulated by Ronald Coase and attempted to theoretically define the firm in relation to the market (Coase, 1937). By explaining why firms organise as firms, and decide to integrate or outsource certain services or functions (make or buy decisions), New Institutional Economics and transaction cost economics (TCE) attempted to redress the neglect of institutions in neoclassical economic theory. As such, New Institutional Economics and transaction cost economics were essentially theoretical responses to neoclassical theory which perceived a firm as a production function[16] rather than as a governance structure. In contrast, NIE claimed that institutions matter (North, 1990) and, more specifically, TCE argued that the characteristics of transactions influence the organisational choice of a firm which in turn affects its performance (Joskow, 1993: 522; Williamson, 1999: 444). In the second generation of transaction costs economics, Williamson and others extend the scope of economic governance to the public sphere (e.g. Frant, 1991; Dixit, 1996; Frant, 1996; Williamson, 1997; Williamson, 1999). In this way, transaction cost economics sets out to explain not only the organisational choices made within firms but also regulation as a special variant of transaction, regulatory choices *per se* and their effect on economic performance (see section 3.4, and Williamson, 1999). By extending TCE to the public sphere, the modernised theory of the state meets the extended theory of the firm to explain phenomena of economic governance.

1.2.3 The second generation: challenging the theories of economic regulation

Still, new institutional approaches in political science and economics face severe limitations in their ability to explain phenomena related to economic governance, regulation and its effect on performance when they are outside their own core realm. Despite the fact that policies and regulation are supposed to achieve competitive prices and generate efficiency gains, as well as guarantee public service interests, political scientists face the problem of not being theoretically equipped to explain economic performance. Rather, their modernised state theories are limited to analysing policy processes and their outcomes.[17] Consequently, performance indicators are related to political performance, for instance in the form of implementation practices. Early regulation theories, to an extent, integrated the effect of regulation on economic performance, but suffered from an economic bias. This bias is rooted in the neoclassical

assumptions and hinders the ability to fully account for the governance aspects which are key in regulatory processes in particular and in institutional change in general. Compared with the new institutional approaches within political science, new institutional economics is better equipped to explain institutional change and how institutions affect economic performance. Utility regulation has often been subjected to transaction cost economics, but the application of TCE to the public sphere remains in its infancy.

Economic governance is about institutional change and has both political and economic dimensions. This interlinking has been acknowledged in recent regulatory studies but, so far, the social embedding of economic governance has not been theoretically explained (Williamson, 2000: 597). For this reason, first-generation regulation theories (i.e. pre-governance) faced severe criticisms for their inability to explain regulatory processes and regulatory outcomes. Genoud proposed grouping the various theoretical approaches of the prevailing schools into explanatory, descriptive and predictive theories. All were seen as potentially able to explain certain facets, but incapable of embracing the whole set of phenomena addressed in regulatory studies. We will start by presenting some of the shortcomings inherent in the group of theories which originated from so-called 'welfare economics'. Self-interest theory (also known as capture theory) concluded that "between the two main contending interests in regulatory processes, the producer interest tends to prevail over the consumer interest" (Peltzman, 1976: 212). In other words, this theory enables one to predict industry-oriented regulatory outcomes[18], but it will not provide an explanation for deviant regulatory outcomes and is of limited use in a dynamic institutional environment (Genoud, 2001; Weinmann, 2004). Public interest theory, on the other hand, provides an explanation, and also a justification, for regulating a market in order to correct market failures such as those related to externalities, market power, natural monopoly and information problems (Breyer, 1982; Ogus, 1994; Newbery, 2001a; Christensen and Lærgreid, 2007). New Institutional Economics was critical of the normative impediment that is inherent in public interest theory and bewailed the absence of government failure as a trigger for abolishing or redesigning regulation (Coase, 1964: 195). The explanation offered for institutional change in the form of regulatory choices simply rests on bad economic performance. For this reason, Newbery criticised normative theory for being too static (Newbery, 2001a: 139). How can one explain a regulatory change if the best feasible regulation is already in place?

Principal agent (PA) models and theories (e.g. Laffont and Tirole, 1993; Laffont, 2000) form a second group known as the descriptive theories of regulation (Genoud 2001: 11). These approaches analytically focus on the relationship between the parties involved in the regulatory processes such as

ministers, independent regulatory agencies and regulated companies.[19] Principal agent approaches analyse delegation and post-delegation relationships. The former explains when and why elected politicians create agencies and transfer formal powers to them, whereas the latter considers relationships between for instance elected politicians and agencies after the institutional design has been set (Thatcher, 2005: 349). PA approaches start by identifying the aim of the principal as assuring its own primacy over the agent by commanding, controlling and setting incentives. In turn, the agent seeks to gain an advantage through its information asymmetry over the principal. "A series of theorems were developed about the forms of optimal contracts between principal and agent, under various conditions of uncertainty and risk aversion" (Frant, 1991: 116). The strength of the PA approach lies in it providing a general mechanism which allows the anticipation of possible actions that agents might chose. In other words, it is a powerful theoretical tool to analyse the agency dimension of regulation. Knowing the functionality of these mechanisms increases not only the understanding of regulatory processes, it can also be used for the design of regulatory instruments.[20] PA models are an important source of explanation but they fail to explain final regulatory choices (Genoud, 2001: 11).

The third set of theoretical approaches, predictive or normative theories (Newbery, 2001a: 136-139) "aim at defining the instruments of regulation, and are generally derived from the previous theories" (Genoud, 2001: 11). In general, these approaches strive to uncover the optimal regulatory instrument for a particular regulatory function. Here, the need for regulation is seen as a given, and the line of thinking starts, for example, with the question of how to respond to monopoly situations by applying particular instruments. With reference to utility regulation, Genoud makes a distinction between two main research avenues (Viscusi, Vernon et al., 1995; Genoud, 2001). One assumes infrastructure to be a natural monopoly and searches for the ideal pricing mechanism (e.g. Vickers and Yarrow, 1988). The other identifies natural monopoly elements in the value chain of utilities and proposes alternative methods to regulate specifically those elements (e.g. Baumol, Panzar and Willig, 1982; Demsetz, 1989). As an illustration, in natural gas markets trade is perceived as a competitive element and transport as a monopoly element in the value chain. For the latter, the use of and access to the infrastructure has to be regulated. Discussions are based on incentive regulations such as specified rates-of-return or price-caps (see section 5.10.2) (Beesley and Littlechild, 1992).

Even though the three groups of first-generation regulation theories generated important insights and contributed to the understanding of how regulation functions, many phenomena were still not sufficiently well explained. Thus, theory development continued into a second generation of regulation

theories following the popularity of governance. Due to their neoclassical assumptions, the earlier economic regulation theories were challenged within economics by NIE scholars and from outside by political scientists who were concerned with explaining regulatory processes and choices. Genoud explicitly addresses the economic bias in first-generation regulation theories, arguing that mainstream economists adhering to the early regulation theory always perceive regulation as a second-best option, with a competitive environment always being the more efficient way to determine pricing and resource allocation. Further, he argued, "those economic theories are of little help when it comes to conceptualising the political dimension of the regulatory process. They develop weak or oversimplifying assumptions on both the institution and policy design of the regulatory process" (Genoud, 2001: 12). Instead, neoclassical equilibrium models often assume an idealised world[21], with rational actors in competitive markets as standard, and a stable institutional environment. NIE challenged these assumptions, and countered by respecifying the core concepts such as bounded rationality and quasi-markets as opposed to competitive markets. In 1975, Williamson rejected the neoclassical assumption of competitive markets as a common standard and instead introduced the idea of quasi-markets. Although the concept of quasi-markets remained very vague (McMaster, 2001)[22], it created an impulse to rethink the reach of neoclassical approaches and the perception of economic governance within economics.[23] Over the following decades, the first-generation of NIE scholars proved that institutions do matter (Williamson, 1985; North, 1990). Since then, the neoclassical assumption that the rule of law is a given and transactions are costless has been revised (Dixit, 2003). As a consequence, TCE introduced a distinct definition of efficiency which complemented the neoclassical distinction between productive and allocative efficiency[24]: "the central meaning of efficiency within TCE, therefore, is transaction efficiency: the extent to which institutions are tuned to the relevant environment" (Van Genugten, 2008: 28).

Using the discriminating alignment theorem, transaction cost economists are able to explain institutional choices and how they relate to economic performance. Williamson summarises the discriminating alignment hypothesis as follows: "transactions, which differ in their attributes, are aligned with governance structures, which differ in their cost and competence, so as to effect a (mainly) transaction-cost economizing result" (Williamson, 1998: 15). According to this theorem, the attributes of a transaction are key in optimising design choices. If the attributes of a transaction do not fit the governance structure, the alignment hypothesis predicts a negative effect on transaction costs which will result in a decreased performance and provoke a change to the existing governance structure. The second-generation of transaction cost

economics extended its reach to the public sphere. This advance mainly rests on the assumption that any transaction which can be formulated as a contracting problem can be evaluated within the transaction cost framework. Second-generation TCE research addresses whether misaligned modes of governance lead to inefficient results in terms of transaction costs and lower performance (Yvrande-Billon and Saussier, 2005; Van Genugten, 2008).

Williamson, one of the founding fathers of transaction cost economics, presented the economics of institutions in a four-layer framework which demonstrated the socio-political embeddedness of regulation (Williamson, 1998). Recently, scholars have found that Williamson's four-layer framework helps to explain differences in economic governance from an evolutionary perspective (see Groenewegen and Künneke, 2005; De Vries and Correljé, 2006; International Gas Union, 2006; Correljé and De Vries, 2007). More precisely, the framework contributes to understanding "why economic institutions have emerged that way they did and not otherwise" (Williamson, 1998: 25) by offering a set of categorical variables. Some of the causal relationships addressed in the framework build on well-developed research traditions in NIE such as transaction cost economics, principal agent approaches and historical institutionalism. Other relationships such as feedback processes are less researched. Nevertheless, the application of transaction cost economics is part of the progressive research programme within NIE to explain regulatory choices at the interface of the public and private spheres. The application of transaction cost economics to the gas reform is discussed in the theoretical chapter (chapter 3) which considers its possibilities and limitations, and how it can be complemented with additional NIE approaches. In recent regulation studies, some scholars have advocated a synthesis of theories that contribute to regulatory studies (Christensen and Lærgreid, 2007). Despite Genoud's criticisms, he emphasises that economic regulation theories should not be discarded. Instead, he proposes that these early economic regulation theories should be balanced and complemented by political science and sociological approaches (2001: 12). Governance literature inspired by political science can support the political dimension and conceptually enrich the perception of regulatory processes and regulatory choices in formulating a public regulation approach.

Nevertheless, a dilemma remains. Political science contributions to the governance field enable one to analyse political processes but they cannot account for the effects on economic performance. Conversely, transaction cost economics is able to explain how governance structures relate to economic performance; but fall short in incorporating the political process into the theory. Our approach integrates a transaction cost framework complemented

by a principal agent perspective and combines this with a public regulation approach to empirically study the evolution of the European gas reform.

1.3 Research questions

An overview of the potential research questions within contemporary regulatory studies in the context of the European Union reveals it is a long, rich and perhaps inexhaustible list that promises important insights into the transformation of modern states. The list includes the following: what kind of regulatory regimes have evolved across the EU? Do the changes in governance reflect a race to the bottom in terms of consumer, environmental and social standards (Vogel, 1995)[25] or, conversely, do new modes of governance promote best-practice and foster improved performance? Which roles do non-state actors actually fulfil? In general, the questions reflect two main research interests. One strand of research focuses on analysing both causes and facilitating factors of regulatory choices; the other is more concerned with investigating the effects of regulatory reforms (Christensen and Lærgreid, 2007). Our problem statement addresses both strands and enters the arena where the modernised theory of the state meets the extended theory of the firm.

> Informed by New Institutional Economics in general, and Williamson's four-layer framework in particular, this PhD thesis investigates the extent to which the evolution of regulatory regimes in European gas markets and the impact of those regulatory regimes on economic performance in the gas sector can be empirically analysed.

Our problem statement encompasses two basic questions:

Q 1: Which variables determine regulatory regimes and economic performance in European gas markets?

This question is first addressed in our theoretical considerations where we deduce variables which appear to determine regulatory regimes and economic performance. In a second step, we empirically investigate the impact of these variables in our qualitative and quantitative analyses.

Q 2: Can we empirically determine the effect of regulation-for-competition, as applied in the European Union, on the economic performance in the European gas markets?

Answering the second question necessitates differentiating between a positive and a negative: if the answer is yes, then we can elaborate on what we can learn about those causal relationships. If the answer is no, then we need to identify the obstacles which hinder an empirical study into the effects of regulation-for-competition on the economic performance of European gas markets.

By addressing the determinants of regulatory regimes and the impact of regulatory choices on economic performance in the gas sector, we tie in with a line of research followed by the second-generation of transaction costs economists. The dissertation focuses on an empirical study of the application of Williamson's four-layer model to European gas market liberalisation and evaluates central aspects of the framework on the basis of this empirical application. Earlier research has evaluated transaction cost economics systematically, although not exhaustively in a theoretical sense.[26] Although our research falls within the NIE and TCE research agenda, our ambition is modest. We share the belief that the application of transaction cost economics to the public sphere is possible (Williamson, 1999), but that it is limited and requires further modifications and specifications to account for the political process. The identification of some of the necessary modifications and specifications will be addressed as we progress (most notably in chapter 3).

A key modification involves employing a public regulation approach which conceptualises regulation and economic performance, and their interrelatedness, to express regulatory comprehensiveness. The public regulation approach conceptually distinguishes between first-order and secondary regulatory goals. Economic regulation takes into account prices and overall (including productive and allocative) efficiency considerations, whereas political regulation targets the safeguarding of public service obligations such as security of gas supply (Cox, 1999; Genoud, 2001; Genoud and Finger, 2004). We combine the transaction cost framework with a principal agent approach to capture the agency dimension in regulatory games. This synthesis enables us to differentiate theoretically between the effects of regulatory choices in distributing energy policy priorities among regulatory authorities in an environment which is characterised by multilevel governance.

To deduce the factors that explain the evolution of regulatory regimes and the way in which these regimes affect economic performance we draw on New Institutional Theory and transaction cost economics in the form of the four-layer model. In our theory chapter, we identify five factors that shape regulatory choices in European gas markets: the prioritisation of energy objectives, the specification of European legal provisions, the authority structure, a country's natural gas resource endowment and the economic performance of the gas sector. In a second step, the analysis seeks to empirically study the effect of

regulation-for-competition as applied on economic performance in the form of gas prices, network tariffs, efficiency and investments in import and transport facilities in European gas markets.

To facilitate our research goals, we draw on a comparative method, complementing quantitative with qualitative analyses. The quantitative research design reflects a two-step causal relationship and is displayed graphically in section 4.2.3. Initially, the two independent variables (prioritisation of energy policy objectives at the Community level and the specification of European legal provisions) are analysed for their effect on shaping regulatory regimes in the member states. In the second step, the specification of European legal provisions turns from a dependent into an independent variable in analysing the extent to which the effect of regulatory regimes on economic performance can be empirically studied. The time frame of the analysis is from 2000 to 2005 and includes the group of old member states (EU-15), but excluding Greece, Portugal and Finland who were granted exemptions from the European Gas Directives.

From the quantitative analysis, our main questions are partially answered through two sub-questions.

Sub-question 1.1: Does the prioritisation of energy policy objectives induce convergence of regulatory regimes?

Sub-question 1.2: Does specifying the European legal provisions for gas market reform induce convergence of national regulatory regimes in the natural gas sector?

The second empirical part also partially answers the two main research questions through two qualitative case studies. One analysis is of the unchanged UK gas storage regime and the other considers the realignment of the Dutch incentive regulation regime. The research design is less parsimonious than the quantitative analysis and contains five independent variables which are seen as determining regulatory choices. The prioritisation of energy policy objectives is considered as the key independent variable. Economic performance, European legal provisions, a country's natural gas resource endowment and the given authority structure are conceived as a sufficient set of independent variables, complemented by the prioritisation of energy policy, to offer a satisfactory explanation. The research design is elaborated in detail in section 4.3.1.

1.4 Thesis outline

The thesis is divided into three main parts. The structure of the thesis and the sequence of the research sub-questions reflect the construction of Williamson's four-layer framework.

In the *first part* (chapters 1-5), the theoretical groundwork is laid out and conceptual clarifications are provided. In chapter 2, the main concepts such as governance and regulation, and their interrelatedness, are determined and the public regulation approach to be followed is outlined. Here, the theoretical assumptions underpinning the gas reform are exposed and the justifications for regulation-for-competition and regulation-for-security-of-gas-supply based on public interest are defined. The concepts of regulatory comprehensiveness and policy convergence are introduced and these later serve as theoretical backbones in the formulation of a methodology to assess the convergence of regulatory regimes in European gas markets.

The third chapter discusses our theoretical framework and the support required from other New Institutional approaches to deduce expectations regarding the convergence of regulatory regimes and its effect on economic performance. Williamson's four-layer model is discussed in terms of applying it to the European gas market and the relevant variables are deduced. This allows us to elaborate our first research question which seeks to identify variables that determine regulatory regimes and economic performance in European gas markets. Moreover, we elaborate on the reach and explanatory power of transaction cost economics in terms of the political dimension of regulation. We combine the principal agent approach with transaction cost reasoning to formulate expectations on how our chosen variables will affect regulatory choices and economic performance. Furthermore, we draw on the literature on policy convergence to refine our expectations.

The fourth chapter contributes to answering our first research question by displaying the relevant variables and outlining how these can be operationalised. In addition, the time frame is outlined and the selection of cases is then justified. The case selection for the qualitative analysis is based on Mill's Method of Difference, while the quantitative analysis incorporates the largest possible population. We also address how the potential pitfalls of drawing inferences from possibly unrepresentative events can be limited if not avoided.

Based on the concepts of regulatory comprehensiveness and policy convergence, in chapter 5, a methodology is developed to measure best-practice in terms of regulation-for-competition. Regulatory regimes are operationalised in such a way that any convergence towards best-practice can be assessed across Europe. The result is an index consisting of 23 indicators covering regulatory

features of the downstream part of the gas value chain. Regulatory instruments and competencies are grouped along two dimensions and individually scored. At the end of the chapter, we summarise our methodology and assign different ranges of the index to identified model types: namely a minimal model, an emerging model and a best-practice model.

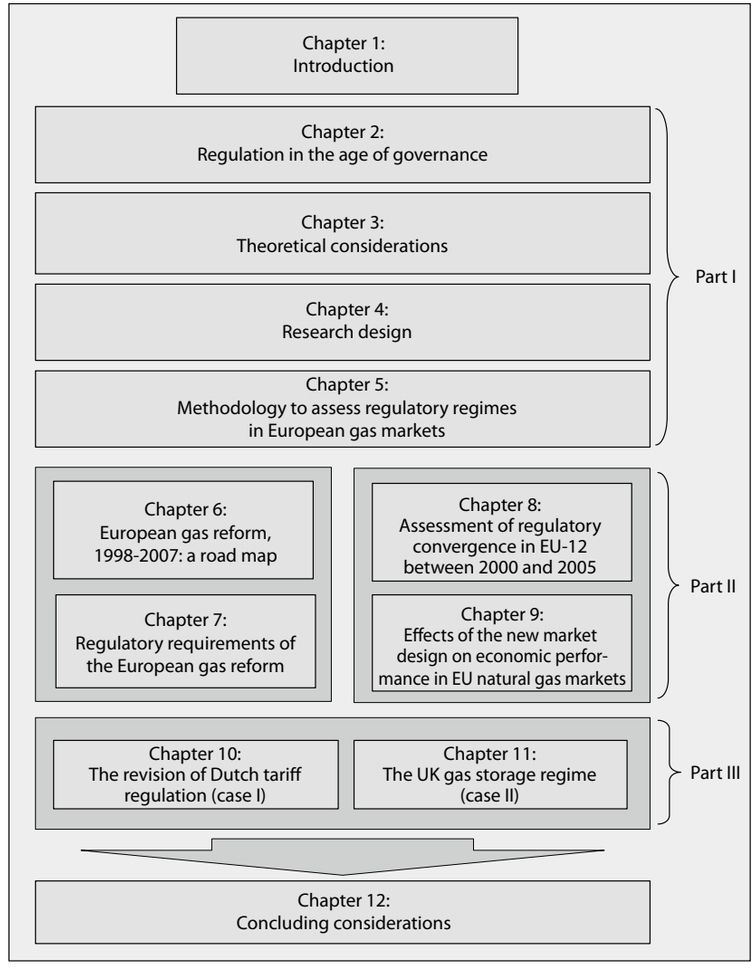


Figure 1: Readers guide

The *second part* (chapters 6-9) covers the first empirical analysis which is quantitative in design and emphasises effects originating at the Community level. Chapter 6 summarises the evolution of European gas policy at the Community level and searches for major changes in general or energy policy objectives and examines their prioritisation. In this way, this chapter enables an assessment of the prioritisation of energy policy objectives at the Community level. This forms the basis for answering sub-question 1.1: "does the prioritisation of energy policy objectives induce convergence of regulatory regimes?" At the same time, the chapter outlines the road map of the European gas reform between 1998 and 2007. In taking into account beliefs manifested in the form of policy objectives, we are referring to the informal institutions that Williamson placed on the first layer.

Chapter 7 addresses the formal institutions on the second layer of the four-layer model. Here, the legal texts constituting the gas reform are examined and, from this, the regulatory space available to the member states with regard to their regulatory choices is identified. Having elaborated on the regulatory space, more specific expectations with regard to regulatory convergence are formulated. This procedure enables us to analyse what effects the introduction of the new legislation has had on the convergence of particular instruments and on the regulatory regimes of European gas markets in general. This assessment of the European legal provisions provides the foundations for later answering sub-question 1.2: "does specifying the European legal provisions for gas market reform induce convergence of national regulatory regimes in the natural gas sector?"

Chapter 8 analyses converging and diverging trends within regulatory regimes in European gas markets. The analysis compares the regulatory regimes found in the old member states and covers the period from 2000 to the end of 2005. This time frame enables us to capture the effects of the first and the second Gas Directives and at the same time collect the necessary data.[27] The comparison is based on a concept of policy convergence which distinguishes between the rate and the degree of convergence. Our conceptual foundation allows us to explore common patterns or paths that member states have followed, and to measure the extent to which member states have decreased the distance between their regulatory regime and a best-practice model. The results are presented from a regime perspective and the findings are then examined on the indicator level. This chapter takes an essential step towards answering our two main research questions (Q1 and Q2) by estimating the regulation variable which is located on the third layer of Williamson's model. Having assessed the evolution of regulatory regimes, we then confront our results with the possible effects on economic performance. Chapter 9 sets out to assess the extent to which regulation-for-competition, as prescribed by the European provisions, can be empirically studied for its effect on economic performance in the European gas

sector. To answer our second main research question, we discuss the effects of regulatory regime on performance indicators reflecting economic and political regulatory goals such as natural gas prices, tariffs, efficiency and investment in natural gas infrastructure. In doing so, we are effectively investigating the effect of layer 3 on layer 4 in Williamson's model.

The *third part* comprises the qualitative case studies with which we aim to move from a static to a more dynamic perspective of the regulatory process. In two case studies, we investigate whether the distribution of energy policy priorities in a multi-authority structure does influence the regulatory outcome (hypothesis 3). Next, in chapter 10, the focus switches to the revision of incentive regulation in the Netherlands, which had the aim of reducing transmission tariffs. The case study seeks to explain the shift from a revenue-cap regulation to rate-of-return regulation taking place in 2007. In chapter 11, we examine the decision by UK regulatory authorities in 2006-07 not to compel the gas industry to provide additional gas storage, which would have reduced price volatility and enhanced security of gas supply.

In the concluding chapter, we summarise our main findings and answer our research questions. To facilitate this we revisit our theoretical approach and evaluate the opportunities and limitations of New Institutional Economics in general and, more specifically, Williamson's transaction cost approach in the form of the four-layer model. Following this, the empirical results of the quantitative and qualitative analyses are discussed. Finally, the main findings are summarized.

2. Regulation in the age of governance

"Regulation has become the new border between the state and the economy, and the battleground for ideas on how the economy should be run."

Giandomenico Majone (1998: 192)

Introduction

This chapter elaborates the main concepts of this dissertation and clarifies how they are interrelated. For this purpose, we draw on the conceptual work in political sciences generated by Comparative European Studies and regulatory studies. This body of literature regularly refers to new institutional approaches within political science (see section 3.2). This elaboration serves four aims. Firstly, elaborating on the conceptional relationship between governance and regulation enables us to develop a better understanding of the multilevel governance of European gas markets following liberalisation. Adopting a multilevel perspective makes it possible to outline the regulatory landscape of European gas market governance. This is necessary for our analysis of the developments at the Community level that have shaped gas market reform (chapter 6) and is also relevant for our theoretical decision to study specific cases in a qualitative manner (chapter 3). Secondly, by addressing the relationship between regulation and competitive gas markets, we can show how the advanced structure-conduct-performance paradigm determined the reform principles and design choices. Thirdly, the concept of regulation comprehensiveness advances the understanding of regulatory conditions for gas market competition and lays the theoretical grounds for the operationalisation of regulatory regimes in chapter 5. Fourthly, the concept of convergence helps in developing a measure to empirically assess and understand the similarities and differences between European member states in how they established regulatory conditions for gas market competition (chapter 8).

2.1 Governance in the European Union: its modes and applications

2.1.1 The notion of governance

In political sciences, governance has been often criticised for being a very vague concept. Nevertheless, the notion of governance has stimulated a wide range of literature and triggered a debate on the changing functions of the state and its modes of intervention in the political sciences (Kersberger and Waarden, 2004; Kooiman, 2003; Maynitz, 2004; Pierre, 2000; Pierre and Peters, 2005; Bressers and Kuks, 2003) and more specifically within European Union research (Eberlein and Kerwer, 2002; Héritier, 2002, 2003; Joerges, Mény, and Weiler, 2001; Knill and Lenschow, 2003; Treib, Bähr, and Falkner, 2007). The research agenda covers a variety of phenomena ranging from different institutional structures and actor constellations in political decision-making to varying types of policy instruments (Treib, Bähr, and Falkner, 2007: 1). "In essence 'governance' is about the ways and means in which the divergent preferences of citizens are translated into effective policy choices, about how the plurality of societal interests are transformed into unitary action and the compliance of social actors is achieved" (Kohler-Koch, 1999: 14). This is similar to the textbook definition by Benz, who additionally emphasises the coordination role of collective actors within such processes (Benz, 2004: 25). On this basis, Schneider suggests that theories explaining the phenomena related to governance can be conceived of as a modernised form of the theory of the state (Schneider, 2004: 5).

The introductory chapter has already alluded to the changes in the relative importance of various state functions, which ultimately cumulated in the postulation of a European regulatory state. With the decline of the welfare state, distribution and taxation paled vis-à-vis regulation, which emerged as one of the central features of state activity. As a result, "regulation can be conceived as that large subset of governance that is about steering the flow of events and behaviour [as] opposed to providing and distributing" (Braithwaite, Coglianese, and Levi-Faur, 2007: 3). Although the concept of regulation is dealt with in more detail below, it is noteworthy that regulation is viewed as narrower than governance. Recently, their shared interest in regulation led to the formerly separate streams of regulatory studies and policy studies becoming interwoven. Political scientists and public policy scholars have generated considerable conceptual work on the notion of governance. The insights stemming from such conceptualisations can form a basis on which to formulate a public regulation approach.

2.1.2 The conceptual trinity: policy, politics and polity

In a review article, Treib, Bähr, and Falkner classified existing understandings according to whether they emphasised the politics, the polity or the policy dimensions of governance (2007: 2). As a result, the authors compiled an overview of categories attributed to modes of governance in the European Union alongside these three dimensions (see Table 1). In particular, the policy dimension received considerable attention. Nevertheless, it remains an ongoing discussion as to whether the most drastic changes related to the concept of governance are related to the decrease of state intervention or to the growing involvement of private actors in the policy process (Kohler-Koch, 1999). Comparative empirical research has not delivered persuasive results with regard to this question. In practice, both elements occur and it is therefore difficult to measure the proportion and impact of either.

During the genesis of the governance concept, modes of governments such as policy instruments have often been attributed or distinguished according to their historical occurrence. Treib, Bähr, and Falkner (2007:10) rejected these old, and also new, modes as analytical categories on the basis that these categories were vague and tended to refer to sector-specific developments indicating whether a certain instrument had yet been applied or not. Instead, they argue, a content-related classification will enhance analytical clarity as the table below shows.

	Dimension	
Policy	**Politics**	**Polity**
Legally binding versus soft laws	Only public actors involved versus only private actors involved	Hierarchy versus market
Rigid versus flexible approach to implementation		Central locus of authority versus dispersed loci of authority
Presence versus absence of sanctions		Institutionalised versus non-institutionalised interactions
Material versus procedural regulation		
Fixed versus malleable norms		

Table 1: Dimensions and characteristics of the governance concept[28]

The characteristics of the policy dimension are concerned with various aspects and describe the degree of discretion or obligation of member states in adopting and complying with policies. Knill and Lenschow (2004) put forward a matrix which distinguishes between the degrees of discretion and obligation in a policy instrument. Self-regulation is characterised as having a low level of obligation and a low level of discretion whereas, at the other end of the continuum framework, regulation implies a high level of obligation and a high level of discretion. Regulatory standards, be they substantive or procedural, show mixed signals when they include low levels of discretion and high levels of obligation. In the interpretation of Knill and Lenschow, regulatory standards and procedural regulations are perceived as one mode of governance rather than a category with different attributes. Taking a different view, Treib, Bähr, and Falkner put greater emphasis on the question as to whether the policy is output or process oriented, and established a category for this in its own right. Accordingly, regulations might set substantive or material standards. The Directives on Bathing and Drinking Water (1975 and 1980) are such examples defining specific standards for water quality. Lenschow and Knill give examples in the field of environmental policy which establish certain procedures that are thought to raise awareness of problems and to strengthen certain groups in the field of the environment. Although these categorisations help to clarify the dimensions and categories of governance in general, in practice some difficulties might still arise in defining the main purpose of a policy instrument. The Gas Directives, for instance, establish certain standards, such as for legal unbundling, but, at the same time, introduce procedural elements for setting up complex monitoring procedures to reduce information asymmetry between regulatory authorities and the industry. Moreover, the category of fixed versus malleable norms is less obvious. This distinction considers the extent to which the norms included in a particular policy instrument are fixed, or context-related to other norms and policies. A decisive characteristic is one where the mode of governance contains the element of sanctions. Whether compliance is mandatory generally depends on the field of European policy and, more specifically, on the bindingness of a particular mode of regulation. Only if these two preconditions are met, can the community law be enforced by the European Commission and the European Court of Justice (ECJ). Non-compliance might then result in heavy financial sanctions (Treib, Bähr, and Falkner, 2007: 7).

The political dimension takes account of the type of actors involved in the policy process. The distinction between private and public actors reflects the growing involvement of private actors, such as non-governmental organisations, experts and industry in formalised as well as non-formalised modes of governance. It has been observed that “empirically there is no mode of governance that

includes either only pubic or only private actors" (ibid: 9). Therefore, a binary distinction, with only private or only public actors involved, is to a certain extent artificial and these should be interpreted as idealised ends of a continuum. By addressing the breakdown of the actors, the category expresses the tendency for one type of actor to prevail in a certain mode of governance. This allows one to distinguish between different forms of policy networks in the first place and, secondly, to analyse how these affect the policy process or outcome (Bressers and O'Toole, 2005; Marin and Maynitz, 1991).

In general, the polity dimension describes the institutional setting in which political decisions take place. It refers to how competences and power are distributed, and reflects the rules of the game. The distinction between hierarchy and markets as the categories within the polity dimension refers back to the transaction costs stream within New Institutional Economics (Arentsen and Künneke, 1996; Williamson, 1985). The New Institutional literature within political science transferred the idea of different mechanisms of economic governance to the political realm. Hierarchy and markets reflect two extreme poles on an analytical level, complemented by networks as a more hybrid form of interaction and distributed competences. "Markets correspond to pluralistic political fields, whereas public hierarchy is a configuration, in which policy-making and collective problem-solving would be exclusively limited to the state. Networks, finally portray a complex division of labour and a highly decentralized distribution pattern of control resources between public and private organizations" (Schneider, 2004: 32). Schneider relates the growing importance of networks to the functional differentiation and specialisation which increase the state's dependence on private actor groups. The growing complexity of regulatory tasks necessitates cooperation with actors outside the public realm in order to obtain information and acquire the expertise needed for the state to fulfil its steering and control functions.

The category of hierarchy versus markets and the category concerning the locus of authority reflect the dispersion of power. Unlike the former, the latter stresses the dispersion of power across the political landscape. In this respect, Treib, Bähr, and Falkner (2007) distinguish between vertical and horizontal dispersions. The horizontal dimension reflects the division of authority within a government, whereas the vertical dimension distinguishes power dispersion among territorial units, or the boundaries of the state.

When analysing modes of governance, one can discern the degree to which policy instruments are institutionalised. Traditionally, legislation and the rule of law are highly institutionalised within the European Union but, with the creation of so-called open method coordination (OMC), policy processes with a comparably low degree of institutionalisation and obligation have been

introduced. Within OMC procedures, the EU only sets benchmarks, while member states determine their own policy without fear of sanction (Knill and Leschnow, 2004: 221).

2.1.3 Multilevel governance in European gas markets

To understand multilevel governance in the European gas market after liberalisation it is necessary to identify the critical level of analysis and the modes of governance employed – a task this section will accomplish. We will outline the main characteristics of the European gas reform in terms of the three dimensions outlined above, starting by referring to the different modes of governance applied and progressing by outlining the regulatory landscape.

In terms of the theories used to explain the politics of the European Union, classical intergovernmental and supranational approaches have been challenged by multilevel governance theory. Contrary to the first two approaches, the latter assumes governance to be a reciprocal process between the national member states and the European institutions supplemented by a horizontal perspective which takes account of politics within the EU (Warntjen and Wonka, 2004: 10). As a consequence, "political arenas are interconnected rather than nested" (Marks, Hooghe, and Blank, 1996: 346). Political decisions can only be explained, it is argued, by taking into account the European and national levels of analysis and the various actors involved. An important contribution made by multilevel governance theories has been to challenge the supranational or intergovernmentalist approaches to European integration which consider either the supranational or the national level to be decisive (Christiansen, 2001). Rather, multilevel-governance-inspired approaches stress that political decision-making in the European Union occurs simultaneously on local, regional, national and Community levels. In this respect Warntjen and Wonka (2004) contrast two views often found in the literature: one advanced by Marks et al. that emphasises the vertical multilevel character of EU politics and the nation states' loss of sovereignty, and the other suggested by Kohler-Koch stressing the governance aspect, highlighting the relatively equal (horizontal) distribution of power in EU politics among private interest groups and public actors. Regardless of which view one favours, not taking a multilevel governance perspective on inter- and intra- institutional interactions runs the risk of not taking dispersion of competences into consideration. In practice, the multilevel perspective understands policy outcomes and processes to result from the impacts of various levels on the governance of a particular sector at a particular time. Hence, a multilevel governance perspective is seen as enabling one to open the black box of European governance and thus gain a fuller understanding of regulatory processes in a specific sector.

Three regulatory preconditions significantly shaped the path the European Union chose for its gas market liberalisation. *First*, was the application of a framework regulation as the main legal tool and, *second*, the use of communicative instruments to complement the harmonisation process. The applied framework regulation is characterised as having a high level of obligation and also a high level of discretion. Compliance is sanctioned by the EU, but member states retain discretion to determine their regulatory instruments, and this usually results in a two-step decision process. Although regulatory choices in the European Union are triggered by European legislation, they are finally determined at the national level. The only exemption, so far, is Regulation 1775 which has to be directly adopted by the member states (section 7.1). To complement this approach, the European Union uses communicative instruments such as the Madrid Forum to facilitate an institutionalised dialogue between public and private actors on gas reform matters. As we will discuss below in more detail, the public-private networks have initiated voluntary self-regulation on some aspects of the gas reform. These forms of self-regulation evolved at the Community level in the form of initially non-binding Guidelines. In parallel, elements of self-regulation evolved within national contexts as well. The most prominent example of self-regulation within the European gas market liberalisation has been the German association agreement (Verbändevereinbarung) on the basis of which negotiated third party access to the gas network was established. In this way, the German gas companies sought to prevent, or at least to postpone, the establishment of an energy regulator which would have introduced regulated third party access (Lohmann, 2006: 27-30). This brings us to the *third* precondition, the implicit decision against the supranationalisation of energy policy in the EU, and the associated circumvention of a Common European Energy Regulator, which resulted in a regulatory landscape that is characterised by a multi-authority structure on both levels.

In Figure 2 below, we present a static interpretation of the institutional structure, by referring to the relevant regulatory institutions. Unlike a dynamic view including all the possible institutional rules for defining the actors' relationships, the static interpretation limits the figure to displaying only the overall constellation pattern. The triangles indicate possible cooperation or conflict between the institutions included. The arrows point to cross-level or cross-actor group inputs. On the Community level, the European Commission clearly has a central position given its influence on legislation through agenda setting and its right to issue secondary legislation (Döring, 2007: 209-208; Steunenberg, 1994). As Majone pointed out, "the offices of the Commission responsible for a particular policy area form the central node of a vast 'issue network'..." (1998: 205). In our context, the Directorate-General for Energy and Transport (DG TREN)

and Directorate-General for Competition (DG COMP) are the parties mainly involved in promoting gas reform on behalf of the Commission. DG TREN has the mandate to respond to the Commission's initiative and propose legislation and regulations to the European Parliament and the European Council. Moreover, DG TREN, as the regulatory lead body, holds executive functions such as granting exemptions from certain European legal provisions. DG COMP's function is to oversee competition issues of a transnational character. Although the European competition authority only plays a complementary role in providing regulatory inputs, its impact in terms of enforcement is considerable. Based on their competence to conduct cross-national investigations in the form of a sector inquiry, DG COMP has a far-reaching tool at its disposal with which to gain sensitive sector knowledge. Moreover, a breach of competition laws may result in huge fines and is a powerful sanction. In other words, DG COMP is equipped with a wider range of competences than DG TREN. In general, the European Commission can also initiate infringement procedures if member states do not comply with their implementation obligations. In terms of the implementation of the Gas reform, DG TREN would be in charge of initiating any infringement procedures on behalf of the Commission. If a member state fails to meet the demands formulated during the procedure, the European Court of Justice can impose a sanction on the dissenter. The European Parliament and European Council are mainly engaged in the legislative process. Their role is to advise, amend, adopt or reject a European provision during the legislative process. The member states' interests are represented in the European Council, whereas the national regulators are organised through the Council of European Energy Regulators. In November 2003, the Commission created a Regulators Group for Electricity and Gas (ERGEG) which was expected to function as a nucleus for the establishment of a common energy regulator and to provide regulatory input from the national regulators to the European discussions by advising and proposing regulations (for the further development of ERGEG see section 6.4).

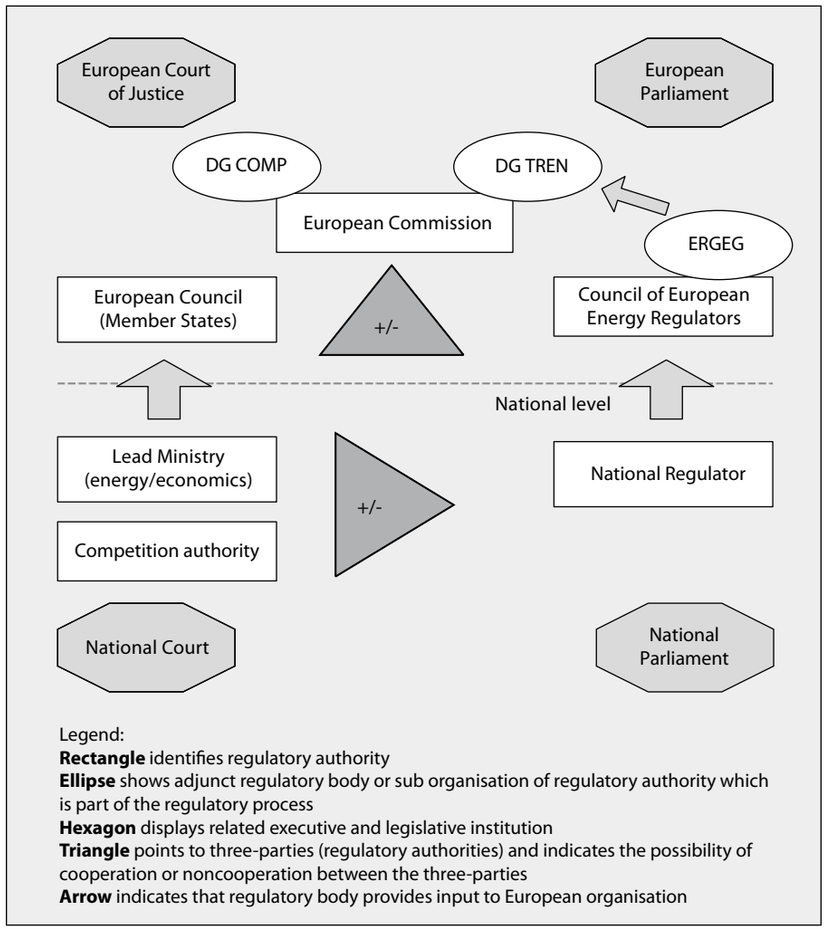


Figure 2: Regulatory landscape for European gas sector regulation

Historically, the theory of the state has perceived the state as a single actor. Our figure, however, demonstrates that the governmental side is not a monolithic block. Regulatory governance of the European gas market is fragmented. National configurations resemble to a certain extent the European pattern of fragmentation. Competences are usually distributed between the so-called lead ministry, the designated competition authority and the national energy

regulator. It differs from country to country as to which ministry takes the lead. Gas sector regulation has at times been assigned to the ministry of economic affairs, the ministry of energy or other ministries responsible for the energy sector.

Recent literature on regulation in various utility sectors suggests that inter-organisational or intra-organisational relationships are not *per se* cooperative in nature. Rather, the institutions involved in the regulation, be it intra- or inter- organisational, might be 'competitive' (Boellhoff, 2006). Tensions and competition for competences arise on both the national and Community levels as well as between national and European regulatory authorities. The two main issues where conflict arises in EU politics concern the left/right and the integration/sovereignty dimensions (Döring, 2007: 211). The left/right dimension is not well researched in regulatory studies. In the context of energy reforms, the dividing line tends to be drawn between market-based and state-controlled regulatory approaches (International Gas Union, 2006). A preference for one over the other might be mediated by left/right political orientations. As the historical discussion will later show (chapter 6), the integration versus sovereignty conflict has been very explicit during the discussion on whether a Common European Energy Regulator should be established or not. Despite this, academic analyses by political scientists of governance in European natural gas markets are missing. So far, the evolution of new governance structures and their effects are, as yet, not well understood. In this context, the EU Council and the Council of European Energy Regulators (CEER) have shared a reluctance to supranationalise competences and transfer decision-making power to the European Commission. At the same time, national regulators are challenging ministries and competition authorities as they strive for greater regulatory competency. In some instances, such as over the question of transferring competences, the regulatory games on the national level are separated from those on the European level. Nevertheless, particular issues related to regulatory functions might be brought forward by a national ministry and/or a national regulator to promote the national standard as a possible European standard. In other words, inter- and intra- institutional coalitions might be formed to promote issue-related specific preferences. To assess this multi-authority structure, we will later suggest adopting a principal agent perspective to analyse the case studies in a qualitative manner (Héritier, 2005).

2.1.4 *The Madrid Forum – a classic example of transnational network governance*

In the context of the European gas reform, the Madrid Forum (MF) functioned as the main instrument for facilitating transnational communication. The combination of framework regulations and a communicative forum is a classical example of applied network governance which lays particular emphasis on the

political dimension. According to Kohler-Koch's characterisation of network governance in the European Union, the state functions as the activator but, at the same time, a multitude of stakeholders are engaged in reaching functionally-specific agreements that cut across different levels (Kohler-Koch and Eising, 1999: 6). To understand the basic functions of the MF, we will first describe its institutional setting and then assess the quantitative inputs from various actor groups. Inputs here are understood as contributions to the forum in the form of presentations, comments, monitoring reports and discussion papers.

The Madrid Forum first met on 30 September 1999 and has since assembled once or twice a year in Madrid. Most representatives are delegated by the European Commission, the CEER or national regulatory authorities such as national regulators and involved ministries. In addition, international organisations such as the International Energy Agency and major interest associations such as Eurogas, the Electricity Association Eurelectric, the European Federation of Energy Traders (EFET), the International Federation of Industrial Energy Consumers (ECIC), International Association of Oil and Gas producers, European Chemical Industry Council, Gas Transmission Europe (GTE) and consumer groups take part. Depending on the agenda, additional speakers from consulting companies such as OXERA, the Brattle Group and Cambridge Energy Research Associates (CERA) may be invited to contribute their expertise to the meeting. The composition of the participants significantly changed in July 2004 due to the enlargement of the EU with ten new member states. Later, candidate countries, neighbouring countries and members of the European Economic Community (EEC), such as Norway, were also invited. Although the number of organisations participating has increased, the number of participants has remained much the same. In the second meeting, in May 2000, 28 organisations participated, and in May 2006 (the 11th Meeting) 41 organisations were represented.

The main objective and function of the Madrid Forum is to build a consensus among all the parties involved in the gas reform process. This mechanism has been explicitly created to complement the harmonisation process triggered by European legislation (Madrid Forum, 1999). The Madrid Forum has no decision-making structure, and functions solely as a communication platform. The aim is to decrease the information asymmetry between regulatory authorities and the industry while, at the same time, finding consensual solutions to the very complex regulatory issues. Alongside the information exchange, the Madrid Forum serves as an arena to test arguments, to convince other players and to build coalitions. The European Commission determines who is accredited and thus may participate. Moreover, the EC sets the agenda and decides whether any revisions to the agenda suggested by participants will be accepted. In practice, the European Commission thus plays a central role not only in the formal but

also in the informal decision-making structures that constitute European gas market governance.

Table 2 shows that the inputs from non-state actors account for two-thirds of the total inputs to the Madrid Forum. As such, the Forum mainly functions as a platform where industry associations can address their concerns to the regulatory authorities.

	Governmental Institutions	Industry	External Consultancies
MF1	1	0	1
MF2	4	15	
MF3	4	17	1
MF4	2	16	1
MF5	10	15	1
MF6	7	13	1
MF7	7	22	
MF8	6	30	
MF9	6	16	
MF10	7	19	
MF11	23	47	
MF12	15	18	
MF13	8	20	
Total input	**100**	**248**	**5**

Table 2: Input to Madrid Forum by actor group (1999-2007)[29]

The activities of the industry and regulatory authorities peaked at the 11th Madrid Forum in May 2006, following the end of our period of detailed examination. The increased engagement by all parties in that meeting can be explained by two circumstances. Firstly, industry actors wanted to actively participate in the formulation of interpretive notes to Regulation 1775, on the basis of which the implementation would most likely be assessed, with this meeting of the Madrid Forum taking place shortly before the implementation deadline. The timing and content of the meeting suggests that they perceived the formulation of interpretative notes as a process of setting subsidiary standards. Secondly, the second set of Guidelines, concentrating on issues related to Gas Storage Systems, was also on the agenda for this meeting. Having experienced how voluntary guidelines could be turned into legally binding Regulations, the interest groups wanted to be actively engaged in the process of drawing up new guidelines within

the Madrid Forum. Unlike framework regulations, Regulations do not require national consultation and decision-making, and are to be directly applied within the member states. This demonstrates how changes in modes of governance can trigger inputs and promote transnational mechanisms. The Madrid Forum, at least temporarily, became the main platform for exchange and lobbying.

Measuring the quantitative inputs of the various actor groups enables one to illustrate the extent to which regulatory authorities use transnational mechanisms to decrease the information asymmetry between themselves and industry actors. One should interpret the presentations and comments not only as preference statements, but also as part of the in-depth discussions on regulatory tools and their possible effects from which the involved actors learn from each other. Nevertheless, the statements made will be interest-driven and the information presented selective. The industry's involvement and its contributions within the transnational mechanism have been criticised for ensnaring regulatory authorities. Rather than relying on expertise from the industry, critics emphasise the need for regulatory authorities to be equipped with sufficient resources and human competences to overcome information asymmetry and so be in a position to pursue regulatory interests.

2.2 Regulation as a mode of governance

2.2.1 Regulation

The term regulation is, rather like governance, used in an inflationary way in public debates and academic discussions, and seldom do discussants share a common understanding. This situation can partly be explained by the scholarly diversity in which regulatory studies evolved (see chapter 1). This discipline and methodological pluralism results in various understandings of the regulation concept, reflecting different research agendas and disciplinary concerns. In the recent literature on regulatory studies, a threefold distinction within the notion of regulation has been recognised (Christensen and Lærgreid, 2007; Jordana and Levi-Faur, 2004). Baldwin proposed distinguishing among a) targeted rules; (b) all modes of state intervention in the economy; and (c) all mechanism of social control (Baldwin cited in Baldwin, Scott, and Hood, 1998). The narrow understanding conceives regulation as a specific form of governance: a set of authoritative rules, often accompanied by some administrative agency for monitoring and enforcing compliance. Regulation as a mode of governance in the general sense can be perceived as any aggregated efforts by state agencies to steer the economy. Apart from, for instance, specific Directives to liberalise a market, additional rule-making or measures, such as taxation, redistribution, subsidies and public ownership, are included in this more general perception. Regulation

in its widest sense goes even further by encompassing all mechanisms of social control and this loose interpretation does not even take into account whether social control is intentionally or unintentionally carried out (Bressers and Kuks, 2003; Christensen and Laegreid, 2007; Ogus, 1994). In this thesis, we see regulation in the narrow sense of the word, as a specific form of governance comprising intentionally formulated and targeted rules.

Despite the lack of an exhaustive and consensual definition, Jordana and Levi-Faur identify a growing acceptance amongst lawyers, economists and political scientists to perceive regulation in the narrow sense. Convergence has taken place across the social science disciplines and also geographically since the 1990s. Traditionally, lawyers had always used this narrow interpretation, whereas economists included all kinds of state interventions (Ogus, 2001). Jordana and Levi-Faur (2004: 4) suggest that the narrow and more precise understanding of regulation is finding its way into the economic profession. Within political science, the understanding tends to depend on the research interest. Those studying international regimes or coming from a constructivist perspective are more inclined to draw on the broad interpretation of regulation (c), whereas political scientists or public administration scholars analysing the European Union tend to prefer the narrow interpretation (a). This pluralism in governance understandings remains, and hence the necessity to explicitly state which concept of regulation is being referred to. Moreover, especially during the 1980s, the understanding of regulation significantly differed on both sides of the Atlantic. In the United States, the narrow understanding dominated the discourse because independent regulatory agencies with their specific way of steering the economy were already widespread. In the European context, and elsewhere outside the US, a more general understanding of regulation (i.e. b) prevailed and included specific and non-specific interventions. In fact, "the notions of 'regulation' and 'intervention' were used almost interchangeably" (Jordana and Levi-Faur, 2004: 4). Since the 1990s, the wave of independent regulatory agencies and their more specific regulatory practices have led to a closing of the transatlantic gap.

Regulation is intertwined with the evolution and global diffusion of independent agencies in the capitalist world. The phenomenon of regulation is hardly thinkable without the evolution of independent regulators. The two phenomena coexist and are interwoven as the following citation shows "regulation refers to sustained and focused control exercised by a public agency over activities that are social[ly] valued. (...) Regulation is not achieved by simply passing a law, but requires detailed knowledge of, and intimate involvement with, the regulatory activity. This requirement will necessitate,

sooner or later, the creation of specialised agencies entrusted with fact-finding, rule making and enforcement" (Majone, 1998: 196).

Further, the literature does not always distinguish in a conceptually precise manner between cause and effect. In other words, was the independent regulatory authority the chicken and regulation the egg, or vice versa? Since this is not at the core of our research question, we do not pursue this further but just note that there is room for theoretical advancement. In the European Union, most of the old member states had already established a regulator for natural gas before the gas reform process started (see section 8.5.5).

2.2.2 *Independent regulatory authorities*

The rise of regulation as a mode of governance for utility services has been accompanied by a wave of independent regulatory authorities across the world. This organisational aspect of the regulatory reforms is often addressed by the term 'agencification', describing the transition from a unitary administration with diverse functions to single-purpose organisations as the dominant mode of regulatory control. In general, "regulation can be carried out through a variety of bodies, such as parliament, ministries, courts, local authorities, private-sector organizations and international organizations" and most of these have already for a long time been in the business of regulation (Christensen, 2007: 12). With the New Public Management movement gaining influence, independent regulatory agencies became *en vogue* for the regulation of all kinds of sectors ranging from healthcare, energy, telecommunication, aviation, water, to food. Some scholars even see it as the new doctrine in which independent regulatory agencies are considered to be the advanced organisational form for ensuring sector oversight and increased regulatory performance (ibid: 32). According to Christensen et al., regulation and agencification operate in tandem: "new regulatory policy needs autonomous agencies, and autonomous agencies need regulation" (ibid: 3).

Given the fact that regulation can be exerted by any governmental body, we may ask when does a regulatory authority qualify to be called an agency? Politt and associates defined an agency rather narrowly as "a structurally disaggregated body, formally separated from the ministry, which carries out public tasks at a national level on a permanent basis, is staffed by public servants, is financed by the state budget, and is subject to public legal procedures" (Politt and Talbot, 2004 cited after Christensen and Lærgreid, 2007: 12). This definition covers various criteria which are mainly related to the degree of independence and should not be interpreted in a too static a manner. In other words, if one criterion is not met, the institution may still be seen as an agency, especially if its independence is not affected. The UK oil and gas authority Ofgem, for instance, is not financed through the government but by the licences they issue to users of

the natural gas network. Here, the independence of the agency is not influenced by the non-conforming money stream. Carpenter identifies three conditions for agency autonomy: "political differentiation from the political executives; independent organisational capacity; and political legitimacy generated by a strong organizational reputation embedded in an independent power base" (Carpenter, 2001 cited after Christensen and Lærgreid, 2007: 13). Regulatory studies not only clarify the defining characteristics of independent regulatory agencies, they also offer a much broader research agenda.

In general, regulatory studies concern phenomena related to independent regulatory agencies, regulatory choices and their effects. The first-generation of regulatory studies mainly tried to explain the reasons for the evolution and spread of agencies, while the second-generation became more concerned with regulatory performance. Performance being viewed largely in terms of regulatory costs, legitimacy and accountability (Christensen and Laegreid, 2007; Héritier and Coen, 2005; Jordana and Levi-Faur, 2004). Both generations of research on regulatory reforms and independent regulatory authorities can be characterised by a theoretical pluralism which we noted in the introduction. The theoretical basis is drawn partly from economic-oriented regulatory theory and partly from more-general organisational and institutional theories from the field of public administration. A comprehensive and structured overview of theoretical approaches within regulatory studies has been provided by Christensen and Laegreid (2007). The authors distinguish three perspectives that can explain phenomena related to Independent Regulatory Agencies (IRAs). Firstly, the rational-economic perspective that embodies public interest theory, self-interest, regulatory capture, and principal agent theory. Secondly, the organisational-structural perspective, "which presumes that one has to study how the public sector is organised to understand the development of regulatory policy and its effects" (ibid: 18). Thirdly, the institutional perspective that can be split into institutionalised organisation and institutional environment branches. The former concentrates on informal norms and values within the agencies and the political-administrative system, whereas the latter advocates a social constructivist view by setting external norms and processes for constructing and interpreting regulatory reality (Christensen and Laegreid, 2007: 18-20). The current state-of-the-art in regulatory studies has revealed limitations with single-perspective studies. Therefore, Christensen and Laegreid advocate combining or mixing perspectives to explain regulatory change (ibid: 21).

With the liberalisation of European markets, independent regulatory agencies evolved on the national level. This restructuring was accompanied by the transfer of regulatory power to these new agencies. The range of competences received by the individual regulators in various member states

ranged from rule making to rule enforcing and so-called hands-on regulation in the form of rules specification, operationalization and revision. Although the superiority of independent agencies in the form of regulators relative to governmental administrations is contested (ibid: 8), a number of considerations convinced governments that they should establish regulators and endow them with the necessary competences. During the 1980s and early 1990s, experiences in the UK demonstrated that "in many cases, privatisation would only mean the replacement of public by private monopolies unless the newly privatised companies were subjected to public regulation of profits, prices, and entry and service conditions" (Majone, 1998: 199). In the process of redefining the functions of the state, several justifications are advanced as to why independent agencies are more appropriate than governmental departments for exerting regulatory power in Europe. The central argument points to the complexity of the issue, and the enormous information asymmetry between industry and regulatory authorities. The rise of regulation as a mode of governance builds on the assumption that "command law cannot cope with conditions of complexity" (Moran, 2002: 402). Sector regulation often requires expertise in highly complex or technical matters in order to design appropriate rules and fulfil its judicial role. Although the information asymmetry can be significantly decreased by strengthening the regulator's competences and staff, some disparity will remain. Proponents of IRAs argue that specialised agencies are better at building up sector-specific expertise than a regulatory entity which is very broad in terms of its functions and is also regulating a number of sectors at the same time. Moreover, due to the lack of a separation of power, governmental bodies tend to be inappropriate for exerting judicial functions. Courts, in turn, should not take over legislative or regulatory actions. Establishing entities separate from government promised to decrease the influence of partisan politics and party political influence on regulatory decisions. Unlike cabinets, the institutional structure of regulators is independent of legislative periods; and the hope is that this will therefore enhance stability and the credibility of regulation, albeit at the cost of democratic legitimacy. Furthermore, proponents of independent agencies claim that public participation is easier to facilitate, "[...] while the opportunity for consultations by means of public hearings is often denied to government departments because of the conventions under which they operate" (Majone, 1998: 1999). Last, but not least, agencies are able to focus public attention on controversial issues because they are more distant from political or governmental agendas. Regulation as exercised by independent regulatory authorities is perceived to be a result of politicians' attempts to enhance the credibility of regulatory policy and reduce political uncertainty (Gilardi, 2004, cited in Christensen and Lærgreid, 2007: 15).

In the literature, four main points of criticism have emerged, addressing

agencies' legitimacy, transparency, accountability and their large administrative costs. Due to the fact that regulatory staff are not elected, but nominated by the government, regulatory authorities have only limited legitimacy in the classical democratic understanding. Of greater concern, is the accountability of regulators' activities vis-à-vis the government, regulatees and citizens. In the public debates, questions have arisen as to whether the regulator should be obliged to report to parliamentary committees, and how transparency in regulatory decision-making can be achieved (Lodge, 2004; May, 2007). Democratic governance rests on the notion of holding officials responsible for their actions. In the literature, we find an ongoing discussion on how this can best be translated into appropriate checks and balances to hold regulatory agencies accountable. Moreover, the administrative costs of regulation are subject of current comparative analysis (Bauer, 2006). The general concern within regulatory studies is whether the costs of regulation are justified by the benefits of the reform. Evaluation of this relationship poses some empirical challenges. While the administrative costs of a regulatory agency can be relatively easily assessed, estimating the compliance costs for regulatees and the benefits of the reform are more problematic.

Our presentation of arguments for and against independent regulatory authority is certainly not exhaustive, nor does it reflect a balanced discussion. Rather, we have summarised the main justifications advanced as to why regulators are better suited than other state entities for promoting regulation-for-competition within utilities. When determining whether an independent regulator or a governmental body is the designated regulatory authority, the crucial question remains whether the authority takes on an enacting or an enforcing role in liberalising the natural gas market.

2.2.3 Regulation-for-competition

The concept of liberalisation, understood as the process of making a market more competitive and less influenced by the state, is closely linked to the degree that the state intervenes in the economy. After the introduction of European liberalisation reforms in the 1980s and 1990s, it soon became clear that liberalisation policies do not result in deregulation, understood as the absence of state intervention, but rather in re-regulation (Finger and Varone, 2006). Famous economists and promoters of market liberalisation, such as George Stigler, could already have observed some decades earlier that the vision of a self-regulating market, in which regulation by a regulatory authority is absent, in reality develops in quite the opposite direction (Jordana and Levi-Faur, 2004: 5). This mistaken anticipation is related to the economic belief in competition as a means to liberalise markets. In fact, liberalisation policies equate with the introduction of competition into markets. Privatisation most commonly fills the

other half of the reform agenda. To account for this empirical reality, Jordana and Levi-Faur generated a typology of regulations based on how competition is tackled (Table 3). The underlying assumption is that the way competition is conceived in a reform process has an influence on the type of regulation. In creating a competition-regulation relationship, the regulation type can be specified.

Type of competition	Types of regulation	Regulatory authority	Examples
Deregulated	Self-regulating markets	No regulation (retreat of the state)	Moving from certification to liability laws in order to protect the consumer
Regulated	Regulation-***of***-competition	National competition authorities	Prevention of concentration through the regulation of mergers, cross-ownership, etc.
Regulated	Regulation-***for***-competition	Sector-specific authorities and national competition authorities	Interconnection regimes in tele-communications, unbundling of networks
Meta-regulated	Enforced self-regulation of competition rules	Sector-specific authorities and national competition authorities	Institutionalisation of self-regulation that corresponds with the legal requirements of competition laws in general and the regulatory regime in particular

Table 3: Types of competition and types of regulation[30]

In characterising a sector reform, it is generally evident whether regulation-*of*-competition or regulation-*for*-competition is being applied. Although, in both circumstances, competition is regulated by an entitled authority, regulation-*of*-competition assumes that competition is, at least to a certain extent, already in place. Thus, the regulatory measures of the competition authorities are essentially

preventive. Market observations enable competition authorities to assess the degree of competition within market sectors and ensure, by regulation, that ongoing market developments (business conduct) such as mergers do not harm the level of competition. Conversely, regulation-*for*-competition describes proactive regulation aiming to introduce competition into a formerly monopolistic market structure. In this type of regulation, competition authorities and sector-specific authorities operate in conjunction. The European gas reform is a classical case of the development of proactive policies for the promotion of competition. The gas reform establishes a prescriptive regulation, where compliance is achieved when the prescribed actions (rules) are implemented (May, 2007: 10). Meta-regulation is considered as a special form of regulation-for-competition in that it combines control by the state with intra-firm control. Jordana and Levi-Faur's typology of competition and regulation distinguishes whether private and public actors are involved in the regulation (politics dimension). The types of competition, ranging from deregulated and regulated to meta-regulated, could also be interpreted as displaying, albeit somewhat tentatively, the hierarchy versus market category (polity dimension) as shown in Figure 3.

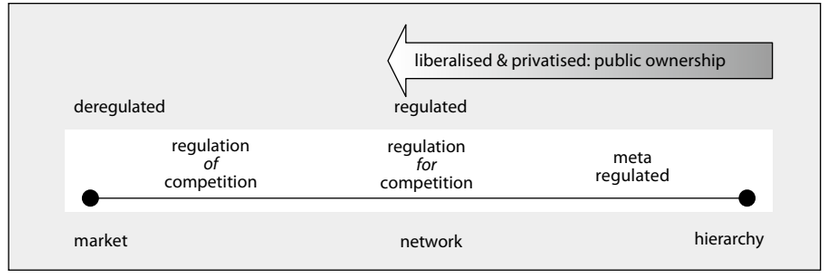


Figure 3: Types of regulation and competition positioned on the market-network-hierarchy continuum

2.2.4 *Regulation in the name of public interest*

The common justification of positive theory (see chapter 1) for intervening in the economy by regulation is market failure. Despite the fact that neoclassical economics considers competitive markets to be the most efficient way to allocate resources, economists have recognised several conditions under which 'the invisible hand' might not be able to safeguard the proper functioning of the market and the delivery of the public interest. In short, "competitive markets fail for four basic reasons: market power, incomplete information, externalities, and public goods" (Abbott, 2001: 31). In the perceptions of the European Union, natural gas markets displayed signs of market failure (see chapters 1 and 6)

in the form of market concentrations, a lack of transparency and the absence of competitive energy prices. Given the California electricity crisis, some scholars even question whether electricity markets show the characteristics of a commodity when it comes to security of supply - an argument one might easily be inclined to extend to natural gas markets as well (Abbott, 2001). The aim of this section is not to evaluate the economic concept of public good versus commodity with regard to its application in natural gas markets since we take the decision to regulate the gas market as a given. Instead, we should define the public interest in the context of the European gas reform.

The concept of public interest is the foundation of state activity and at the core of public administration. Despite this, the discipline has failed to deliver a single general concept of public interest that scholars are happy to sign up to. After analysing thoroughly how public interest has been conceptualised, Pesch concludes that the concept of public interest is 'enigmatic' in character, "as one can never be sure what the public interest really is" (2005). To a certain extent, the public interest is a moving target and subject to debate involving strong normative stances. With reference to de Bruin et al. (2004), Van Genugten (2008) juxtaposes an economic with a politico-administrative approach. The economic approach understands public interest as those social interests that the market cannot safeguard. The politico-administrative approach defines public interest as whatever the political administration calls a public interest. In identifying public interest, both approaches take into account characteristics and the importance of the services delivered. Additionally, the economic approach considers market characteristics and the transaction mechanism, whereas the politico-administrative one instead incorporates views on the roles and responsibilities of governments and the capabilities of markets. The approaches also differ as to whether the public interest can be scientifically established or is the subject of contested standards and knowledge. Of the two, the economic understanding is less dynamic. Genoud advances a public regulation approach when incorporating economic and public service interests. At the same time, he analytically distinguishes between first-order economic regulation and second-order political regulation (2001: 16)[31]. In this sense, the public regulation of a liberalised market prioritises the creation and maintenance of a competitive market, with public and private actors, over the procurement of public services and public policies (Genoud and Finger, 2004). Although this distinction is analytically straightforward, operationalising public interests is not. Some instruments, such as competition and public service obligations, may serve both. Moreover, even if public interest is defined at one time and explicitly prioritises goals, it may change, or change relative to other interests, over time. The inherent ambiguity is hard to remove (for a further discussion see section 3.6).

In the case of the European gas reform, the public interest is explicitly defined in Directives. According to these, the main reform objectives are twofold: completing the internal market and establishing a competitive natural gas market. Regulation-for-competition is pivotal. The EU also aims to increase efficiency, reduce prices, raise service standards and increase competition (see European Commission, 1998: Recital 1-3; European Commission, 2003: Recital 2). Political regulations that promote the fulfilment of public service obligations, such as security of gas supply and environmental concerns, are also mentioned (see section 7.2). However, it is reasonable to assume that market liberalisation focuses mainly on the first order, so-called economic regulation, and that political regulation ranks somewhat lower. Therefore, in the reform, regulation-for-competition is supposed to be given priority (and market competition approaches should be favoured) over security of supply concerns which could lead to fewer competition promoting instruments (chapter 3). In our analysis of the correlation between regulation-for-competition and the effects on performance in chapter 9, we consider the effects on both first-order and second-order performance indicators.

2.2.5 *Regulation and the structure-conduct-performance paradigm*

Solutions that address market failure are theoretically addressed and embedded in the structure-conduct-performance paradigm which is the core framework used in industrial organisation studies within economics. To gain a better understanding of the gas reform, its chosen instruments and its aims, we refer to the theoretical underpinning of the reform goals and the traditional principles applied in liberalising reforms in utilities on which the concept of regulatory comprehensiveness is built. Our methodology in chapter 5 is grounded on these theoretical assumptions that *ex ante* structured the market reforms.

The reform started with the idea of changing the governance arrangements in order to achieve long-term benefits for consumers (Joskow, 2006: 3). The means used to achieve this, as can be deduced from the structure-conduct-performance paradigm (Bain, 1968; Graham, 2000; Mason, 1939; Mason, 1957), involved trying to enhance overall welfare by influencing economic performance in the energy sector. According to the prevailing model in industrial organisation studies, economic performance depends on the conduct of buyers and sellers. Business conduct incorporates not only pricing policies and practices but also spans most corporate activities such as marketing strategies and research and development plans. Conduct in turn is influenced by the market structure. Market structure is characterised by

> the number and size of sellers and buyers, the degree of physical or subjective differentiation distinguishing competing sellers' products, the presence or absence of barriers to the entry of new firms, the shapes of cost curves, the degree to which firms are vertically integrated from raw material production to retail distribution, and the extent of firms' production line diversification (conglomeration). (Scherer and Ross, 1990: 5)

The model sees market structure determined by basic conditions that can be grouped into supply and demand side indicators. In our case, the supply side is, for instance, characterised by the gas supply situation, the nature of the relevant technology and business attitudes. Price elasticity, availability of product substitutes and rate of growth account for the demand side. The causal flow suggested by the context of the structure-conduct-performance paradigm is not unidirectional *per se*, but instead anticipates feedback from each variable in the model.

Public policy in general, and the European gas market reform in particular, bear indirectly on economic performance by influencing market structure and conduct (Bain, 1968; Scherer and Ross, 1990: 5). This is in line with two broad conceptualisations of competition, one of which emphasises market structure and one that stresses the conduct of sellers and buyers (Scherer and Ross, 1990: 15-18). Liberalising European gas markets self-evidently necessitates introducing competition, but what are the sufficient conditions for calling a market competitive? Scherer and Ross (1990: 16) offer the following general definition:

> In modern economic theory, a market is said to be competitive (or more precisely, purely competitive) when the number of firms selling homogenous commodity is so large, and each individual firm's share of the market is so small, that no individual firm finds itself able to influence appreciably the commodity's price by varying the quantity of output it sells.

The European Union applied several principles of market reform which had been generated by the literature on the structure-conduct-performance paradigm and New Institutional Economics. Such principles are that third party access, competition, unbundling, decrease of information asymmetry and independent regulators should all enhance competition in the utility markets. To minimise the barriers to market entry for new firms, the European legal provisions regulate network access conditions at the transmission and distribution levels. Trading activities are not within the regulatory scope even though Joskow (2006)

identifies the existence of mature trading facilities as a key component for the development of competitive markets. Even if trading is not regulated, Joskow stresses the important role that spot markets and trading hubs play in allocating scarce network transmission capacity and ensuring the effective balancing of demand and supply in electricity markets (ibid: 4-5). Some member states have chosen to influence conduct by employing incentive regulations in the form of price-capping which restricts the pricing behaviour of companies when setting tariffs for their networks. Most of the employed regulatory instruments, such as legal market opening and third party access, are aimed at changing the market structure. Additionally, vertical separation of trade and transport (so-called unbundling) promises to break up prevailing market structures. Here, the underlying assumption is that transport and trading companies will have distinct profit interests, and therefore follow different incentive structures. Under perfect market conditions, it is anticipated that a transport company will, of its own volition, strive to diversify its customer portfolio by offering transparent tariffs and access conditions. Conversely, the transport arm of an integrated incumbent would have an incentive to prevent competitors from competing with its own trading schemes. However, a separation of trade and transport companies has not become a reality in most European gas markets. Given the lack of perfect market conditions, a considerable number of the measures aimed at introducing competition try to enhance transparency and decrease the information asymmetry between incumbents and new market entrants and also vis-à-vis the regulator. As a result, transparency has become a rallying cry for reducing information asymmetry.

2.3 Convergence of regulatory regimes. A conceptual clarification

2.3.1 Regulatory regimes in the context of European gas market reform

This section fulfils three purposes. First and foremost, we provide our working definition of regulatory regime. Second, we outline the concept of comprehensiveness as it relates to regulatory regimes and, third, we present a classification system for regulatory models.

> One can think of a regulatory regime as a means for achieving regulatory goals (Hood, Rothstein, and Baldwin, 2001; Lodge, 2004; May, 2002). A regime comprises an institutional structure and assignment of responsibilities for carrying out regulatory actions. The institutional structure is made up of rules that prescribe expected behaviors or outcomes, standards that are benchmarks against which compliance can be measured, a mechanism for determining the degree of regulatory compliance, and sanctions for failure to comply with the rules. (May, 2007: 2)

In our context, a regulatory regime is defined as the bundle of institutional arrangements triggered by the liberalisation process in the context of the European gas reform. Institutional arrangements can be put in place, or executed, by individual firms, by the market, by any regulatory authority or by some combination of these. These institutional arrangements have mainly been implemented on the national level in anticipation of having to meet obligations imposed by the European Gas Directives. Referring to Williamson, we distinguish between formal institutions, such as laws, and institutional arrangements (Williamson, 1998a: 25-29). In general, institutional arrangements include actual regulatory instruments and decisions as well as contracts, forms of public and private cooperation, firms' tariff structures and trading practices (International Gas Union, 2006: 22-23). Our analysis concentrates on the formal dimension: the actual regulatory instruments or so-called hands-on regulation (ibid). Regulatory practices are not included in our assessment of regulatory regimes.

For the operationalisation of regulatory regime, we refer to the concept of regulatory comprehensiveness initially put forward by Genoud, popularised jointly by Finger and Genoud, and then applied to the European gas sector by Arentsen (Arentsen, 2004; Genoud, 2001; Genoud and Finger, 2004). Genoud conceptualised regulation in the context of electricity liberalisation reforms in order to analyse the impact of privatisation on regulatory performance in terms of coherence, efficiency and effectiveness. Genoud takes a broader public policy perspective than the economically biased understanding of regulation seen in various theories of regulation. In his descriptive analytical framework, he suggests that existing regulation and privatisation shape the outcomes of regulatory games. In his context, it was necessary to assess and conceptualise the coherence of the regulation as both an independent and a dependent variable because he assumed the existing regulatory framework would influence the establishment of a new one (Genoud, 2001: 26-27).

Within the process of conceptualisation, Genoud made two important steps that are relevant for our analysis. First, by taking a public policy perspective, Genoud was able to distinguish between the policy and polity dimensions of

the regulatory regime (2001: 13). Arentsen labelled these two dimensions as regulatory function and regulatory competences (2004: 85). Second, Genoud evaluates regulatory frameworks by referring to the quality of the institutional arrangements within them. In this context, he distinguishes three criteria: coherence, efficiency and effectiveness of the regulation. For our analysis, the coherence and effectiveness aspects are the most important. Genoud conceives coherence in the following manner:

> We consider that a regulation framework is coherent in institutional terms when three conditions are met. First, the distribution of functions among the actors should follow a logical and functional pattern: a specific function is attributed to an actor according to its nature and purpose. Second, the attribution of two functions to the same actor or strongly integrated group of actors must be justified by efficiency, effectiveness or legitimacy reasons. In any case, dispute settlement mechanisms and procedures should be implemented to avoid conflicts of interest or overlapping competences. Third, all functions of the regulatory process must be assumed within the institutional framework. This criteria of coherence can be applied in both dynamic and static terms. In ***dynamic*** terms, the coherence criteria measures the quality of the institutional arrangements when particular issues (a game) are addressed to the regulation framework. In ***static*** terms it can be used to evaluate the general institutional arrangements in formal terms for example during the regulation framework stage. (Genoud, 2001: 27)

The way in which actors' responsibilities are distributed with regard to the regulatory functions and the regulatory competences they address is central to the idea of coherence. Any theoretical argument or applied methodology used to empirically assess the coherence of a regulatory framework should therefore take into account the distribution of regulatory functions and competences. Three conclusions can be drawn for our analysis from Genoud's elaborations on coherence. Firstly, a static interpretation of coherence is best applied for assessments that are quantitative in character, whereas coherence can best be analysed in a dynamic way within qualitative case studies because these enable one to consider specific issues within a regulatory game. Genoud assumes that some actors, or actor groups, are more appropriate than others to be made responsible for certain regulatory functions. With reference to Bauby's typology of regulatory functions of the regulation process (2000), Genoud argues that either public authorities or sector regulators should be assigned responsibility for the oversight of the seven given functions (2001: 20). He suggests considering a wide range of regulatory functions: from setting sectoral legal frameworks, via infrastructure access, to monitoring the evolution of the reform process.

Next to the coherence criterion, Genoud proposes evaluating regulatory frameworks on their efficiency and effectiveness. Efficiency is understood here as the relationship between resources and output, and refers to the performance of a particular framework in terms of financial, transactional and political costs. Effectiveness addresses the extent to which reform goals are achieved. In this sense, effectiveness says something about the way regulation and economic performance relate to each other in practice. The evaluation of effectiveness is addressed in chapter 9, where we analyse the correlation between regulation-for-competition and economic performance indicators in the EU.

Genoud made no explicit reference to the fact that the concept of regulatory comprehensiveness is embedded in the structure-conduct-performance (SCP) paradigm. As in the SCP paradigm, regulatory comprehensiveness also perceives regulation as a variable which is linked to the structure - business conduct - performance triangle. Regulatory comprehensiveness incorporates traditional reform principles such as third party access, unbundling, decreasing information asymmetry and the comprehensive establishment of strong regulatory authorities (section 2.2.5). According to several authors (Genoud, 2001; Genoud and Finger, 2004; Arentsen, 2004), regulatory comprehensiveness determines the degree of openness of gas markets. This is perceived as a basic determinant of the degree of competition. In addition to regulation, both market structure and business strategies also influence the degree of competitiveness in gas markets. The comprehensiveness of a regulation can be seen as a two-dimensional concept: "one dimension referring to necessary regulatory functions and one dimension referring to regulatory competences" (Arentsen, 2004: 85). Ultimately, the concept makes it possible "to assess whether or not the Member State's legal reforms meet formal standards of a competition-based gas market" (ibid). Applying this concept, Arentsen conducted a preliminary assessment of the regulatory comprehensiveness induced by the European gas reform. On the basis of his empirical findings, he suggests a threefold classification of regulatory models (ibid: 90):

1 The comprehensive regulatory model, encompassing all legal regulatory conditions for competition.
2 The emerging regulatory model, still developing the legal regulatory conditions for competition.
3 The minimal regulatory model, containing only minimal legal regulatory conditions.

Our analysis adopts the concept of regulatory comprehensiveness as developed by Genoud, Finger and Arentsen (Genoud, 2001; Genoud and Finger, 2004; Arentsen, 2004). Using Arentsen's initial attempt to assess the regulatory performance as a starting point, chapter 5 formulates a research methodology that allows us to analyse the convergence towards competition-based regulatory regimes in the European gas markets.

2.3.2 *Regulatory convergence*

In general, our proposed conceptualisation is based on the assumption that regulatory choices are specific forms of policy choices. Consequently, regulatory convergence is perceived as a variant of policy convergence. This section starts by defining the meaning of policy convergence and then introduces approaches for assessing policy convergence. According to Knill:

> policy convergence can be defined as any increase in the similarity between one or more characteristics of a certain policy (e.g. policy objectives, policy instruments, policy settings) across a given set of political jurisdiction (supranational institutions, states, regions, local authorities) over a given period of time. Policy convergence thus describes the end result of a process of policy change over time towards some common point, regardless of causal process. (2005: 29-30)

This is not dissimilar to the widely cited definition formulated by Bennett, but enriches it in two ways. First, Knill renders it more precise by distinguishing between different types and levels of policies. This contributes to research rigour by drawing a clear line between policy process and policy outcome, while also taking into account multilevel governance. In its second part, Knill's definition emphasises the dynamic nature of the concept. In this context, Jordan rightly notes, "...because policies are the same at a given point of time, does not necessarily confirm that policy convergence has occurred: they could have emerged independently but in similar forms" (Jordan, 2005: 946). To identify coincidental as against causal relationships in policy convergence, it is therefore necessary to emphasise the temporal dimension of the convergence concept. As Bennett put it: "there must be a movement over time towards a common point" (ibid).

We concentrate on the policy outcome when analysing policy convergence with regard to regulatory regimes in European gas markets. In doing so, we analyse the policy and polity dimensions, and include those regulatory instruments or measures that have been chosen and implemented in order to fulfil the obligations imposed by the Gas Directives. The analysis aims to assess the similarities of regulatory instruments chosen by member states over time.

The comparative policy literature suggests several approaches for assessing convergence. Essentially there are four basic types which, with reference to the Greek alphabet, are known as sigma, beta, gamma and delta convergence (Heichel et al., 2005: 831-834). For our purposes, we are only concerned with three: sigma, gamma and delta convergence. These three types use indicators that reflect the degree, direction, scope or speed of change (Holzinger and Knill, 2005). However, given the restricted number of European member states, and the selected case of only the old member states, the scope indicator is not relevant for this analysis.

Sigma convergence describes, in its classical form, the "decreasing coefficient of variance" and follows the logic of "growing together" (Heichel et al., 2005: 831). Sigma convergence is often assessed in studies on economic globalisation, and is also used to measure similarities between policies and regulatory instruments. Sigma convergence occurs if there is a decrease in the variation of policies among the countries under consideration (Knill, 2005: 769). Most convergence studies of this kind adopt a quantitative design, but sigma convergence can also be used for qualitative analyses or with a small number of cases. Sigma convergence occurs when there is a decrease in the range and standard variation, reflecting an increase in the number of countries that implement similar instruments.

Whereas sigma convergence does address the degree of change, beta, gamma and delta convergences describe three different aspects of qualitative change (direction). Beta convergence is used quite prominently in the economic convergence literature to, for instance, analyse the economic progress of developing countries. Beta convergence occurs when poor economies grow faster than rich ones, and its name reflects the growth coefficient. As such, beta convergence can be measured if the phenomenon of 'catching up' is to be detected. The mobility dimension (or speed of change) is covered by gamma convergence, which was formulated in response to criticisms of beta convergence. As Heichel et al. note, beta convergence has been criticised for not capturing sufficient aspects of cross-country dynamics. For instance, convergence trends resulting from rich countries falling back are ignored when assessing beta convergence, but are taken into account in gamma convergence (Heichel et al., 2005: 832). Gamma convergence reflects the mobility of countries with regard to the speed of implementing certain regulatory instruments.

> For the analysis of gamma convergence, country rankings for different points of time are compared to assess the mobility of countries. If countries in the first ranks fall behind or catch up over time, convergence occurs. (Ibid)

The analysis of gamma convergence enriches the interpretation of sigma and delta convergences because it allows one to assess changes in country rankings over time. Gamma convergence is particularly helpful for the analysis of path dependency. The path dependency concept suggests that there will be regulatory inertia in those countries that entered into the European gas market reform with a highly monopolistic market structure. Accordingly, countries such as Germany are expected to make slow progress in liberalising their market through the application of certain regulatory instruments.

In general, gamma convergence is seen as occurring when a trailing country catches up, or a leader falls back. As such, we can make a distinction between positive and negative gamma convergence. Positive gamma convergence occurs when one or more countries with less favourable instruments or measures start to implement more favourable instruments. The positive gamma convergence is stronger if it occurs in the early stages of the reform. We speak of negative gamma convergence if countries with favourable instruments replace them with less favourable instruments. This approach can be extended from the indicator level up to the regime level. Thus, if a country begins with a relatively low score for its regulatory regime and increases this, positive gamma convergence occurs. The absence of positive or negative gamma convergence may indicate path dependency, although this is not certain.

The most sophisticated, but rarely considered form is delta convergence (Heichel et al., 2005: 834). This type of convergence reflects the direction of change. A decrease in the variation of national policies will be accompanied by an upward or a downward shift in the overall level. Holzinger and Knill noted that "the direction of convergence is usually related to the extent of state intervention or to the strictness of a regulation" (Holzinger and Knill, 2005: 777). Delta convergence assesses not only the direction of change, but also the ordinary ranking of countries. According to Knill's definition, "we speak of delta convergence when similarity change is operationalised by comparing countries distance changes to an exemplary model" (2005: 769). In this study, the exemplary model operationalised by creating an index in the methodology chapter serves as a best-practice model. Delta convergence occurs when a decrease in the distance to the best-practice model is identified. When observing trends from an indicator perspective, delta convergence occurs when an increasing number of countries apply the instrument considered to be best practice and receive high scores. Translating this to the regime level, delta convergence occurs the more countries achieve high scores. The methodology applied allows a dynamic interpretation since the scores for delta convergence are expressed in percentages (see section 7.4). It is possible that all the convergence types occur simultaneously. In their summary of the convergence literature, Heichel et al.

stress "empirically, sigma and delta convergence often occur simultaneously. If countries reach total similarity relative to a policy model, variance between them is obviously reduced" (2005: 833). Nevertheless, the different types of convergence can also occur in their own right.

2.4 Summary

The literature review has resulted in the view that governance can be understood as a conceptual trinity with policy, politics and polity dimensions. The categories within these dimensions mainly reflect different degrees of intervention in terms of *ex ante* or *ex post* control, or the involvement of public and private actors. We follow Baldwin's narrow interpretation of regulation, and use regulation in the narrow sense of the word as a specific form of governance comprising intentionally formulated and targeted rules. The review of existing typologies of regulation and of competition has identified regulation-for-competition as the type of regulation applied in the European gas reform. The regulatory instruments associated with the gas reform show mixed characteristics. Instrument choices range from directly-adopted Community Regulations, with a high level of obligation and a low level of discretion, through framework regulations that allow greater discretion, to non-binding guidelines formulated in transnational networks such as the Madrid Forum. When reviewing the polity dimension of gas reform, we outlined the regulatory landscape and found considerable fragmentation on the regulatory side. Moreover, European comparative studies suggest that inter- and intra- organisational relationships amongst the regulatory authorities might be competitive. In regulating the European gas market, conflicts mainly concern the questions as to whether market-based or state-controlled market design approaches should be applied and whether extending the regulation is a matter for national governments or an aspect of European integration. To capture the agency dimension of regulation, we have decided to employ a principal agent approach since this allows one to account for the multi-authority structure that spans various levels of governance. In doing so, we can address the central versus dispersed loci of authority category within the polity dimension of governance. A principal agent framework enables one to systematically integrate the existence of several principals with the dynamics and mechanisms that evolve in regulatory games between ministries, regulators, incumbents and new entrants. The principal agent approach is outlined in section 3.5.

The justification for adopting regulation-for-competition is based on the European Union's mandate to safeguard public interests in the gas sector. The Gas Directives define public interest in terms of first-order economic regulation,

as the completion of an internal competitive gas market, and second-order political regulations, through public service obligations. Hence, we can assume that regulation-for-competition prioritises the creation and maintenance of a competitive market over the procurement of public service obligations such as security of supply. More specifically, the aim of the reform is to increase efficiency, safeguard competitive gas prices, raise the standard of service and intensify competition in these markets – in short, to improve the overall economic performance.

A working definition of a regulatory regime has thus been developed with reference to transaction cost economics and political approaches within regulatory studies. The regulatory regime is then defined as the bundle of institutional arrangements triggered by the European gas market liberalisation process. Employing a public regulation approach, the regime takes into account formal aspects of the policy and polity dimensions of regulation. Institutional arrangements incorporate regulatory instruments, hands-on regulation and the distribution of competences, and these are grouped along the two dimensions of regulatory function and competences. We showed that the concept of regulatory comprehensiveness is embedded in the structure-conduct-performance paradigm in which the reform has its theoretical roots. Thus, the concept serves as a basis on which to evaluate the quality of institutional arrangements. In our analysis, the criteria of effectiveness and coherence are essential. The effectiveness criterion comes into play when evaluating the effect of regulatory regimes on performance (see chapter 9). The idea of coherence relates to both dimensions of the regulatory regime. In terms of regulatory competences, it shows that some organisations are more appropriate for being given the responsibility for certain regulatory functions than others. For example, regulators are considered to be more appropriate for controlling tariffs than the transport entity of the incumbent gas company. Turning to regulatory functions, the concept encourages us to consider a wide scope of regulatory functions along the value chain of the gas business.

In developing our methodology in chapter 5, we draw on the concept of policy convergence which has been elaborated upon within European comparative politics. Our analysis limits itself to three aspects: sigma, gamma and delta convergences. While sigma convergence covers the degree of change, gamma and delta convergences describe qualitative aspects. Gamma convergence takes into account the speed of change. We make a distinction between positive and negative gamma convergences to show whether countries are progressing rapidly or more slowly towards best practice. Delta convergence leads to the formulation of a best-practice model (see methodology chapter) and allows one to measure the distance from best-practice.

To sum up, drawing on the regulatory studies branch of political science has enabled some fruitful conceptual clarifications and analytical refinements with regard to governance, regulation and institutional change. These conceptual steps were necessary to avoid an oversimplification of the regulations (see chapter 1) and to formulate a methodology that allows one to assess the evolution of regulatory regimes in European gas markets.

3. Theoretical considerations

3.1 Introduction

The purpose of our theoretical considerations is to arrive at hypotheses that can be investigated and tested in our empirical analysis. This requires several interim steps during which we will refer to various theoretical approaches. In the first step, the core of the New Institutional Theory is identified and briefly summarised. Key ideas and concepts, such as institutions and the underlying behavioural assumptions, of New Institutional Theory are clarified. In the second step, we discuss Williamson's four-layer model and its potential application to the energy market in general and to the European gas market in particular. A synthesis of this discussion results in a modified conceptual framework from which relevant variables are deduced for our qualitative and quantitative analyses. The interrelatedness of the layers as well as the causal relationships between variables are then specified with reference to institutional logics. To understand the micro-foundation of institutional logics we propose investigating the central hypothesis within transaction cost economics (TCE), the alignment hypothesis. Then, as a third step, we outline the alignment hypothesis and consider the propositions in more detail to determine optimal modes of governance and their effect on economic performance in European gas markets. Next, we refer to the limitations of applying transaction costs to the public sphere by showing that TCE are not well equipped to predict or fully explain regulatory choices. At the same time, however, a transaction cost perspective does offer the opportunity to examine incentive schemes, which enables us to theoretically develop a preferred distribution among regulatory authorities for certain regulatory goals. To capture the dynamic aspects of the relationship between regulatory

authorities and economic agents, we complement our theoretical considerations by applying a principal agent approach in our qualitative analysis. While reviewing and discussing the application of New Institutional Economic approaches, we formulate expectations with regard to the relationships among the variables we are considering in our research design. Finally, we summarise our main theoretical considerations and hypotheses.

3.2 New institutional core: institutions, bounded rationality and opportunism

New institutionalism is not a grand theory but rather pitched in mid-range and serves as an umbrella for various theoretical approaches within social sciences that subscribe to a new institutional core. Being epistemologically related, New Institutional Theory (NIT) and New Institutional Economics (NIE) fall under this umbrella but, at the same time, they are traditionally seen as having sharp distinctions. The politically and sociologically oriented branch of NIT distinguishes between rational choice, sociological and historical institutionalism.[32] Within New Institutional Economics, one differentiates between transaction costs, principal agent, property right and historical institutionalism. As indicated in the introductory chapter, political science has particularly borrowed from historical institutionalism and principal agent theory, with NIE origins, and transferred their applications to the public sphere. Historical institutionalism and the concept of path dependency originated from New Institutional Economics (e.g. North, 1990) and was expanded to analyse political processes (e.g. Pierson, 2000). Public choice theory is another example which draws to an extent on the micro-foundation of economics in general and on principal agent approaches in particular to explain, for instance, voters' behaviour (Mueller, 2003). In general terms, "New institutionalism places the analytical focus on the polity. (...) The presumption is that the polity structures the inputs of social, economic and political forces and as a consequential impact on the polity outcome" (Bulmer 1998: 369). As we will discuss later, transaction cost economics is relatively less advanced in its application to the political sphere.

The common ground is largely based on the core assumption that institutions matter and subscribe to certain behavioural ideas and concepts such as bounded rationality and opportunism. Structure determines the outcome. New Institutional approaches are to an extent complementary, but they differ in the extent to which they are institution-as against actor-centred. Although new institutionalism is by definition institution-centred, this does not mean that the empirical concern is only with institutions (Bulmer, 1998: 376). Although institutions are a central concept within new institutionalism,

definitions vary as to what institutions should encompass. The most commonly cited characterisation has been formulated by North (1994: 360):

> Institutions are the humanly devised constraints that structure human interaction. They are made up of formal constraints (e.g. rules, laws, constitutions), informal constraints (norms of behaviour, conventions, self-imposed codes of conduct), and their enforcement characteristics. Together they define the incentive structure of societies and specifically economies.

North's definition refers to three important insights which are broadly shared in the literature. Firstly, institutions unfold their impacts in a process of human interactions characterised by information feedback. Secondly, unlike in old institutional theory[33], emphasis is given not only to formal institutions such as laws, but also to informal routines and relationships (Rutherford, 1996). Some authors emphasise the role of informal institutions by claiming that "the most effective institutional arrangements incorporate a normative system of informal and internalised rules" (Levi, 1990: 409); a view shared by North (North, 1990: 36):

> In our daily interaction with others, whether within the family, in external social relations, or in business activities, the governing structure is overwhelmingly defined by codes of conduct, norms of behaviour and conventions. Underlying these informal constraints are formal rules, but these are seldom the obvious and immediate source of choice in daily interactions.

Accordingly, when formal rules are aligned with informal beliefs, conventions and routines, then institutions will be most forceful in influencing regulatory outcomes. To capture the complexity of informal institutions and their impact on institutional change within electricity markets, Sine and David proposed the concept of institutional logics (2003: 185) as follows:

> Prevailing institutional logics – i.e. sets of socially-constructed assumptions, values, and beliefs – define appropriate structures, practices, and behaviors within organizational fields, and changes in these logics can lead to increased entrepreneurial and ultimately changes in industry structure.

These informal institutions exhibit a great deal of inertia - "some because they are functional (as with conventions); others take on symbolic value with a coterie of true believers; many are pervasively linked with complementary institutions (formal and informal), etc." (Williamson, 2000: 597). The idea of institutional logics tries to capture the interwovenness of formal and informal institutions that Williamson is referring to. Moreover, it points to the fact that, usually, beliefs, values, conventions and practices occur as a set and are difficult to disentangle. In other words, formal and informal institutions, institutional arrangements and business conduct are, in times of stability, aligned with a certain prevailing institutional logic.

The citations from both North and from David and Sine imply that informal institutions shape formal institutions. Thirdly, the compliance of these institutions is reinforced and guaranteed by compliance procedures ranging from monitoring compliance with norms to punishing deviant behaviour. Moreover, the literature refers to the distinction between organisations and institutions. On a conceptual level, organisations and institutions are analytically not sharply distinguished. Organisations are no more than a particular manifestation of institutions. In this sense, organisations are a special form of institutions, ones which are formal and shaped as a corporate entity. New institutional approaches are based on so-called methodological individualism which starts from the rational self-interested choices made by individuals to explain institutions. Individuals are taken as a given, and their preferences are derived from the theory of subjective utility which underlies neoclassical economics. Accordingly, "choices are made: (1) among a given, fixed set of alternatives; (2) with (subjectively) known probability distributions of outcomes for each; and (3) in such a way as to maximize the expected value of a given utility function" (Simon, 1997: 291). NIE relaxes some of these convenient behavioural assumptions and takes into account the cognitive limitations of a decision-maker. With reference to Simon, Williamson defines bounded rationality as a form of rationality in which economic actors are assumed to be "intendedly rational but limited so" (quoted in Hodgson, 2007: 20). Human beings face limitations due to incomplete information and limited capacity to process the available information, with limited human and computing capacities. Moreover, rationality is restricted in terms of communicative capacities and preference formation skills (ibid). Simon observes (1997: 198):

> The first consequence of the principle of bounded rationality is that the intended rationality of an actor requires him to construct a simplified model of the real situation in order to deal with it. He behaves rationally with respect to his model, and this behaviour is not even approximately optimal with respect to the real world. To predict his behaviour we must understand the way in which this simplified model is constructed, and its construction will certainly be related to his psychological properties as a perceiving, thinking and learning animal.

The NIE literature does not question the rationality assumptions. Weinmann (2004) emphasised that mental models, because they substitute for and reduce the complexity of reality, play a major role in the decision process. Due to the complexity of life and the limited capacities to process all the relevant information and options, humans "tend to do 'satisfice' or use variety of heuristic (shortcuts) in their decision making process" (Halpern and Stern 1998: 5). Institutional logics can serve as such a mental model or heuristic short cut by offering certain values and beliefs, and also by clothing, or suggesting ways of structuring, processes or business.

New Institutional Economics has refined the idea of bounded rationality by taking into account the dimension of learning, which influences the degree to which rationality is limited. The rationality of a decision can be either estimated on the basis of the end result, or evaluated against a relative increase in rationality – understood as an increase in the capacity to process information – induced by feedback processes. In the literature, this mechanism is referred to as the notion of procedural rationality (Isla, 2000; Weinmann, 2004). Ultimately, North regards feedback processes as essential in altering rational decision-making processes, reasoning that "if [...] the actors are incompletely informed, devise subjective models as guides to choices, and can only very imperfectly correct their models with information feedback, then a procedural rationality postulate [...] is the essential building block to theorizing" (North, 1990: 108). In short, feedback processes need to be included in the NIE research agenda if one is to understand the mechanisms that alter the limited rationality of human minds.

In addition to the notion of self-interest, which assumes maximising behaviour by agents, Williamson introduced the concept of opportunism. For some contemporary authors, opportunism is just another word for self-interest: because of self-interest, maximising behaviour does not imply that economic agents will act like saints, in the sense of fairly and in accordance with the law. Nevertheless, Williamson explicitly refers to self-interest as seeking with guile. Opportunistic behaviour can occur in subtle, obvious and potentially even illegal forms such as stealing and cheating. In its most common form, an agent

behaves opportunistically by providing intentionally incomplete or distorted information, or withholding some true information, in order to mislead, distort or confuse the other party. Opportunism can be carried out actively or passively, and occur before, during or after the decisive transaction or process. It is essentially the effect of opportunistic behaviour that leads to the way contracting is perceived within transaction cost economics. When opportunistic behaviour is presumed, contracting partners need to ensure that safeguards are introduced to prevent or discourage opportunistic behaviour. Safeguards are defined as "the added security features that are introduced into a contract in order to reduce hazards and to create confidence" (Williamson, 1996: 379). Especially in complex environments, contracting parties prefer to identify potential hazards and to implement *ex ante* safeguards in the contract. Nevertheless, all complex contracts face a dilemma. According to Williamson, the most important implication of bounded rationality is that "all complex contracts are unavoidable incomplete" (1996: 37). This implies that such contracts and other institutional arrangements will have to be renegotiated or even substituted by other modes of governance. Examples for such substitutions are the outsourcing of certain services by a company, or the privatisation of formerly state-owned companies. Transaction cost economics argues that transaction cost efficiency is the driver for such changes in modes of governance. As such, the optimisation of transaction costs is a general explanation for why institutional change occurs (see below).

3.3 Williamson's conceptual framework and institutional change

In general, New Institutional Economics perceives institutional change either as an eruptive revolutionary process or as a gradual and incremental process evolving over time (Künneke, 2008). Williamson's four-layer model falls within the evolutionary tradition of explaining institutional change and helps in understanding how the regulatory framework and the market are related to one another. Williamson's conceptual framework initially set out to illustrate the position of New Institutional Economics within different levels of social analysis. It is based on three criteria: main purpose, frequency of institutional change and level of analysis. Recently, scholars have used the framework to explain differences in economic governance (Correljé and De Vries, 2007; De Vries and Correljé, 2006; Groenewegen and Künneke, 2005; International Gas Union, 2006). More precisely, the framework contributes to understanding "why economic institutions have emerged in the way that they did and not otherwise" (Arrow cited after Williamson, 1998: 25) by offering a set of categorical variables. Williamson distinguishes between four variables that represent different levels

of analysis. In essence, these variables are informal institutions (Level 1)[34], the formal institutional environment (Level 2), institutional arrangements (Level 3), and (market) behaviour (Level 4) (Williamson, 2000). External variables are not explicitly linked to the framework, but are usually included with or without reference to the structure-conduct-performance paradigm (see section 2.2.5) which sees the basic conditions or market characteristics as part of the research equation (Correljé and De Vries, 2007). From the way Williamson has arranged his framework one can assume that he has been influenced by the SCP paradigm although he has interpreted structure from a new institutional perspective. Unlike its conception within industrial organisation studies, which heavily focus on the concentration of market power, Williamson perceives structure as an institution that separates formal and informal institutions, and institutional arrangements. Researchers from the Clingendael International Energy Programme (CIEP) have produced the table below of Williamson's four-layer framework and add, in the right column, examples of where the framework is applied to energy markets.

Level 1	Informal institutions	Broad values, norms, technological and physical characteristics	Broad (energy) policy objectives and balance between security of supply, market and environment
Level 2	Formal institutional environment	Laws and constitutions	Regulatory models and market design
Level 3	Institutional arrangements	Organisations, contracts and hybrids such as Public Private Partnerships	Actual regulatory instruments and decisions Forms of PP cooperation Firms' tariff structures and trading practices Public and private evaluation and sharing of risk, profit, market etc.
Level 4	(Market) behaviour	Interaction between actors with different objectives, strategies	Market strategies, investments lobbying, R&D, cooperation and conflict

Table 4: The socio-political embeddedness of regulation[35]

Williamson assumed that the main direction of influence was from the first level, where the beliefs and norms are located, downwards, feeding through to the fourth level which describes economic performance. An implicit assumption is that while other causal relationships may arise, they will be less strong (Williamson, 1998: 26). "The basic causality in this model flows from the top towards the behavioural layer. But it should be clear that via processes of learning, lobbying, technical development and societal change in the broader sense, there is also an upwards influence on the form and content of the basic values and beliefs" (International Gas Union, 2006: 23). So far, the interactions between the levels, or feedback processes, have largely been ignored in empirical research (De Vries and Correljé, 2006; Williamson, 1998). An "important point of critique is the lack of a proper analysis of the interrelatedness of these levels. (...) Groenewegen and Künneke argue that there might be some kind of 'logic' between the levels of institutions" (Künneke, 2008: 242). By applying the four-layer model to the European gas market and offering an interpretation of institutional logics, we will contribute to the development of this analysis. Currently, the explanatory power of Williamson's conceptual framework has still to be tested to clarify its benefits and limitations. One may describe the state of research using an allegory stemming from chemistry: the main substances are determined, but the composition of the substances and the chemical processes (mechanisms) are not fully understood. The strength of the framework is to organise the analysis by showing which institutional variables are involved.

However, the model fails to account for variables describing an actor's behaviour in a systematic way (Williamson, 1975: xiii). Actor behaviour is mainly captured by the fourth layer and partly by the third layer. New Institutional Theory is grounded on the micro-foundation of economics. Actors' preferences are characterised by bounded rationality and opportunism (Williamson, 1996: 6). It is assumed that actors strive to maximise their profit, and this supposedly defines their preferences. New Institutional Theory has therefore been criticised for not identifying key actors and failing to fully account for the nature of agency: "as a result, institutional theory has struggled to explain how change comes about when existing structures embedded in the broader environment are so constraining upon human actions" (Frumkin and Kaplan, 2000).

3.3.1 Conceptual applications to the European gas market reform

In the next section, we will discuss Williamson's framework and its possible application to the European gas market reform in more detail. The next section shows that the initial model from Williamson and its more recent applications differ in the processes of application and interpretation. We do so by contrasting our application to those of Dutch scholars researching the economics of

energy infrastructure. The aim of this section is to theoretically embed our analysis. Figure 4 illustrates the version of Williamson's conceptual framework (Groenewegen, 2005) that we applied to the gas market, and which we will now elaborate upon.

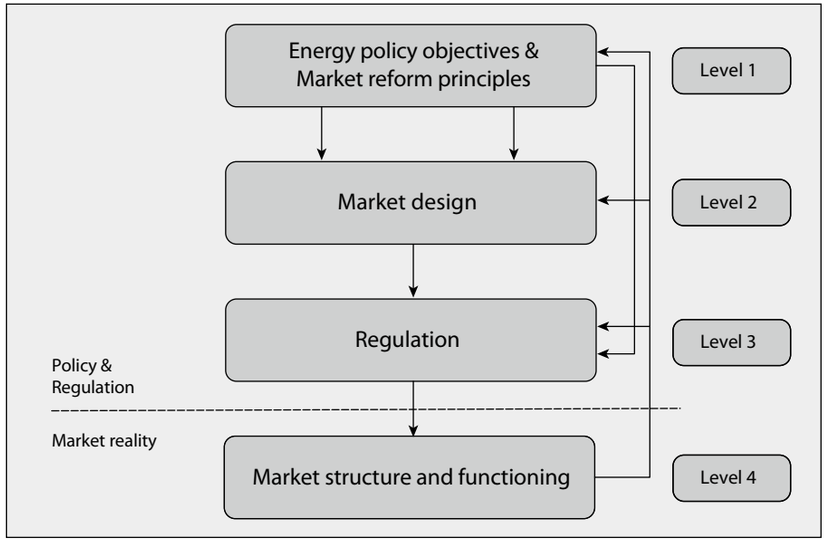


Figure 4: The regulatory framework and the market[36]

The **first level** represents informal institutions such as broad beliefs, values and norms (Williamson, 1998: 27). North (1991) further subsumes under informal constraints, sanctions, taboos, customs, traditions and codes of conduct. These informal institutions are assumed to be stable with changes only occurring over long periods. According to Williamson's proposition, they might change only once every one hundred years, or even more slowly than that. When applying Williamson's four-layer model to the gas sector, the author group from the Clingendael International Energy Programme identified potential drivers for beliefs, values and norms related to the gas market. In their view, these are triggered by "perceptions about sovereignty over national energy resources, equity, scarcity and resource independence, the environment, in/exclusion of social and ethnical groups, and beliefs about states versus markets" (International Gas Union, 2006: 22). Differences in attitudes regarding these principles or issues often stem from the

> presence or lack of energy resources, the role of natural gas in the energy portfolio, the openness of the economy, political culture, norms of 'good governance' and the involvement of the interest group in society via 'deep' political principles and beliefs (ibid).

CIEP specified the first level by labelling it as "energy policy objectives and market reform principles". On this level, principles of liberal market reform, such as unbundling, access and competition on the one hand, and energy policy objectives, on the other, are considered pivotal in shaping market design processes. We distinguish between general policy, energy policy and even sector-specific policy objectives. The general policy objectives may be overarching socioeconomic development goals such as employment and economic growth. Energy-specific objectives often refer to guaranteeing security of energy supply, or competitive energy prices. Additionally, the general attitude towards liberalisation of markets or overarching economic objectives may influence the establishment or reformulation of regulatory regimes in the gas sector (ibid). Moreover, beliefs about the state versus the market are ultimately expressed through member states' attitudes towards liberalisation. Elsewhere, Correljé and De Vries elaborate:

> The policy goals set the direction for the restructuring process. The policy goals, and the relative weights attached to them, vary widely. Objectives in related policy areas, such as energy security of supply, environment and employment policy (fuel choice), social policy (energy prices) may also affect electricity market policy. (Correljé and De Vries, forthcoming)

On the **second level**, Williamson places the rules of the game. The relevant formal institutions comprise the polity, the judiciary and the bureaucracy of government. Here, "the laws regarding property rights – their definition and enforcement – are prominently featured" (Williamson, 1998: 27). In addition to international treaties, national laws and constitutions, other elements of the market design are determined within this layer. CIEP also suggests that the position of the regulator vis-à-vis the administration and courts is determined here (International Gas Union, 2006: 22). The distinction between the second and third levels, and their labelling, is not fully convincing, or at least poses some demarcation problems. In the more general understanding, market design includes the applied regulatory instruments, and regulation incorporates legal provisions. As such, the adapted version of Williamson's model in Figure 4

does not necessarily enhance the clarity of the framework. In some instances, the distinction between the second and third levels is not as clear-cut as the framework suggests. This is explained further in the next section.

When applying the framework to the European electricity sector, De Vries and Correljé introduced a distinction between generic and sector-specific institutions. The generic formal institutions are congruent with Williamson's understanding of the rules of the game, whereas the sector-specific institutions are determined by the scope of the European Directives and regulations (De Vries and Correljé, 2006).

The **third level** is central in assessing the institutional arrangements, labelled as 'regulation' in the figure. The game is played on this layer. According to Williamson (1998), every one to ten years, one can observe the process of aligning governance structures with transactions (ibid: 26). Within institutional arrangements we place actual regulatory instruments and decisions (hands-on regulation), firms' tariff structures and trading practices, forms of private-public cooperation and contracts.

The **fourth level**, 'market structure and functioning' covers classical economic performance and business conduct. Level 4 is characterised by interactions between actors with different objectives. Here prices, quantities and investments are continuously determined by the business conduct of the engaged actors. Market strategies are chosen and deployed, lobbying comes into play, and buyers and sellers exchange goods. Actual behaviour is circumscribed by the space offered by the market design and regulation.

3.3.2 Criticism of the four-layer model

Several scholars have challenged the four-layer model in order to improve its explanatory power in enhancing understanding of the restructuring of energy markets. One central criticism concerns the interrelatedness of the layers and the direction of causal flows within the model. Another questions the assumptions made with respect to the frequency of institutional change. A third criticism emphasises the role that external factors may play in changing the variables representing the layers. We would add a fourth criticism concerning the distinction between the second and third layers of the model. A fifth criticism addresses possible intra-variable effects.

Firstly then, the four-layer model has been criticised because of the lack of proper analysis of the interrelationships between the levels (Künneke, 2008). Related to this, Correljé and De Vries challenge the constitutive character of the four-layer model. Originally, the direction of causality was seen as feeding through from the first to the second layer, from the second to the third and so on to the fourth. Although a reverse flow is mentioned, its impact is seen

as less effective and less profound. Other possible intra-layer interactions, such as economic performance or other aspects of market behaviour feeding back to informal or formal institutions, are not considered. However, Correljé and De Vries (2006) show that "feedback from the governance level to the level of informal institutions can have significant influence and can cause cultural changes at a much higher speed than Williamson suggests". Consequently, a rigid interpretation of Williamson's preferred direction of feedback may be inappropriate and limit the model's explanatory power, especially when applying it to explore causal relationships.

Second, Correljé and De Vries question Williamson's views on the longevity of those institutions. They argue that a range from 100 years to a millennium for informal institutions, or general time constants based on a factor of 10, might be too long and static. They wonder if the proposed time spans were inspired by aesthetic considerations rather than empirical observation. In fact, Williamson's proposition can be interpreted in such a way that some institutions will show greater inertia towards institutional change than others. The idea of frequency is quite important when it comes to the alignment of institutional logics across the four layers (see next section for more detail). For example, while regulatory regimes or policy objectives may have already been changed by treating natural gas as a commodity, gas import contracts and investment conditions might still be organised in the same way as before liberalisation.

Third, Correljé and De Vries emphasise the impact of external factors on all levels. Consequently, they argue, exogenous factors should be taken into account, both general ones and those related to the energy sector.

Fourth, when applying the four-layer model to the European gas market reform, the distinction between formal institutions and institutional arrangements was not as clear-cut as the model suggests. Correljé and De Vries faced the same difficulty in trying to separate sector-specific formal institutions and institutional arrangements when applying the model to their 2006 analysis of the European electricity reform. They placed rules released by the regulator on both levels. Moreover, they concluded that the distinction between generic and sector-specific formal institutions is ambiguous. This poses the question as to what causes the lack of conceptual clarity, if we can resolve this maybe we can overcome this obstacle. What proves to be problematic can be summarised as the same indicators occurring in both the sector-specific institutions, set by the European Union, and in institutional arrangements. This conceptual ambiguity can be illustrated by two examples. First, European provisions determine legal unbundling to be the minimum reform, but it is left to the national regulatory authority to decide the degree of unbundling applied. Another example concerns the distribution of regulatory oversight. As the European law does not determine the position of the

regulator vis-à-vis the government by prescribing the regulatory competencies, their distribution has to be decided at the national level. On the one hand, an option might be taken by a regulator which would mean that it took the actual regulatory decisions (Level 3). Conversely, a national law could transfer the regulatory oversight of certain aspects of regulation to the regulator, the government and/or the transmission system operator. Depending on the choice made, the actual regulation might be in the form of a decision prescribed through national law, the decision of the regulatory authority, or through a two-step process involving both levels. To summarise, with the European gas market reform, the actual regulatory functioning is finally determined on the level of institutional arrangements. First and foremost, the cause of the conceptual ambiguity stems from the nature of regulation – a process that involves several factors and levels. Second, the model in its early form does not fully account for multilevel governance. In striving for a general solution, it comes down to whether the allocation of subjects to levels is primarily subject-related or primarily dependent on who decides. We are not proposing a definitive clarification of which indicators should be subsumed under formal institutions and which under institutional arrangements, which would allow generalisation, since the purpose of our analysis is explorative. Rather, we apply a solution based on our research interests by distinguishing between the European legal provisions of the gas reform on the one hand, and institutional arrangements determined by national authorities - be it in the form of law or regulation - on the other. This enables us to identify the effect European law has on convergence in gas market regulation across Europe. For our purposes, it is sufficient to adopt a multilevel governance perspective differentiating between the EU and national levels within the layer.

Fifth, energy policy, and member states' beliefs as expressed through attitudes towards liberalisation, might change within an examination period, and directly or simultaneously affect the institutional arrangements on the third level. In other words, while European energy policy, or member states' attitudes, at moment 't1' might be predominantly focused on liberalisation, priorities and views might change in 't2'. If our first criticism is valid, that time factors might be considerably shorter or changes coincidentally fall within an examination period, then inter-variable flows between the first and the third layers become theoretically possible. An impulse stemming from the first layer might affect both the originally subordinated layers (second and third) simultaneously, or with little time delay between the second and the third. This might be caused by an extraordinary event (Sine and David, 2003), or triggered by an accumulation of structural changes in the basic market conditions (Helm, 2005). Helm postulated that an energy paradigm shift occurred around 2000. After that date, the objectives of energy policy shifted towards security of supply

and climate change, whereas in the 1980s and 1990s energy policy concentrated on privatisation, liberalisation and competition (ibid). In other words, there are indications that energy policy objectives, and member states' attitudes, changed within the period of study. In our quantitative and qualitative analyses we will explore the impact of energy or sector-specific objectives and attitudes, perceived as part of institutional logics, on regulatory choices in the European gas markets (see chapters 6, 10 and 11).

Based on the points of criticism, the following can be concluded. Firstly, the interrelatedness of the different levels and the variables constituting the levels needs to be better specified. Feedback processes should be considered in a more systematic way. For our analysis, the feedback from the fourth layer to the institutional arrangements and to policy objectives on the first layer needs to be integrated within a conceptual framework. The operationalisation of differentiating criteria such as frequency, purpose or level of analysis are sometimes difficult to operationalise (Kuenneke, 2008: 242). In our analysis, we intend to locate the European legal provisions on the second layer, and the institutional arrangements (regulatory decisions) on the third layer.

3.3.3 Towards an applied conceptual framework for analysing European gas market governance

Informed by the proposed improvements to the original four-layer model, we now bring together Williamson's four-layer model and some additional elements stemming from Correljé and De Vries' conceptual framework to organise our analysis. Correljé and De Vries followed the conceptual path exposed above and modified Williamson's framework by integrating the concept of path dependency and external factors in their application which set out to explain the institutional context which shapes energy reforms. These two propositions will be explained below in more detail. In the course of this description, we make only minor modifications to their framework before reaching our applied conceptual framework (Figure 5).

The first layer reflects the distinction between related policies and the objectives of restructuring. The related policies mainly account for political regulatory goals, whereas the objectives of restructuring group a mix of sector-specific and economic regulatory goals. Related policies target safeguarding the security of supply, environmental concerns and maybe social issues (energy subsidies or social tariffs for low-income groups). The objectives of restructuring incorporate aspects to ensure the prevalence of liberal policy and ideology, increasing economic efficiency, ensuring investment in energy systems and so forth. Restructuring processes, such as energy market liberalisation, can be analysed as to whether the policy objectives are primarily sector-specific

or more general in nature. A clearer characteristic is to differentiate between different policy objectives by the priority of their regulatory goals. It is rare that liberalisation policies have a single objective as seen in textbook explanations. Therefore, we share the view of Correljé and De Vries that the balance between policy objectives relevant to the reform influences the restructuring process. In this sense, our earlier proposal to distinguish between first and second order regulatory goals seems to find support (see section 2.2.4).[37] In our conceptual framework, policy objectives do influence the institutional arrangements in the form of regulatory choices. The prioritisation of policy objectives can influence regulatory choices before they are even manifested in the form of European legislation. Actual regulatory decisions by the European Commission, or by national regulatory authorities that represent the third layer, can be directly affected by preferences or policy objectives.

On the second layer of our framework, we position formal institutions such as European legal provisions. Our description of the four-layer model covers the full range of what this layer can incorporate. We apply here a sector-specific interpretation when concentrating on the European Directives and regulations. In tackling our fourth point of concern, we reasoned that we should subsume, for our analysis, the polity dimension, understood as the distribution of regulatory tasks amongst regulatory authorities, in the third layer and, as such, deviate from Williamson's initial proposition.

The institutional arrangements are located on the third layer where a specific bundle of institutional arrangements form the national regulatory regime. Our perception of a regulatory regime is based on the concept of regulatory comprehensiveness (section 2.3.1) and distinguishes between polity and policy dimensions. Whereas the polity dimension recognises the distribution of competencies among regulatory authorities and institutional capacities, the policy dimension is limited to the regulatory instruments that member states apply to regulate European gas markets. These regulatory regimes in general, and more specifically their regulatory choices, influence the market strategies, the business conduct and the overall economic performance of those markets. The specific composition of regulatory regimes is based on a number of regulatory choices which are triggered by variables on all layers.

The interaction between regulatory regimes and market performance is two-way. Utilities' profits, operational costs and tariffs are reviewed by regulatory authorities so that they can apply informed regulatory incentives. To this extent, a company's economic performance directly affects any adjustment to its regulation. More general performance concerns, such as ensuring competitive natural gas prices or sufficient investments in natural gas facilities, also trigger regulatory decisions. Market parties adapt their strategies and business conduct

to the regulatory regimes. At the same time, the gas industry tries to influence regulatory choices. Correljé and De Vries anticipate different feedback times, depending on whether a public or private actor is involved. Government or regulatory authorities respond to negative performance and a response might be accelerated due to the influence of lobby groups. For instance, groups of energy-intensive users or more general consumer groups might lobby for lower gas prices. In general, it is assumed that private market players, especially from within the sector, are quicker in terms of feedback because they have more information and greater incentives to influence regulatory processes and choices. This is in contrast to governments where the "feedback is characterised by long time delays due to investment lead times, incomplete information and incomplete understanding of the meaning of that information" (Correljé and De Vries, forthcoming: 13).[38] Hence, Correljé and De Vries follow the structure-conduct-performance paradigm (see section 2.2.5) when separating market parties' strategies and market performance. Williamson's framework does not foresee such a separation between business conduct and performance but merges these in the fourth layer. As we do not specifically analyse business conduct on a variable level, we integrate business conduct and economic performance in the fourth layer.

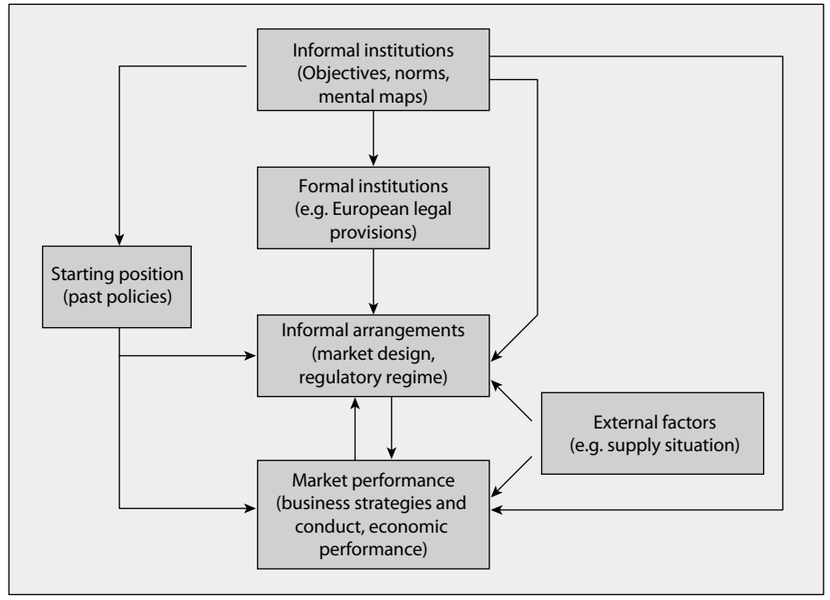


Figure 5: Applied conceptual framework[39]

The variable 'external factors' is borrowed from the structure-conduct-performance paradigm in which the variable is termed 'basic conditions'. External factors are subdivided into physical, economic and institutional factors, all of which constrain the regulatory regimes and market performance (Correljé and De Vries). These external factors encompass characteristics such as the physical endowment of energy resources, the level of economic development and growth, and institutional stability and rule of law.[40] In the literature, it has been emphasised that the resource endowment of a country (a physical factor) influences design choices in the context of electricity reforms (Bunn and Weinmann, 2004). Correljé and de Vries describe the impact as that the "presence or absence of primary energy sources drives the choice of primary fuels, the technical and economic characteristics of the sector and drives interests and policies" (Correljé and De Vries, forthcoming).

The starting position of a country affects its restructuring process (Arentsen and Künneke, 2003). Adopting the idea of path dependencies (Liebowitz and Margolis, 1995)[41], Correljé and De Vries include a variable 'starting position'. Previous policy decisions, with regard to the energy mix of a country, influence today's regulatory decisions. The life cycles of plants and also any gas import infrastructure function as lock-ins for regulatory choices. Historical institutionalism is especially able to explaining inertia in the process of institutional change. A drastic change in the dominant institutional logic is rather unlikely. As such, regulatory choices will be influenced by the market organisation prior to the restructuring process. "It is easier to introduce competition into a market with fragmented ownership than into one with a monopoly. If the monopoly is state owned, the government has the power (if not always the willingness) to break up this company, like the U.K. did with the Central Electricity Generating Board. A private monopoly may be more difficult and costly to split up" (Finon, 2003; quoted in Correlje and De Vries, forthcoming). We argue the starting position of a country triggers both regulatory choices and, at the same time, business conduct. Although 'starting position' is a plausible variable, which is why we include it in the general framework, it seems difficult to control for. In our analysis, we account for the degree of change a member state undertakes with regard to its regulatory decisions by applying a convergence concept that reflects the mobility dimension (section 2.3.2).

The applied conceptual framework enables us to identify relevant variables on each level: policy objectives, European legal provisions, specific regulatory choices or the bundle of institutional arrangements summarised as a regulatory regime, economic performance, and the country's endowment with natural gas. Williamson's conceptual framework also considers the particular authority structure as a relevant variable. When referring later to the principal agent

approach, the role the authority structures play within our analysis will be elaborated in greater detail to understand European gas market governance.

The next step is to learn more about how these levels or variables are interrelated. Groenewegen and Künneke (2005) argue that there might be some kind of 'logic' between the levels of institutions. Künneke follows up on this idea and exemplifies, with reference to the electricity market, two identified logics, one before and one after its liberalisation.[42] The introduction of the European electricity reforms marks "a shift of the dominant logic from public utilities towards a market orientation in which electricity is treated as [a] commodity" (Künneke, 2008: 243). Künneke contrasts the two logics by showing how they correspond with different layers of the model. Before liberalisation, "the institutional arrangements allowed for public ownership (Level 2) and direct political involvement in the decision process (Level 3). The resource allocation was oriented towards public service tasks (Level 4)" (ibid). After liberalisation, "firms are privatized (Level 2) and their governance is oriented towards the realization of private investors' objectives (Level 3). Profit maximisation has become an important goal of resource allocation (Level 4)" (ibid).

The same shift in logic can be observed in the European gas market reform. Accordingly, an institutional logic which treats natural gas primarily as a public utility or commodity can be conceived as a specific form of embeddedness of this sector within the norms of society. Institutional logics are a powerful mechanism in explaining what triggers regulatory choices. Yet, to date, the application of the 'institutional logic' concept remains rudimentary and the understanding of the underlying logic needs to be advanced. As a contribution, we suggest that the alignment hypothesis offers a micro-analytical explanation for the evolution of those logics that underlie economic governance in general and European gas market governance in particular.

3.4 Transaction cost economics in a nutshell

The central proposition of transaction cost economics is the alignment hypothesis. By referring to the alignment hypothesis, we can increase our understanding of the institutional logics that relate the layers in Williamson's four-layer model with each other. Referring to the transaction cost framework allows us to specify more precisely how informal institutions, formal institutions, institutional arrangements and economic performance are all linked. Section 3.4 first clarifies the propositions in the alignment hypothesis. Next, the transaction characteristics of European gas markets and the well-aligned modes of governance are both identified. This allows us to theoretically deduce expectations as to whether and why it is unlikely that best-practice in

terms of regulation-for-competition is applied. By referring to the second part of the alignment hypothesis, we can deduce the expectation that regulation-for-competition will have a negative influence on economic performance. Moreover, referring to a political transaction cost framework enables us to identify differences in incentive schemes between various regulatory agents which will affect regulatory decisions.

3.4.1 *Discriminating alignment hypothesis*

In transaction cost economics[43], the core hypothesis used to explain institutional change in economic governance[44] is called the discriminating alignment hypothesis. Williamson summarised the alignment hypothesis as follows:

> Transactions, which differ in their attributes, are aligned with governance structures, which differ in their cost and competence, so as to effect a (mainly) transaction cost economizing result. (1998a: 37)

The propositions summarised in the hypothesis are twofold. The first part of the alignment hypothesis assumes that characteristics of transactions determine which type of governance is best suited to a particular situation. Yvrande-Billon and Saussier refer to this proposition as the first-order hypothesis of transaction cost cconomics (2005: 75). Contracting partners choose organisational arrangements according to the transaction characteristics with the intention of minimising transaction costs. Transaction cost economics aims not only to explain contractual choices, but also tries to link the misalignment of governance structures with observed performance (ibid: 69). This leads us to the second proposition, namely that misaligned transaction characteristics and governance structures lead to reduced economic performance. This second-order hypothesis of transaction cost economics (TCE) is also referred to as the misalignment hypothesis (ibid: 75). An assumption is that there is a higher probability of change in governance structures when a misalignment between transaction characteristics and organisational choices results in poor economic performance. “The performance penalties associated with misalignment will on average trigger efforts by inappropriate[ly] aligned organizations to reduce their degree of misalignment” (Nickerson and Silverman, 2003: 436). TCE offers two options on how to resolve misalignments: “transaction cost economics suggests that a situation of misalignment between governance structure and the characteristics of its transactions provide incentives either to shift to another mode of organization or to modify the feature of the transactions.” (Yvrande-Billon and Saussier, 2005: 79)

Transaction cost economics refers to two not dissimilar ways to identify well-aligned modes of governance, understood as optimal design choices. Both are comparative in nature and foresee first investigating the underlying characteristics of transactions and then evaluating them against their anticipated capacity to mitigate potential hazard. Then, one can either compare an idealised or imaginary type of governance with the existing one (Coase, 1964), or compares two existing types (or an existing one with a recent historical example). In order to determine an efficient mode of governance, the remediableness criterion was introduced. Then, “an extant mode of organisation for which no superior feasible alternative can be described and implemented with expected net gains is presumed to be efficient” (Williamson, 1999: 30). Due to its relative considerations, transaction cost economics is also referred to as comparative institutional analysis. The impact on economic performance can be analysed in a similar way. First one assesses the alignment of transaction characteristics with governance structures and then one analyses the impact on performance.

The first-generation of transaction cost economics focused on the first-order hypothesis. Here, transaction cost economics mainly analysed the way asset-specificity, transaction costs and incomplete contracts encouraged or discouraged vertical integration as a specific form of economic governance (Joskow, 1993). In their extensive literature review, Macher and Richman found remarkable support for the application of transaction cost frameworks to a wide range of phenomena related to organisational choices (2006). Carter and Hodgson were more conservative when pointing out that the findings we are only partly consistent with a transaction cost framework (2006). Most of the studies reviewed only tested to a limited degree the theory’s predictions because the empirical assessment of transaction cost characteristics, governance structures and performance is very demanding in terms of data requirements. Yvrande-Billon and Saussier observe that “econometric tests of the TCE propositions are usually indirect. They show that contractual choices correspond to what the theory advocates and then infer from this result that these choices are efficient, that is to say that transactions are minimized” (2005: 74). Williamson notes in this respect that “empirical research on transaction cost matters never attempts to measure costs directly. Instead, the question is whether organizational relations (contracting practices; governance structures) line up with the attributes of transactions as predicted by transaction cost reasoning or not” (Williamson, 1985: 22). This functioned as the guiding question in the first-generation of transaction cost economics in seeking empirical support for the first-order hypothesis. The second-generation of TCE widened the scope in at least two ways. Firstly, the application of transaction cost economics was extended to the public sphere and, secondly, the impact on performance, as reflected in the misalignment hypothesis, is given greater

attention. To date, the research on the impact on performance of misalignment has resulted in only a few empirical tests and it remains relatively undeveloped. Before touching further upon these two shifts within the TCE research agenda, the next section elaborates on the two elements that determine (mis-)alignment.

3.4.2 Transactions and modes of governance

As the name transaction costs economics suggests, the transaction is the unit of analysis. A transaction is essentially the exchange of a good or a service, which is organised within a contractual relationship or governance structure. Institutional arrangements such as contracts, in practice, show an enormous variety. Contractual pluralism is prevalent. According to Williamson (1985: ix), transaction cost economics rests on the assumption that any problem that can be formulated as a contracting problem can be analysed in transaction cost economising terms. A transaction can be conceived as follows:

> According to John R. Commons, the 'ultimate unit of activity …must contain in itself three principles of conflict, mutuality and order. This unit is transaction.' Not only does transaction cost economics subscribe to the idea that transaction is the basic unit of analysis, but the triple to which Commons refers – conflict, mutuality, order – is very much what governance is all about. (Williamson, 1998: 36)

To understand the notion of transaction, one has to consider and investigate the three aspects that Williamson refers to. What is potentially creating conflict? To what extent are the contracting partners interrelated or dependent on each other? How are potential hazards, which might arise out of conflicting situations or asymmetric relationships, prevented? Contractually, the prevention of hazards is usually translated into safeguards.

For illustrative purposes, Williamson uses a parallel from engineering to explain transactions:

> A transaction occurs when a good or service is transferred across a technologically separable interface. One stage of activity terminates and another begins. With well-working interfaces, as with a well-working machine, these transfers occur smoothly. In mechanical systems we look for frictions: do the gears mesh, are the parts lubricated, is there needless slippage or other loss of energy? The economic counterpart of friction is transaction cost: do the parties to the exchange operate harmoniously, or are there frequent misunderstandings and conflicts that lead to delay, breakdowns, and other malfunctions? (Williamson, 1981: 552)

This citation might give the impression that transactions and costs only occur when physical goods or services are physically delivered (Furubotn and Richter 2005). A strict interpretation of transactions could exclude financial services such as options on futures or derivatives in forward markets since there are no physical deliveries involved. The literature responded to this unintended restriction by perceiving a transaction as a bilateral act involving two different points in time.

> Any transaction rests, analytically, on two bilateral acts, namely, (i) the act of expressing mutual assent to exchange, and (ii) the act of exchanging. The difference between discrete and relational contracts is that in the case of discrete contracts mutual assent to exchange is brought to expression in the act of exchanging, whereas in the case of relational contracts mutual assent to exchange is expressed separately from subsequent acts of exchanging. (Ruiter, 2005: 290)

Van Genugten (2008) emphasised that mutual assent remains crucial for exchange, regardless of whether the transaction involves a physical delivery. The agreement to exchange leads to a governance structure, be it in form of markets (discrete contract), or between firms (relational contract). Ultimately, the analytical distinction introduced by Ruiter helps to widen the scope and reach of transaction cost economics. In this way, transactions characterising the gas markets are fully covered right along the value chain.

As the discriminating alignment hypothesis suggests, certain attributes determine the distinct character of a transaction. Transaction cost economics distinguishes between three characteristics: uncertainty, frequency and asset-specificity. Although asset-specificity has received most attention in the literature, transaction cost economics conceives these characteristics as interrelated. The combination of these characteristics and their values amplifies or dilutes (Williamson, 2005: 14).

Here, uncertainty refers to behavioural and environmental uncertainty. Behavioural uncertainty is deduced from the bounded rationality assumption that New Institutional Economics is based upon. Humans are limited in their capacities to process information and may further behave in an opportunistic way. Behavioural uncertainty refers to *ex post* opportunistic behaviour by one contracting partner. A good example would be an independent regulator who unilaterally changed the rules of the game after the utility company had invested in capital-intensive infrastructure. The company is locked-in by its investment but is reliant on the regulator's revisions of tariff regulations etc. to make a return on its investment. In anticipation of such later opportunistic behaviour

by the regulatory authority, utilities might delay such investments or even decide against major investment projects. The literature refers to this situation as a hold-up problem (Klein, Crawford et al., 1978).

Environmental uncertainty does not refer to judging human behaviour on whether actions are sustainable in an environmental/ecological sense, but refers to uncertainty as to the way the human environment is developing. Environmental uncertainty stems mainly from unanticipated changes in factors or conditions that affect transactions. The structure-conduct-performance paradigm often locates such environmental changes in the basic conditions affecting the market (section 2.2.5).

A transaction might occur or be necessary only once, or more frequently. The basic logic is that the more frequent the transactions, the more that total transaction costs rise. Frequent exchanges of goods and services require constant monitoring and this may justify establishing a private or public hierarchical mode of governance, be it in the form of a vertical integrated company, a state-owned company or an independent regulator to monitor the transactions. The third option involves high set-up costs, but promises benefits in terms of reputation. Unlike an independent monitoring body, a firm-based monitoring routine is regarded as biased and less independent (Williamson, 2005: 14).

The presence of frequent transactions under conditions of uncertainty and asset specificity helps determine which mode of governance is regarded as best suited. Williamson distinguishes six types of asset specificity (Williamson, 1991):

1. site specificity (the output of the production process cannot easily be removed)
2. dedicated asset specificity (production facility too large for alternative customers)
3. physical asset specificity (the procedure or product is made to a specific standard)
4. temporal specificity (adjusting production to consumption requires just-in-time synchronisation)
5. brand-name capital
6. human asset specificity

All of those asset specificities may serve as a lock-in for choosing or remaining with a specific form of economic governance, and invoke path dependency (North, 1990). The various types of asset specificity and consequent expectations with regard to the most efficient modes of governance are discussed in their application to the European gas sector below. First, we briefly outline the modes of governance and their supporting features.

Very generally, Williamson distinguishes three discrete modes of governance: spot market, hybrid forms (bilateral or trilateral governance) and hierarchy (unilateral governance)[45]. Although these modes are viewed as discrete alternatives, they can be seen as representing characteristic nodes on the governance spectrum. The modes differ in several respects. Key features are related to incentive intensity, administrative control, adaptation and contract law. Incentive intensity "is a measure of the degree to which a party is reliably appropriates the net receipts (which could be negative) associated with its effort and decisions. High-powered incentives will obtain if a party has a clear entitlement to and can establish the magnitude of its net receipts easily. Lower-powered incentives will obtain if the net receipts are pooled and/or if the magnitude is difficult to ascertain" (Williamson, 1996: 378). Incentive intensity affects the individual actor, and in markets is translated into individual monetary gains. Administrative controls refer to the degree that transactions are monitored and held accountable for the effects of the transactions incur. These controls are safeguarded by a number of support staff and established monitoring procedures. In this sense, administrative controls express the degree of bureaucratisation within an organisation. Adaptation - as the final distinguishing feature within modes of governance - refers to the degree of autonomy with which adaptation can be realised. Contract law is a specific interpretation of the more general assumption of the rule of law. Transaction cost economics postulates that different modes of governance are supported by different specific forms of contract law. The literature defines classical contract law, neoclassical contract law and forbearance of a contract as three different forms. In a hierarchy, such as an integrated company, disputes are settled internally (forbearance) whereas, in markets, disputes are resolved by the courts (classical contract law). Neoclassical contract law corresponds more to hybrid modes of governance and leaves the contracting parties with more room to manoeuvre. Such contracts purposefully remain flexible and incomplete: a "neoclassical contract i. contemplates unanticipated disturbances requiring adaptation, ii. provides tolerance zones within which bad performance will be absorbed, iii. requires information disclosure and substantiation if adaptation is proposed, and iv. provides arbitration in case voluntary agreement fails" (Williamson, cited in Van Genugten, 2008: 26). An example of a neoclassical contract is a long-term gas importing contract offering some degree of flexibility in terms of volumes and prices. If the predetermined price band is exceeded or volumes change, a renegotiation clause ensures that the importing and the exporting companies can re-optimise their contractual conditions through negotiations. In general, forborne contracts and neoclassical contracts also exist in such markets, but they are less common and certainly not characteristic of those markets.

Table 5 shows the values of the features attributed to the different modes of governance. Markets are associated with high-powered incentives, low administrative controls, high autonomous adaptation and classic standardised contracts. Hierarchy sits at the other end of the continuum, being characterised with opposite values for these features. A hierarchy implies a strong degree of coordinative adaptation along with a high level of administrative controls, while at the same time disputes are settled internally without invoking contracts. In a hierarchy, autonomous adaptation is weak and incentives are low powered. Hybrid modes are located between these two ends and the features are all present, but to a lesser extent. Neoclassical contracts are significant within hybrid modes.

	Market	**Hybrid**	**Hierarchy**
Instruments ***Incentive intensity*** ***Administrative controls***	 ++ 0	 + +	 0 ++
Performance attributes ***Autonomous adaptation*** ***Coordinative adaptation***	 ++ 0	 + +	 0 ++
Contract law	++	+	0
Note: ++ denotes a strong, + denotes semi-strong and 0 denotes a weak presence			

Table 5: Distinguishing attributes of market, hybrid and hierarchy modes of governance[46]

The distribution of values between market, hybrid and hierarchy modes reflects that transaction cost economics assumes that market coordination in the form of simple contracts[47] provides a more efficient, or lower cost, mechanism for managing economic exchanges than the other two modes of governance. However, "given that most complex contracts are incomplete, the theory holds that in certain situations the costs of market exchange may increase substantially and surpass the technical efficiencies provided by the market" (Leiblein, 2003: 939). In other words, hybrid or hierarchy modes might be more efficient if they are better able to cover the contractual hazards than market coordination. Transaction cost economics presumes an increase in motivation and coordination costs occurs when contractual safeguards are inadequate for the potential hazards in the exchange under consideration. As Leiblein summarizes: "Typically, these costs have been associated with the likelihood of opportunistic behavior (Williamson, 1975; Williamson, 1985), the potential

for hold-up (e.g. Klein, Crawford et al., 1978), challenges in measurement and monitoring (Barzel, 1982), or insufficient levels of coordination (Alchian and Demsetz, 1972)" (Leiblein, 2003: 940). Having now outlined the determinants of transactions and modes of governance in general, we can turn to characterising these determinants in European gas markets.

3.4.3 Transaction characteristics and governance structures of European gas markets

This section considers, with reference to transaction cost principles, which kind of governance structure is best aligned with the transaction characteristics of European gas markets. To do so, sector-specific transaction cost characteristics are first examined and then the corresponding governance structure is determined.

In any economic sector, a plurality of transactions occurs, involving different exchanges of goods and services. European gas markets are based on a range of transactions. To apply the transaction cost framework to gas markets requires identifying the most relevant transactions and their governance modes. The exchange of natural gas and related services is accommodated through various forms of contract, used to organise transactions along the gas value chain, with different modes of governance being applied. Some are related to spot market trading and are organised in the form of a market. Other contracts are bilateral and show a hybrid mode of governance. Historically, European natural gas imports were based on long- term take-or-pay contracts including a destination clause which prohibited re-export of imported gas (Neumann and von Hirschhausen, 2005). Another variant of bilateral contracts are inter-firm 'over-the-counter' (OTC) deals on the wholesale level. "OTC is the term used to describe trades which are customised confidentially between the parties concerned – in contrast to open-market trades which are standardised and priced transparently" (Wright, 2006: 21). Other contracts organise the access to the distribution or transmission networks. The bundle of contracts prescribing these transactions is also referred to as the tariff system and balancing regime. On the retail side, consumer end-user contracts determine the terms of conditions applied. Depending on the consumer group, contracts and their modes of governance vary. Whereas companies organise their transactions with residential consumers in the form of classical contracts, industrial consumers tend to apply neoclassical contract law in order to accommodate flexibility in demand and supply changes. Natural gas markets fall within the group of network industries. A significant factor is that the exchange of gas and related services requires a gas network, import facilities (LNG terminals, regasification plants) and, on the production side, export (pipelines, a liquefaction entity and LNG export terminals) and production (upstream) facilities. In the context of

the European gas market reform, the network for gas transport is subjected to reform and therefore of most significance. To a certain extent, transactions and their attributes within a sector resemble one another. Based on this, we argue that a portfolio of a sufficient number of identical, or very similar, transaction attributes allows one to use a sector argument here. Below, these attributes will be evaluated with regard to asset-specificity, uncertainty and frequency.

In a general sense, asset-specificity refers to the relative inability to transfer assets intended for use in a given transaction to other uses. It is assumed that highly specific assets represent sunk costs[48] that have relatively little value beyond their use in the context of a specific transaction. Glachant considers that four of the six variants of asset specificity outlined above are most relevant when analysing network industries (2002).

Site specificity affects gas transport and natural gas production assets. These assets are immobile, their set-up or relocation costs are large and, therefore, relocation is not a viable option. Once a network is in place, this asset will be used for a single purpose. Some authors claim site specificity can be reduced "by the attribution of access and connection rights, or by the regulated construction of additional facilities" (ibid). Parallel pipeline systems are seldom economic as the capacity demand is rarely sufficient to justify an additional pipeline. While third party access may reduce site specificity, it may not similarly reduce the incumbent's desire to vertically integrate all parts of the gas value chain starting with production, through transportation, storage and processing to consumer supply.

The degree of dedicated asset specificity depends heavily on the individual relationship. There are certainly transactions between large industrial users and gas companies for which dedicated pipelines exist; meaning that the pipeline connection between the two companies is exclusive. If the industrial user decides to switch fuels from natural gas to say coal, then the pipeline becomes unnecessary and the asset owner is faced with a stranded asset. In other words, the extent of dedicated asset specificity depends on the network characteristics in relation to the consumer base. However, production and transport facilities often enjoy a broader consumer base. Overall, dedicated specificity is, on average, somewhat semi-specific in gas markets.

Physical and temporal specificities are also pertinent. Prior to the EU gas reform, the networks were not designed for flexible trade within Europe. In terms of physical specificity, the inter-operability of the natural gas grids has been key. Physical specificity still plays an important role in minimising harmonisation barriers. For instance, different gas qualities impose technical obstacles. Glachant comments that "physically specificity can be neutralised by the regulatory establishment of interoperability standards and norms, or via a

legal obligation to ensure entry- and exit-points linking interconnection flows" (ibid). So far, an European grid code has not been established, even though the Third Energy Package is aiming to achieve this. The limited capacities to store gas poses challenges for a timely management of gas flows which are necessary to optimise supply with demand. Any measure to integrate a growing number of players, which any liberalisation of the markets essentially implies, complicates the gas flow management and increases temporal specificity. Glachant notes in this respect "temporal specificity can be attenuated by designating an accredited controller to synchronise the flows" (ibid). A transmission system operator can reduce but not remove the temporal specificity that characterises gas transport. European gas markets thus continue to demonstrate high physical and temporal specificities.

Brand-name capital and human asset specificities are, according to Glachant, low. Although natural gas differs in quality by origin and by trader, it is certainly not a commodity comparable with branded products such as Parmesan and Coca Cola. Unlike these companies, gas companies such as British Gas or Ruhrgas do not generate capital on the basis of their brand but by their geographical availability. Unlike Glachant, we believe that human asset specificity has some relevance for the gas sector. Highly educated staff are required to handle the network, be it to balance gas flows or to trade gas on the wholesale level. In comparison, the transport of gas requires much more sector- and asset- specific knowledge than, for instance, milk. Before liberalisation, only a very few people had access to the details of the gas network and tariffs. At that time, gas flows, capacities, in- and out- take points were strategic knowledge. Later, the reform aimed to broaden the knowledge base through the help of a set of third-party access measures. The availability of a sufficient number of specifically trained people such as engineers with expertise in oil and gas projects is crucial. Whereas exploration, production, construction and maintenance areas face difficulties in attracting certain technical staff in sufficient numbers, and at reasonable cost, other branches of the business do not face shortages. However, since the current shortage of staff might be only a cyclical problem, we consider European gas markets to be moderate in terms of human specificity. To sum up, there are ways in which certain specificities can be reduced at the expense of higher transaction costs. The European Unions' attempt to establish a European grid code, and to harmonise balancing markets, may be seen as an effort to reduce physical and temporal specificities. This effort necessitates greater collective coordination and monitoring. The most significant asset specificity in terms of characterising transactions in European gas markets is site specificity. Investments in transmission and distribution networks, storage and in gas production and exploration remain highly site specific. The provision of capital

for these investments is dependant on whether exposure to potential hazards can be safeguarded against, for instance by agreeing long-term supply contracts. For this reason, we argue that contract flexibility has its limitations. Contract flexibility involves at least three dimensions: long term versus short term, small volume versus large volume, and the agreed price parameter. Given the site specificity, any investing party has to accommodate price, volume and time risks. In opting for a market-based mode of governance, rather than a hierarchical form involving vertically integrated companies, a dilemma related to collective action is added.

When it comes to the frequency of transactions in the gas sector, this can vary with the type of transaction. However, transactions facilitating gas trading and gas transport do occur frequently. Uncertainty may arise because of unpredictable changes in the environment or unforeseen behavioural changes by relevant actors. In European gas markets, environmental uncertainty is mainly related to unknown developments that will affect the demand and supply of natural gas. Although numerous sophisticated demand and supply projections exist, geopolitical changes, with politically or economically motivated fuel choices, may alter the picture quite dramatically and rapidly. The restructuring of the energy sector after the oil crisis in 1975 is a good example. In a less spectacular way, each company and country has to take into account whether contracted volumes will physically be delivered at the agreed price. Energy price volatility poses an enormous environmental uncertainty as natural gas prices are linked to oil prices. Behavioural uncertainty also plays a part. The literature mainly refers, in the context of utilities, to the relationship between the investing companies and the regulatory authority. Companies face the threat that, after they have made huge investments in production or network facilities, the regulatory authority could change the regulatory framework in such a way that the investment fails to provide an adequate return. Once the firm has made the investment, it is effectively locked into a contract with the regulator and thus runs the danger that the investment fails to return a profit. Transaction cost economics would view the regulator as behaving opportunistically if it changed the rules of the game or the contract *ex post* in its favour because the company is dependent and locked in by its investment. This specific form of uncertainty is also referred to as regulatory uncertainty (Spanjer, 2007). It is perceived to be a structural problem that may result in a delay or withholding of an investment decision.

Now that we have tentatively reviewed the actual levels of asset specificity, uncertainty and frequency in transactions in European gas markets, we can confront our estimation of the situation with a prediction based on TCE. In other words, which mode of governance is best suited for transactions which have high asset specificity, and which are characterised by a high level of uncertainty and

a high frequency? With reference to Williamson's transaction cost framework, Van Genugten formulated the following hypothesis:

> When asset-specificity increases, transaction costs associated with market governance increase. Bilateral dependency leads to a weak ex post negotiation position of investors. Therefore the investor will be reluctant to make the investments, which leads to hold up. Hybrids and hierarchies then become the preferable over markets: at very high levels of asset specificity, hierarchy is the appropriate governance form" (2008: 30-31). To which we would: transactions with a high frequency also encourage a strict form of coordination through the establishment of a hierarchy.

The classical application of Williamson's transaction cost theory explains why natural gas companies opt for vertical integration as their mode of governance and prefer long-term contracts. According to the reasoning, hierarchical (vertical integration) and hybrid forms (long-term contracts) are perceived as the most efficient modes of governance when there is asset specificity. The main reason being that competitive markets do not allow one to safeguard the risks associated with the sunk costs of capital-intensive infrastructures. If there is a misalignment, there are only two ways to overcome this unfavourable situation: either the features of the transactions need to be changed, or a different mode of governance has to be chosen. A realignment might occur in the form of a governance switch (e.g. from vertical integration to long-term contractual arrangements) or the given mode of governance might be refined. As we see in the case of the European gas market reform, decisions concerning economic governance are not left to economic agents but are the subject of regulation and political processes. Yvrande-Billon and Ménard observe: "In the private sector market forces push decision-makers towards adopting organisational forms aligned with the characteristics they support while reducing as much as possible the inevitable contractual hazards" (2005: 678).

It is not only economic agents that are inclined to take into account the arguments brought forward by the industry: when it comes to investments in natural gas infrastructure and security of gas supply, the government and its regulatory authorities are locked into a bilateral relationship. The industry provides the know-how, the organisation and the funding base on which the natural gas supply of a country relies. For this and other reasons (see below), a considerable number of relevant political agents might avoid voting for a fully-fledged liberalised gas market, or at least be reluctant to see dramatic changes in economic governance without having first developed an alternative that has proven to be reliable in practice and to provides a safeguard against potential

hazards. The introduction of competition to the natural gas markets in the European Union, by applying regulation-for-competition, aims to replace the old modes of governance by greater market coordination. This implies a shift in the dominant institutional logic from perceiving natural gas as a public utility to seeing it as a commodity. The European gas reform seek to establish markets where once hierarchy and hybrids were the dominant modes of economic governance. Within best practice regulation, we include those regulatory measures that aim to achieve competitive markets.[49] We should stress that the European Union's perception of best-practice is contrary to that predicted by transaction cost theory for an optimal gas market.

We have demonstrated that significant transactions in European gas markets occur frequently and take place under conditions of environmental and behavioural uncertainty, while asset specificity remains. Site specificity is especially pertinent, even though physical and temporal asset specificity could be reduced by the establishment of a European grid code or the introduction of independent system operators. Nevertheless, Couwenberg and Woerdman conclude in their analysis of shifts in gas market governance that: "when transaction characteristics do not change, the same design problems will remain" (Couwenberg and Woerdman, 2006: 18).

Based on the transaction cost reasoning reflected in the first-order alignment hypothesis, we can deduce the following expectation with regard to the convergence of regulatory regimes.

Hypothesis 1: A misalignment between transaction characteristics and modes of governance, as is inherent in regulation-for-competition in European natural gas markets, is likely to result in a reluctance to apply what the EU perceives as best-practice which will hold member states back from moving towards (delta) convergence in terms of regulation-for-competition best-practice.

This hypothesis will be empirically tested in the quantitative and qualitative analyses of regulatory choices made in the European Union following the introduction of the European gas reform. The assessment of regulatory regimes in chapter 8 investigates the extent to which member states are converging. The qualitative case studies investigate single regulatory choices. The research designs for both types of analysis are described and operationalised in the next chapter. The next step is to consider the second part of the alignment hypothesis, which argues that the misalignment between transaction characteristics and governance structures leads to inferior economic performance. For this purpose, we first need to clarify how economic performance, efficiency and transaction costs are conceived within the TCE framework.

3.4.4 *Economic performance, efficiency and transaction costs*

The European Union decided to treat natural gas as a commodity in order to prevent and correct market failures (section 2.2.4). Through third party access to the network and other regulatory measures, competition would be fostered in the trading and transportation of gas. The structure-conduct-performance paradigm argues that the introduction of competition will reduce monopoly rents, provide incentives to reduce costs, increase efficiency and, ultimately, improve economic performance (section 2.2.5). In other words, the basic argument is that regulation-for-competition fosters competition in the market, which leads to improved economic performance. Transaction cost theory qualifies this prediction: successful economic performance depends on the transaction characteristics being well aligned with the governance structure. As we have demonstrated, competitive, regulated natural gas markets are not perceived as the optimal governance structure in the classical TCE interpretation. Rather, the high level of asset specificity indicates that a hierarchy, in the form of vertical integration, or a hybrid, understood as involving long-term contracts, are better-aligned governance choices. "Although TCE advocates selecting a governance form that minimizes the sum of total production and transaction costs, its application has emphasized the importance of the costs associated with governing and monitoring transactions" (Leiblein, 2003: 939). Nevertheless, both somewhat contradictory theories rest on the assumption that reducing costs results in better economic performance. This common perception is important to note for our understanding of what economic performance refers to. However, "the most general proposition regarding performance implications of transactional misalignment can be summarized as: the more misaligned an organizational or contractual choice, the poorer the performance" (Yvrande-Billon and Saussier, 2005: 78).

Economic performance can be optimised by increasing the efficiency of production and the exchange of goods and services. In this respect, economic literature refers to productive, allocative and transaction cost efficiency. The productive element aims to achieve the maximum production output with the minimum input in terms of labour and material etc.. The allocative component accounts for the efficiency with which the produced products and services are allocated among consumers. Allocative efficiency is achieved when resources are allocated so as to maximise the welfare of a society. New Institutional Economics has theoretically contributed to the understanding by adding an organisational dimension to the efficiency considerations by not only perceiving a firm as a production function but also as a governance structure. The alignment hypothesis argues that transaction costs increase when the mode of governance is not well aligned with transaction characteristics. Transaction costs are different from

production costs. Whereas production costs are related to the execution of a firm's contractual decisions, and comprise material, labour and financial costs, transaction costs relate to arranging the contracts *ex ante* and monitoring and enforcing the contract *ex post* (Dixit, 1996: 38). The latter "are the comparative costs of planning, adapting, and monitoring task completion under alternative governance structure[s]" (Williamson, 1989: 142). *Ex ante* transaction costs arise in the contract set-up phase, including drafting and negotiating the contract. *Ex post* transaction costs are those costs arising after the contract has been agreed. These are related to the setting up and running costs of the chosen governance structure, and also include the costs of safeguarding the contract's execution in the form of monitoring contract specifications and settling disputes in the event of conflict. To sum up, "the central meaning of efficiency within TCE, therefore, is transaction efficiency: the extent to which institutions are tuned to the relevant environment" (Leerdam, cited in Van Genugten, 2008: 28).

Transaction cost efficiency is empirically determined by measuring the degree to which transaction costs are optimised due to the transaction characteristics and the applied mode of governance being well aligned. The comparative element in TCE poses several problems. One involves the operationalisation of core concepts, and another the direct measurement of transactions costs. Transaction costs can be operationalised in the form of administrative costs, the set-up costs for a new governance structure, or monitoring entity, and the costs arising from adapting or controlling transactions. As we indicated earlier, measuring transaction costs directly for a firm, or even for whole markets, is rare. Instead, transaction costs are vaguely conceived as those costs that result from a misalignment between transaction characteristics and governance choices, but without estimating them. In reality, only a few studies have taken into account those costs associated with the success or failure to align transaction costs and governance forms. The authors have found empirical evidence that the effects of misalignment can be substantial, resulting in lower profits and higher failure rates (Macher and Richmann, 2006: 53-54). These empirical findings support the second part of the alignment hypothesis and emphasise the impact on performance.

Research on performance impact is usually carried out at the firm or the regional level. However, we would argue that a market perspective is also appropriate because the sum of firms' activities is the economic performance of a market as such. Our argument follows the same logic as methodological individualism, where individuals' behaviours can be aggregated to collective behaviour.

The way in which economic performance is perceived within the TCE literature has developed over time. Ménard and Saussier pointed out that several dimensions can be taken into account and that financial, economic and even physical indicators may be chosen (Ménard and Saussier, 2002: 453-454). Today,

the literature covers a wide range of different interpretations of economic performance starting with profitability, to technological innovation and investment, to quality of services. In general terms, transaction cost economics is based on the assumption that a well-aligned governance structure fosters productive efficiency through transaction cost efficiency. Economic agents strive for cost-efficient results and aim to align the mode of governance with this goal. Williamson (1985) originally proposed conceiving of performance in the sense of 'profit, that is revenues minus production and transaction costs' (Yvrande-Billon and Saussier, 2005: 77). The interpretation of performance to include the quality of a good or service, or technological innovation, shows that the scope of empirical analysis has gone far beyond Williamson's core interpretation of the 1980s. The general argument advanced by Riordan and Williamson invited a broader interpretation by other scholars.

> With reference to consumer welfare, the main implication of the argument is this: firms that decide for profitability reasons to integrate (produce to their own needs) will produce more and realize lower costs than if they were constrained by public policy to procure from the market. Note in this connection that we treat all costs - production and governance, market and internal - as social costs. Market governance costs do not therefore reflect rents but rather are added costs due to maladaption (…) and haggling costs. These are real costs for which full social cost valuation is warranted. (Riordan and Williamson, 1985: 375)

Within the second-generation of TCE, at least three criteria have been interpreted as performance related: cost-benefit analysis, survival and the quality of goods and services. Cost-benefit analysis expresses whether a positive or negative impact is observable and should not be misunderstood as a analysis which weighs the costs against the benefits. The cost analysis component refers mainly to the impact of misalignment on performance using accounting-based measures of profitability or management costs. The former has been conceived as net profits (Yvrande-Billon, 2003), profit margins (Mayer, 2000) or as return on sales (Mayer and Nickerson, 2002). The benefit analysis focuses on the beneficial impact of alignment. In such studies, the interpretation of performance is considerably extended. For instance, Sampson analyses how innovative benefits, measured using citation-weightings, are limited due to a misalignment (2004). Other authors investigated the correlation between misalignment and a firm's technological performance (Leiblein, Reuer et al., 2002).

The survival criterion is linked to the profitability argument. Bearing in mind that profitability is enhanced by the proper alignment of transactions and organisational modes, some scholars have deduced that the survival rate of

companies is an extreme indicator for the impact of misalignment (Bigelow, 2003). Further, the quality of services has been interpreted as a performance criterion. Yvrande-Billon and Saussier refer in their literature review to two publications which analyse "whether the quality of goods or services varies with the degree of alignment of the governance structure monitoring their procurement" (2005: 78). In the first of these studies, Poppo and Zenger measure the quality of goods and services indirectly by customer satisfaction, the second study is based on a direct measurement of water quality (Ménard and Saussier, 2002).

In our analysis, we take into account cost analysis indicators covering the downstream part of the gas value chain. Here, we concentrate on those parts, transport and trade, which are most effected by the re-regulation of the European gas reform. Until recently, gas storage has not been given much attention, compared to third party access to the gas network and price controls, in the gas regulations. To capture performance in the area of trade, gas price indicators are considered as relevant. On the retail level, we refer to industrial and household prices and, on a higher level, wholesale and spot market prices are taken into account. The first qualitative case study revolves around the evaluation of the latter, whereas our more general consideration of performance in chapter 9, as part of the quantitative analysis, considers the full spectrum of natural gas prices. Our performance indicators to describe transport activities represent a more diverse mix ranging from investments in gas transport and network tariffs to efficiency measures. The first of these encompasses the investment in import facilities such as LNG terminals and import pipelines, as well as transmission and distribution networks. In our quantitative and quantitative analyses, we use gas transmission network tariffs for small businesses and for large users as these are immediate and more accessable tariffs.[50] Efficiency is interpreted as production efficiency in the form of pipeline capacity utilisation, because this is seen as the most common and feasible indicator (see discussion in chapter 9).

Asset-specific investments and efficiency lay at the core of TCE theory, while prices are historically given more prominence in neoclassical theory. However, if costs are driving prices and tariffs, then regulation, or the setting up of a regulatory regime, aimed at reducing costs is expected to directly or indirectly influence prices and tariffs. This may be induced by the application of tariff regulations through which regulatory authorities limit the return made by companies. We argue that profitability is influenced by prices and tariffs and that the presence, or absence, of regulation will affect prices and tariffs.

TCE argues that a higher level of investment specificity encourages greater integration, mainly in the form of vertical integration. Therefore, if a market or hybrid mode of governance is adopted where there is a high degree of investment specificity, then the inherent misalignment is expected to result in lower

investment levels. Earlier, we demonstrated that the European gas reform seek to move away from hierarchically organised modes of governance towards market-based ones. For instance, the network and trade activities of formerly integrated companies are supposed to be unbundled. In general, best-practice in terms of regulation-for-competition involves establishing a competitive European gas market. Due to the high levels of asset specificity, uncertainty and frequency that characterise transactions in European gas markets, a market-based mode of governance is in terms of the TCE approach misaligned. For this reason, we advance the following hypothesis.

Hypothesis 2: The greater the misalignment between the mode of governance and the transaction characteristics, here interpreted as a regulatory regime reflecting a competitive market (the best-practice of regulation-for-competition), the poorer the performance will be in terms of natural gas prices, network tariffs, productive efficiency and investment in natural gas infrastructures, and the more likely the regulatory choices will be realigned.

The second hypothesis is tested in quantitative and qualitative analyses where the correlation between regulation-for-competition, as applied, and economic performance is assessed. The quantitative part covers all the above-mentioned performance criteria, whereas the qualitative case studies concentrate on only one indicator (see above).

3.4.5 Public sector transactions and political opportunism

The first-generation transaction cost economics referred only to economic governance. Although utility regulation was a subject researched in the first-generation of studies, TCE did not systematically account for the political dimension. The publication in 1996 of "The Mechanism of Governance" (Williamson) marked the widening of the scope of TCE applications. Three years later, Williamson outlined a more substantive theoretical application of TCE beyond the private sector. In the search for optimal market designs, TCE developed a much more differentiated view on economic governance than neoclassical theory, but they shared a general belief in the superiority of markets. Nevertheless, the revised TCE mantra "try spot markets, try firms, try regulation, and reserve recourse to public bureaus when all else fails (comparatively)" (Williamson, 2000: 603) reveals a differentiated perspective on the designation of the most efficient governance structure in that it suggests that a public bureau *can* under certain circumstances be an efficient form of governance. In reviewing this body of literature, we are seeking an answer as to whether regulation of gas markets can be perceived, using transaction cost reasoning, as the most efficient mode of governance.

To capture transactions in the public sphere, Williamson proposes distinguishing between six different types of public sector transactions: procurement, redistributional, regulatory, sovereign, judiciary and infrastructure. To date, the literature on different types of transactions and their corresponding optimal governance designs has not advanced that far. Williamson only discussed the sovereign type of transaction in a more detailed systematic way. He starts his analysis of sovereign transactions with the fundamental question as to why the state never contracts out its foreign affairs but always organises these in the form of a public bureau. Williamson identifies two key characteristics, human asset specificity and probity, which are essential in determining the optimal mode of governance for foreign affairs. Human asset specificity comes from the specific knowledge of protocols and regions around the world. The criterion of probity is a recent introduction and is related to the hazard of probity. Probity is understood as "the loyalty and rectitude with which the foreign affairs transaction is discharged" (Williamson, 1999: 322). It anticipates the damages that can arise if the probity of staff is not secured, in the form of scandals or severe damage to international relations which can effect the cooperation between countries. He concludes that, due to this probity aspect, sovereign transactions are most efficiently organised within the state as a public bureau – i.e. this is the best of the feasible governance responses (Williamson, 1999: 340).

Although regulation as a mode of governance is addressed, it is not systematically researched. There is only a general definition which attempts to outline some of the characteristics in a rather descriptive manner.

> Regulation could be thought of as a very long-term incomplete contract of a cost-plus reimbursement kind in which the interests of the government are protected by (1) embedding the agency in a complex regulatory apparatus, whence extensive rules, regulations, and procedures will appear and provision will be made for periodic auditing, (2) executive appointments are made in consultation with the president and with the tacit (or actual) approval of Congress, and (3) the staff of the agency is provided with both added security of employment and greater social conditioning to the mission of the agency, possibly through the training by the staff of the regulatory agency. (Williamson, 1999: 344)

In this citation, Williamson shows that regulation can be interpreted in transaction cost terms by perceiving regulation as a very incomplete long-term contract. Williamson places regulation close to the hybrid mode of governance by associating it with similar attributes. Thereafter, regulation is characterised as having medium level incentives and a medium degree of bureaucratisation.

The long-term contract is semi-strong with regard to executive autonomy, staff security and legal dispute settlement. The adaptive autonomy and the integrity of regulatory authorities are also positioned in the middle of the spectrum (see Table 6).

	Privatisation	**Regulation**	**Public Bureau**
Instruments			
Incentive intensity	++	+	0
Bureaucratisation	0	+	++
Performance attributes			
Adaptive autonomy	++	+	0
Adaptive integrity	0	+	++
Contract law			
Executive autonomy	++	+	0
Staff security	0	+	++
Legalistic dispute settlement	++	+	0
Note: ++ denotes a strong, + denotes semi-strong and 0 denotes a weak presence)			

Table 6: Distinguishing attributes of privatisation, regulation and public bureau modes[51]

One should note that the distribution of attributes and their specific values remain tentative. The distinction between privatisation, regulation and public bureau emphasises the ownership dimension, whereas the distinction between markets, hybrids and hierarchy is focused more on competition. The threefold scheme proposed by Williamson fails to integrate the two dimensions, and markets (and European gas markets are no exception) show both dimensions. In practice, while private companies are often regulated to deliver a competitive market organisation, many companies are still vertically integrated. European gas markets contain governance aspects that can be classed under privatisation, markets, hybrids, regulation and even hierarchy. Transaction cost economics does, in general, recognise both the ownership and the competition dimensions, but this recognition is not reflected in the scheme for a public sector organisation.

To date, the theoretical responses to the desire to designate a concrete optimal market design for European gas markets remain vague. This is related to the general problem Williamson highlights:

> Regulatory transactions are often beset with asset specificity, as with natural monopoly or by information asymmetries, as with consumer and worker health regulation. Milton Friedman has described natural monopoly as a condition for which there are no good choices: all of the options - private unregulated monopoly, private regulated monopoly, and state operation – fail to implement an efficiency ideal. (…) The upshot is that, defects with rate of return regulation notwithstanding, such regulation (which combines the private firm and public regulatory agency) is sometimes 'best' when the comparison is restricted to alternative feasible forms, all of which flawed. (Williamson, 1999: 320)

Ultimately, he claims that all governance solutions can be only evaluated on a comparative basis and will be suboptimal when asset specificity or information asymmetries are present or the market shows characteristics of a natural monopoly. The theoretical extension of the transaction cost scheme to the public sphere has not provided a definitive answer to the question as to when regulation should be given preference over other modes of governance. A substantial analysis is missing and further advancements are needed.

For this reason, some authors warn against a careless application of TCE to the question whether it is appropriate to extend the contracting scheme to a public sector organisation (e.g. Van Genugten, 2008). The main objection stems from the underlying differences between the public and the economic spheres. Regulation and the public bureau or agency, as distinct modes of governance, differ in at least two respects from pure economic transactions: the political process and the special nature of public services (Van Leerdam, 1999). Transaction cost economics is not equipped to predict regulatory decisions because a framework developed to analyse economic governance will not capture dynamics in political processes and the logic of providing public services. Insofar as there is a common understanding in the literature it is that TCE cannot be applied directly to the organisation of public agencies. While transaction cost economics does allow one to explain why economic

agents opt for hybrid or hierarchical modes of governance in the presence of asset specificity, the preferences and choices of regulatory authorities are not really within the scope of the TCE framework. However, the strand of literature that seeks to establish a political transaction cost framework (Frant, 1991; Dixit, 1996; Ter Bogte, 2003) does offer some helpful insights to the preferences of regulatory authorities.

The public sphere should not be seen a monolithic block of actors. Wilson observed, for agency relationships in government bureaucracies that: "Government bureaucracies typically have several dimensions of effort (input) and result (output), and each of these is only imperfectly observable or verifiable.

(2) each agency deals with several principals who are simultaneously trying to influence its decisions − the executive and legislative branches of government, the courts, interest groups, media." (Wilson, cited in Dixit, 1998: 95). Governmental institutions are normally multitasked with multiple principals. As a result, outcomes remain suboptimal because the principals impose various constraints and conflicting goals.[52] Wilson puts forward the argument that multi-principal structures, with several competing goals, hinder high- powered incentive schemes unfolding in the way that this is anticipated in economic agencies. Other authors, such as Frants[53] and Dixit (1996), also refer to incentive schemes in trying to increase understanding of the internal organisation of public agencies and their regulatory choices.

Williamson saw markets and privatisation as modes of governance with high-powered incentives, whereas hybrid and regulation modes have only medium-powered incentives schemes. Unlike Williamson, Frant claims that public sector transactions, such as regulation, do provide high-powered incentives but, unlike in the economic sphere, profit maximisation is not the main incentive. In the economic sphere, money is seen as the driver for cost reductions and innovation. High-powered incentives promote productive and allocative efficiency. "In democratic societies, what is it that plays the role in the political sphere that money plays in the market sphere? I suggest that it is politicians' desire for re-election. This is the public sector version of high-powered incentives" (Frant, 1996: 370). To understand the argumentation it is first necessary to clarify that the interests of citizens and politicians are not by definition congruent: that is, public interest is not necessarily reflected in specific regulatory choices. Nevertheless, the politicians' wish for re-election is likely to translate into them aligning their preferences and regulatory decisions with the public desires. In other words, politicians and political officers within ministries are inclined to prioritise those regulatory objectives which ensure electoral support. In turn, high-powered incentives "promote allocative efficiency by increasing the likelihood that the public sector's products will be valued by the people" (ibid: 371). This underlying behavioural disposition is often labelled political opportunism and is recognised as a specific variant of the generally assumed opportunism of human beings.

If political opportunism is pertinent, then the degree of incentives should vary depending on the extent to which regulatory authorities are reliant on re-election. On this basis, independent regulatory authorities should provide lower powered incentives than a ministry whose ministerial decisions are far more focused on being seen as achieving a successful legislative period. Proponents of independent regulatory authorities maintain that the establishment of separate entities from governments will decrease the influence of partisan politics and

party political influence on regulatory decisions. Regulatory studies effectively use the same argument with the public sector transaction cost approach offering a micro-analytical explanation (see section 2.2.2).

Given that Frant did not explicitly link his incentive reasoning with Williamson's modes of governance, it remains unclear whether he considers high-powered incentives to be equally strong in the public and economic spheres. His proposition could be interpreted as an absolute or as a relative argument for the primacy of money vis-à-vis re-election as a driver for incentives. Within the regulation mode of governance, we can perceive a difference between the levels of incentives characterising ministries as against independent regulatory authorities. Without further evidence, we remain unconvinced that incentive schemes based on political opportunism are as strong as those based on financial interests. Before revising Williamson's assumptions on the comparative strengths of incentives in different modes of governance, further considerations are required.

Analysing the incentives scheme which is characteristic of public organisations generates some useful insights into governance in European gas markets. According to Frant's reasoning, we can expect ministers and politicians to prioritise those regulatory goals which potentially could help secure their party's re-election, whereas independent regulatory authorities (IRAs) are less inclined to align their regulatory goals with politically opportunistic considerations. With respect to the gas reform, IRAs are more likely to apply a strict regulation-for-competition approach, whereas ministries are expected to be more inclined to ensure that public service obligations in the form of security of supply[54] are covered. Incentive schemes set by regulatory authorities are influenced by the extent to which the performance of these authorities is related to political re-election considerations. Such theoretical considerations do not however account for dynamic interactions between regulatory authorities and economic agents. To gain a better understanding of interactions within regulatory games we next refer to principal agent theory.

3.5 Principal agent relations in European gas market governance

As we pointed out in the introduction, principal agent theory is applied in attempts to explain the phenomenon of IRAs. One strand of literature considers "when and why elected politicians create agencies and transfer formal powers to them" (Thatcher, 2005: 249). Another strand concentrates on analysing the outcomes once IRAs have been established. During this so-called post-delegation phase, regulatory studies focus on the relationship between elected politicians and agencies, and especially the autonomy of the latter from the former (ibid).

Elected politicians might head ministries or groups in parliament and, in the delegation phase, they shape the institutional design which determines the power delegated to the agencies and the degree of statutory discretion. A more precise distinction differentiates between parliament, ministries and independent regulatory authorities to account for different degrees of political independence, perceived here as a reliance on re-election. By adopting a principal agent approach, the agency dimension can be captured. A principal agent perspective allows a more dynamic interpretation of actor constellations and allows one to explain actors' behaviours in a given structure which is especially relevant for the analysis of our two qualitative case studies.

Principal agent theory generally shares the behavioural assumptions found within New Institutional Economics and specifies these with regard to a principal agent relationship. Principal agent theory is based on three behavioural assumptions: "1) actors are rational utility maximiser, 2) principal and agents may develop different preferences 3) there is an informational asymmetry between principal and agent" (Héritier, 2005: 121). As in transaction cost approaches, principal agent theory conceives regulation as a public contract in which the regulatory authorities and firms are bonded in a relationship. All contracts are necessarily incomplete and so are regulatory contracts. Consequently, principals cannot account for all circumstances or specify all the agent's activities. Due to a lack of the necessary resources, such as time and expertise, the principal is forced to delegate tasks to his agents. The transfer of decision-making necessarily bestows a certain degree of discretion to the agents. An agent will accumulate expertise over time resulting in information asymmetry between the principal and the agent. When the principal is on the regulatory side and the agent is a representive of the regulated firms, the information base differs considerably because regulatory authorities can only request certain commercially sensitive information on the company's transactions in the process of legal inquiries conducted by courts or competition authorities. "The agent disposes of detailed information on market's functioning, the network infrastructure's production technology, the provision of services, and client relations" (Héritier, 2005: 124). This information asymmetry offers the agents the opportunity to pursue their objectives and to increase their autonomy (Pollack, 1997). Being regulated always imposes costs on the regulated companies, and the information asymmetry can be used to reduce these costs. Conversely, the principal's interest is to create an institutional design that allows it to limit the agent's autonomy in the most cost efficient manner, be it in the form of formulating *ex ante* codes of conduct and rules, or *ex post* monitoring of task fulfilment and imposing sanctions in the event of failure. "Agencies can act in contrast to the preferences of their political bosses ('agency losses') by following their own preferences ('shirking') or because the

agency has incentives to behave contrary to the wishes of the political agencies ('slippage')" (Christensen and Lærgreid, 2007: 16). More precisely, shirking reflects regulators becoming distanced from their initial political objectives, whereas slippage describes the phenomenon of regulators attempting to gain more competencies or power to improve the regulatory environment (Coen, 2005: 5). Accordingly, regulatory choices and their refinement are influenced by the struggle among regulatory authorities on how to distribute competencies among themselves, and which policy objectives are prioritised.

In section 2.1.3, we showed that European gas market governance is characterised by a multi-authority structure spanning at least the national and European levels. When analysing UK utility regulation from a principal agent angle, Prosser (2005) criticised the ambiguity in who was the principal and who the agent, pointing out the different approaches to defining the roles.[55] For our purposes, a convincing and very concise interpretation is offered by Héritier:

> We have three different principals, the European authorities (P1), the national government (P2) and the national regulators (P3). And we have three agents, the national government (A1) are the Commissions agents; the national regulators (A2) are the agents of the national governments; the firms are the agents (A3) of the national regulators (P3). Two actors, the national governments and the national regulators, wear two hats, they are principals and agents. It is the interaction between national governments (P2) and national regulators (A2 and P3), but mainly between national regulators (P3 and A2) and firms (A3) which are of interest in the context of our empirical research. However, the behaviour of the national regulator (P3) vis-à-vis firms is also influenced by the relationship between the national regulator to its own principal, the national government (P2). And this way, to some extent, be influenced by the latter's to its principal, the European Commission. (2005: 122)

Even though Héritier developed the principal-agent relationship and considered all those involved in analysing rail regulation in the United Kingdom and Germany, the regulatory structure is also applicable to the interpretation of regulation in European gas markets in the post-delegation phase (see Figure 2 in chapter 2). By considering the way in which the authority structure was organised vis-à-vis the players in the regulated market, Héritier was able to derive hypotheses on how principal agent constellations effect the behaviour of companies in order to gain access to the regulator on the one hand, and how changes to political guidance, in terms of structure or newly prioritised objectives, effect the regulatory contract with the regulated companies on the other.

The presence of multiple regulatory authorities increases the likelihood of so-called regulatory shopping. When a regulated company is not satisfied with the regulatory decision of one regulatory authority, it may opt to address its concerns to another regulatory authority. Héritier stresses the importance of multiple access points for agents and sees these as opportunities for agents to influence regulatory decisions in their own favour. Prosser (1999) also sees a danger in agents playing regulatory authorities off against each other. If a company does not succeed in solving a conflict with principal P3, it may address principal P2 to seek a solution in its own favour. For this reason, Héritier concludes that "a regulatory structure with multiple authorities on the vertical and the horizontal level offers the regulatee more strategic possibilities for reducing regulatory costs" (Héritier, 2005: 125).

A refinement or change in regulatory instrument can also be triggered by responses by the regulatory authorities themselves. Political principals might even consider a renegotiation of the delegatory terms, including the distribution of regulatory competencies, between the ministry and the independent regulator. "This is likely to occur if a government feels that the NRA (*national regulatory authorities*) has moved too far from its original delegation" (Coen, 2005: 7). A principal might also initiate a change or refinement to the regulatory contract if the agent has, in the view of the principal, failed to deliver a satisfactory performance. Principal Agent theory is able to explain the behavioural response to a negative performance, whereas transaction cost analysis offers an explanation beyond the feedback from negative economic performance to the realignment of governance structures. Besides a performance factor, a change in political guidance might trigger a revision to the regulatory choices. Based on the political transaction cost perspective, we concluded that political principals such as ministries are more prone to political opportunism than independent regulators. With respect to the European gas market reform, ministries are expected to be more inclined to ensure that public service obligations, in the form of security of gas supplies, are met rather than following a strict regulation-for-competition application. In this context, one should note that pursuing the introduction of competition does not necessarily contradict public service obligations. However, national regulatory authorities may profile themselves and be evaluated on the basis of their success in introducing competition to the gas market as this was the primary purpose and justification for their establishment. In the next section, we will continue to elaborate on the tension between the first- and second- order regulatory objectives of the gas reform and develop two hypotheses based on the principal agent approach.

3.6 Regulation-for-competition versus regulation-for-security-of-natural-gas-supply?

In general terms, energy policy has recently undergone a significant transformation, moving from a paradigm that perceived liberalisation, privatisation and competition in the gas sector as paramount, to one that addresses security of supply concerns and climate change. According to Helm, this is a result of structural changes in the energy markets such as a structural increase in oil prices, the ageing of assets, network failures and greater import dependency that became apparent to politicians and policy planers (Helm, 2005). As a consequence, security of energy supply moved up the political agenda. Regulators, policy planners and politicians on both European and national levels were faced with the question of how to guarantee and meet the public service obligation of a secure supply in liberalised gas markets. In this context, long-term security of supply is perceived as equating to a sufficient investment in import and network capacity to meet future demand. Due to imperfect markets and certain characteristics of the natural gas market (see above), there is a consensus among regulators and policy planners that energy supply will not be secured by the invisible hand of the market alone, but must be ensured by hands-on regulation and enhanced coordination. The old paradigm (liberalisation, privatisation and competition) was based on the institutional logic that treated natural gas as a commodity. However, it remains unclear how exactly the new institutional logic evolved in terms of institutional arrangements (Künneke, 2008: 243).

Helm elaborates five ways in which governments or regulatory authorities may try to ensure security of supply in liberalised electricity markets. The first two fall under the category of competitive market approaches. Both put forward price regulation as a key element of industry regulation. The second variant combines price regulation with capacity elements. Both price regulation and the mixed variant are based on the neoclassical idea of influencing performance by influencing price and/or quantity. The third possibility looks at directly imposing more complex obligations on network operators. The fourth possibility represents various forms of state subsidy. Subsidies might be granted in the form of direct money flows into investment projects or by taking over planning risks. The fifth possibility is to rely on market power leading to the necessary expenditure. Helm describes this as a kind of virtual barter trade between government and the dominant company, in which the government does not intervene if the company guarantees a sufficient level of investment. Helm (2005) elaborates:

> The price of market power is investment. And with the ability that market power renders to pass through costs to final customers, the advantage of the market power model is that it reduces the cost of capital. In principle, provided the threat of regulation stops the undue exploitation of that market power, investment should be higher in proportion to the reduction in the cost of capital. In effect, it is quasi-rate-of-return regulation by default. (Helm, 2005: 11)

This brief summary of the possibilities shows that, out of the five regulatory possibilities, only the two competitive market models are in line with a purist application of the liberalisation, privatisation and competition paradigm. The growing importance attached to security of supply on the political agenda combined with the regulatory authorities' guarantee ultimately increases the likelihood of employing approaches other than competitive market models. We argue that the coexistence of competitive policy objectives and regulation-for-competition on the one hand, and security of supply objectives on the other, does not necessarily promote the convergence of regulations towards competition (delta convergence)[56] as the various objectives tend to favour different instruments. Whereas the former objective prefers market competition approaches, the latter is likely to increase the attractiveness of instruments that are less supportive of competition. Accordingly, our third hypothesis argues:

Hypothesis 3: If regulatory authorities (Principal 2 and Principal 3) in a multi-authority structure differ in their prioritisation of policy objectives, then it is likely that a refinement or change of regulatory choices (including modes of coordination) will occur.

Moreover, the applied conceptual framework suggests that the natural gas resource endowment of a country is another factor triggering regulatory choices. Security of supply concerns may arise where the resource endowment is decreasing. Therefore, the fourth hypothesis postulates:

Hypothesis 4: A country whose natural gas supply situation is deteriorating is likely to change its natural gas objectives towards giving greater emphasis to security of supply concerns and will favour those regulatory choices which emphasise achieving security of supply as opposed to competition.

We acknowledge that other strategies are possible to tackle general security of supply concerns rather than by means of gas market regulation. Politicians might instead opt for the substitution of natural gas in the energy mix by

renewable energies, coal or nuclear. This goes along with countries' desires to reduce their dependence on external energy supplies by increasing the share of self-sustaining energy sources[57] in the energy mix. Another possible strategy is to strengthen the supply situation by diversifying gas supplies using long-term contracts. Although this list is by no means exhaustive, it gives an indication of other ways in which security of energy supply concerns might be tackled.

3.7 Impact of European legal provisions on the convergence of regulatory regimes

It is possible to specify the impact of European legal provisions on regulatory choices by referring to research undertaken using new institutional approaches within European comparative politics. The literature analysing drivers of policy convergence has generated useful insights with which to formulate expectations with regard to the impact of European legal provisions on regulatory choices in natural gas market governance. In a literature review, Heichel et al. (2005) considered findings from approximately 75 convergence studies covering various policy fields. Ultimately, the authors concluded that there is no convergence in convergence research. Nevertheless, comparative analyses in political science of public policies have identified various reasons why some policies converge and others not. In the sub-field of European comparative policies, the historical institutional approaches perceive a general phenomenon of policy convergence from a transposition angle, and analyse the compliance of European member states with European policy. While the body of literature on policy convergence emphasises the mechanism that triggers policy-converging policy changes across countries, and the facilitating factors that determine the effectiveness of these mechanisms, the literature grouped around the "goodness of fit" idea has generated a considerable number of auxiliary variables which may determine the ease of compliance. The "goodness of fit" hypothesis assumes "that the ease of compliance depends on the goodness of fit between EU policy demands and existing national policies" (Mastenbroek, 2007: 60). Thus, it is in effect an argument for path dependence and puts the stress on the importance of national characteristics.[58] Recently, academics have criticised the focus on the "goodness of fit", and argued that this is not the decisive variable (Haverland, 2000; Héritier, Kerwer et al., 2001; Falkner, Hartlapp et al., 2005; Mastenbroek, 2007). Supported by the mixed empirical results, they argue that a misfit is a necessary rather than a sufficient condition.[59] It is beyond the scope of our analysis to discuss and test the numerous auxiliary variables that the "goodness of fit" approach has generated. Instead, we concentrate on the European harmonisation mechanism.

Convergence research and studies linked to the "goodness of fit" hypothesis

identify European harmonisation as a stimulus which triggers convergence. Convergence researchers see European harmonisation as a special form of the international harmonisation mechanism and identify the law as a driving factor. Once the Single European Act was in place, and the decision to start the gas market reform made, the causal mechanism of European harmonisation could take effect. In line with this, the policy convergence stimulus is a legal obligation established by European law (Holzinger and Knill, 2005: 778-782). Legal provisions do not inevitably result in a convergence of policies or institutional arrangements. The success of harmonisation depends on the degree of legal specification. The more concretely that European law sets targets, or prescribes regulatory instruments, the more likely it is that convergence will occur. Holzinger and Knill observe, "convergence effects are less pronounced, by contrast, if legal rules are defined in a less rigid way, leaving member states broad leeway for selecting appropriate instruments to comply with international policy objectives" (Holzinger and Knill, 2005: 787). They distinguish between formal institutions, in the form of European legislation, that are objectively based, or determine minimum standards, and those that set maximum standards. From an analysis of the implementation of electricity liberalisation in Germany, Eising supports the view that EC rules do matter (Eising, 1999). A second factor affecting the degree of policy convergence is the capacity to enforce compliance (Holzinger and Knill, 2005: 793). A significant, or possibly even full, convergence towards best-practice can be expected if regulatory authorities not only have the capacity but also choose to enforce the rules.

On the basis of our conceptual framework and informed by the convergence literature within European comparative politics we can deduce a fifth hypothesis:

Hypothesis 5: The more that European provisions (Level 2) specify the subjects (indicators) of gas market reform, the more likely it is that best practice will be applied, resulting at the regime level (Level 3) in greater delta convergence.

In chapter 7, this general hypothesis is specified for each indicator by formulating individual expectations.

In this context, it is worth noting that the convergence of institutional arrangements (Level 3) and policies, as part of a European policy process, is not only induced by formal laws, but also encouraged through diffusion and learning processes. This dimension of European governance is captured in the analytical framework of policy transfer and isomorphism. Holzinger and Knill, in their literature review, identify transnational communication as a mechanism through which the promotion of policy convergence is triggered (2005). Radaelli provides detailed explanations of the ideas of policy transfer and isomorphism

and their application to European political processes (2000; 2005). As we are concentrating on the impact of formal legal provisions, our analysis does not account for the informal aspects which, to a large extent, unfold in the Madrid Forum in the form of diffusion processes (section 2.1.4).

3.8 Summary of expectations

Williamson's four-layer model served as the starting point in organising our analysis. The discussion of the original framework and recent adaptations to cover governance in the energy market identified some shortcomings which our synthesised conceptual framework endeavours to improve. The applied version is less static and more comprehensive: it contains more dynamic aspects due to the integration of feedback processes between the layers and it assumes a less static sequence of institutional changes. External factors such as a country's resource endowment and its starting position (its former policies) are considered. The applied conceptual framework enables us to identify variables relevant for our empirical analysis on each layer of the framework. These are policy objectives, European legal provisions, specific regulatory choices (or the bundle of institutional arrangements summarised as a regulatory regime), authority structure, economic performance and a country's natural gas endowment. To overcome the lack of analytical clarity as to how those layers are interrelated, and to determine causal relationships between the variables, we draw on the ideas of institutional logics. If the institutional logic is based on the assumption that natural gas is a commodity or public utility, then institutions on all layers reflect this logic and are organised accordingly. In turn, we argue that the micro-foundation of institutional logics is best understood with the help of the alignment hypothesis found within transaction cost economics. In our attempt to determine which mode of European gas market governance is best aligned with the characteristics of transactions in gas markets we have reached a preliminary answer. Based on the classical transaction cost framework, and its contemporary advances, transactions which are characterised by high asset specificity, high levels of behavioural and environmental uncertainties, and high frequency (as in the gas industry) are best aligned with hierarchical or hybrid modes of governance. As such, the introduction of market-based coordination and competition is not the most efficient way in terms of transaction efficiency to safeguard against hazards related to transactions that involve high investment costs. In other words, transaction cost economics takes the theoretical standpoint that, given the transaction characteristics of the gas sector, the optimal way of dealing with governance in natural gas markets is to perceive a form of public

utility as the organising institutional logic. This proposition has been challenged theoretically by Glachant, who has put forward a counter-argument that asset specificity in energy markets can be lowered. To date, there is no profound, concise or more-elaborated theoretical reasoning on how the potential hazards related to asset specificity can be safeguarded against.

Our theoretical considerations are complemented by a principal agent approach and combined with insights from the application of transaction costs economics to the public sphere to arrive at hypotheses describing what we believe to be the causal relationships among our chosen variables. In particular, the comparison of incentives for political principals, as part of the government, and independent regulators suggests that the former are more prone to political opportunism. In a time when security of gas supply is very prominent on the political agenda, we would expect ministries to prioritise a secure gas supply over regulation-for-competition concerns, whereas IRAs are more likely to emphasise a strict application of regulation-for-competition.

To summarise, on the basis of our theoretical considerations outlined above, we have postulated, and will proceed to empirically test, the following hypotheses:

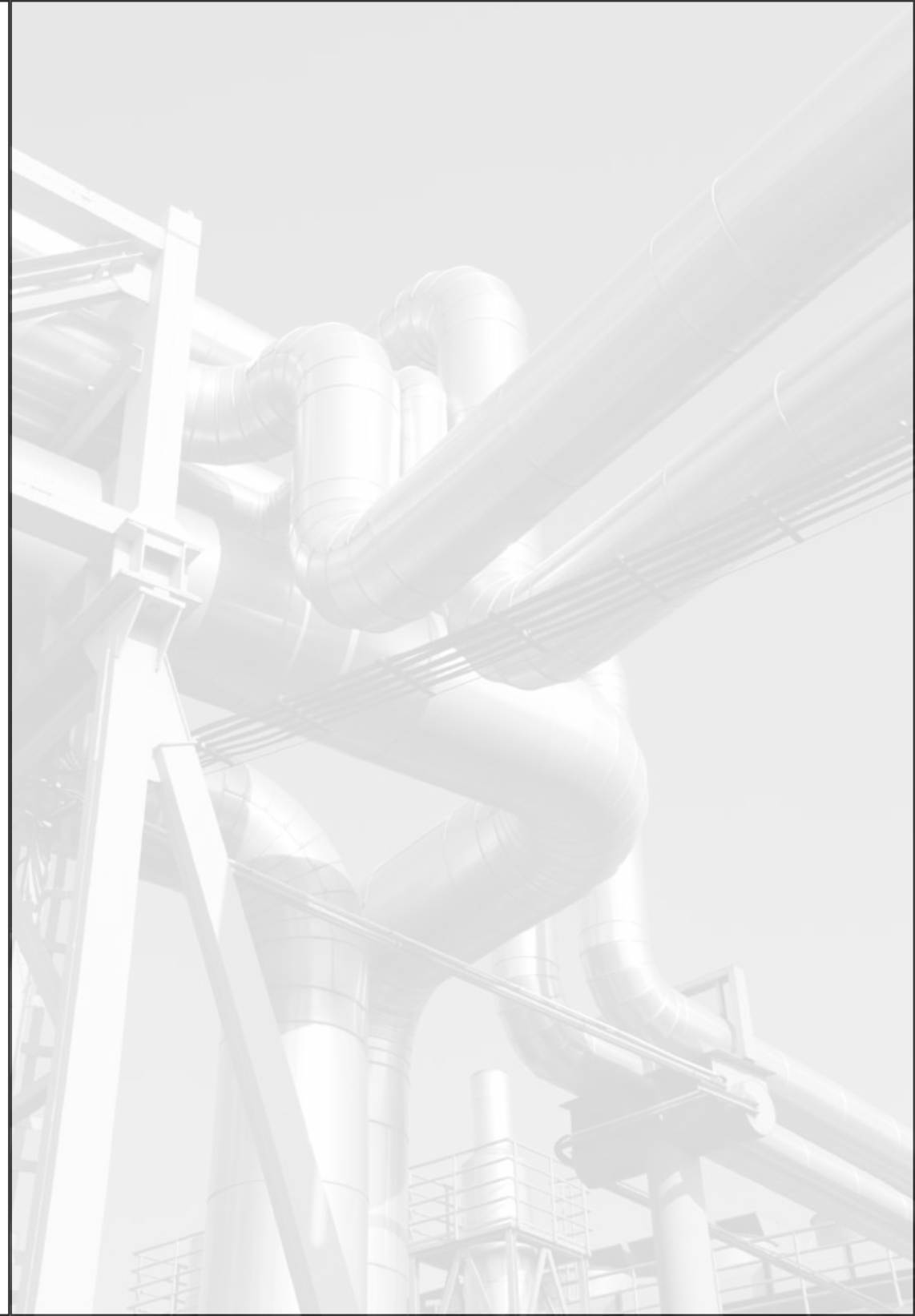
Hypothesis 1: A misalignment between transaction characteristics and modes of governance, as is inherent in regulation-for-competition in European natural gas markets, is likely to result in a reluctance to apply what the EU perceives as best-practice which will hold member states back from moving towards (delta) convergence in terms of regulation-for-competition best-practice.

Hypothesis 2: The greater the misalignment between the mode of governance and the transaction characteristics, here interpreted as a regulatory regime reflecting a competitive market (the best-practice of regulation-for-competition), the poorer the performance will be in terms of natural gas prices, network tariffs, productive efficiency and investment in natural gas infrastructures, and the more likely the regulatory choices will be realigned.

Hypothesis 3: If regulatory authorities (Principal 2 and Principal 3) in a multi-authority structure differ in their prioritisation of policy objectives, then it is likely that a refinement or change of regulatory choices (including modes of coordination) will occur. In turn, in case regulatory authorities in a multi-authority structure apply the same prioritisation of policy objectives, then it is unlikely that a refinement or change of regulatory choices (including modes of coordination) will occur.

Hypothesis 4: A country whose natural gas supply situation is deteriorating is likely to change its natural gas objectives towards giving greater emphasis to security of supply concerns and will favour those regulatory choices which emphasise achieving security of supply as opposed to competition.

Hypothesis 5: The more that European provisions (Level 2) specify the subjects (indicators) of gas market reform, the more likely it is that best practice will be applied, resulting at the regime level (Level 3) in greater delta convergence.



4. Research Design

4.1 Introduction

The dissertation contains qualitative and quantitative comparative analyses of the evolution of European gas markets. A quantitative, cross-national, comparative analysis of natural gas market regulation in the European Union, as intended here, has its strengths and weaknesses. On the one hand, the general strength of a quantitative analysis is the relatively high number of cases involved, providing more evidence for generalising findings and enabling a comparison of regulatory performance. Furthermore, a large number of cases reduces the risk of a selection bias to which comparative case studies are often prone. On the other hand, a quantitative analysis is restricted to aggregated formal data. This drawback applies to our analysis which draws on the formal aspects of regulatory regimes in European gas markets. The study includes data on formal regulatory regimes but does not detect how these measures are precisely implemented and interact in each member state's gas market. Hence, the analysis only partially reflects the regulatory performance, i.e. the reality, of natural gas markets. Nevertheless, it does provide an aggregated analysis of the convergence of regulatory regimes in the old member states following the introduction of the gas reform. The quantitative study has the advantage of being parsimonious in its design and thus enabling one to concentrate on partial correlations among specified variables. To capture the more complex, causal relationships this quantitative analysis is complemented by a comparative qualitative case study in the third part of the dissertation in which processes can be traced.

From theoretical considerations, we deduced the variables which we expect to determine regulatory regimes and economic performance, which partially answered our first research question. This fourth chapter further contributes to answering our first question by displaying the relevant variables and outlining their operationalisation. The structure of this chapter reflects the division of the thesis into two distinct empirical research elements. Following this logic, we continue by outlining the two main research components separately, starting with the set up for the quantitative analysis and then continuing with the design for the qualitative analysis. The reasons for the chosen population and case study selection are given. The time frame and the geographical scope are clarified, and data concerns are addressed. Furthermore, the research design is outlined by identifying the variables under consideration and explaining their operationalisation. The regulatory regime variable is operationalised separately in chapter 5.

4.2. Part two: quantitative case study design

This section outlines the research design for the quantitative analysis to be carried out in the second part of the thesis. Firstly, the case selection is described and the representativeness of the chosen cases amongst European gas markets is reflected upon. Secondly, the time frame and measurement points are defined. Thirdly, the causal relationships being considered are addressed.

4.2.1 Case selection

The European Union's (EU) political landscape changed profoundly during the period studied (1998-2006), especially as a result of the enlargement of the supranational power in May 2004. For the new member states, this required the implementation of a huge number of measures, including the Gas Directives. Unlike the old member states, where the regulation was introduced in 1998 and had to be implemented by 2000, gas market regulation in the accession countries was only being put in place towards the end of the research period. For this reason, the quantitative analysis was limited to the 15 old member states (referred to as EU-15).

Significantly, the EU-15 group dominates in terms of market coverage. In 2000, the enlarged European Union with 25 member states (EU-25) consumed 376 million tonnes of oil equivalent (Mtoe) of natural gas of which the EU-15 states alone accounted for 339 Mtoe, i.e. 90% of the total enlarged European gas market as we know it now (European Commission and Directorate General for Energy and Transport, 2003c: 150-176).

When the first Gas Directive was put in place, it foresaw the possibility of derogations allowing some member states not to implement a new regulatory regime (European Commission, 1998; European Commission, 2001: 4; European Commission, 2003). These derogations were applied to Finland, Greece and Portugal who were seen as emerging gas markets with a marginal market size or limited network connectivity. To illustrate the relatively small markets, the natural gas consumption of the three countries in 2000 amounted in total to 7.17 Mtoe (Finland 3.42 Mtoe; Greece 1.7 Mtoe; Portugal 2.03 Mtoe), just 2% of total EU-15 consumption. Consequently, by excluding Finland, Greece and Portugal and selecting 12 member states (referred to as the EU-12 for convenience) for the analysis, the quantitative analysis still covers 88% of the EU-25 natural gas market (based on 2000 data) and 98% of the EU-15 market. For these reasons the analysis of the EU-12 member states is seen as representative of the EU-15 (European Commission and Directorate General for Energy and Transport, 2003c: 176).

The cross-national analysis of the EU-12 covers Austria, Belgium, Denmark, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Spain, Sweden and the United Kingdom. The selected cases represent both small and large countries (and gas markets), both producing and consuming countries, countries with high and low network connectivities, as well as countries with small and large numbers of gas companies. As argued above, the analysis covers the largest possible population within the European Union.

4.2.2 *Time frame*

The period of examination begins with the introduction of the first Gas Directive in 1998 (which had to be implemented by 2000) and ends with the latest available assessment at the end of 2005. The observations cover six years of European gas reform and include six possible (annual) measurement points. Accordingly, the quantitative analysis consists of 72 observations (N). Econometricians are divided on how large N needs to be to make confident inferences based on regression analyses. Some consider more than 30 sufficient; others feel more confident once the number of observations exceeds 100 (Wooldridge, 2000: 169). In our analysis, we effectively used the largest number possible, but we would still recommend caution in interpreting the results.

The relatively short time frame poses some challenges in appropriately interpreting the results as the very concept of policy convergence is linked to long-term changes. Classical policy convergence studies tend to cover at least 10 years, so-called medium time frames cover 15 to 30 years and a considerable number of studies cover even longer periods. Some authors even argue that a time frame of 10 years leads to questionable results (Howlett, cited in Heichel

et al., 2005: 830). Therefore, it is important to be cautious with our findings. A short time frame may lead to the identification of a temporal convergence phenomenon which is in effect a cyclical development that does not reflect a permanent, one directional, policy convergence. Given our limited time frame, we see our analysis as having the character of a trend study which assesses policy convergence with regard to regulatory regimes in the European gas markets. Hence, any noteworthy, solid or ultimate conclusions on the convergence of regulatory gas market regimes will only be confirmed after a longer period of observation.

4.2.3 *Considered causal relationships and their operationalisation*

In our theory chapter (section 3.7), we concluded that the specification of European legal provisions (independent variable 1) and the prioritisation of energy policy objectives on the European level (independent variable 2) will affect the regulatory regime in European gas markets (dependent variable 1). Further, regulatory regime choices (independent variable 3) will influence the economic performance (dependent variable 2) of a market. This two-step causal relationship is displayed below in Figure 6.

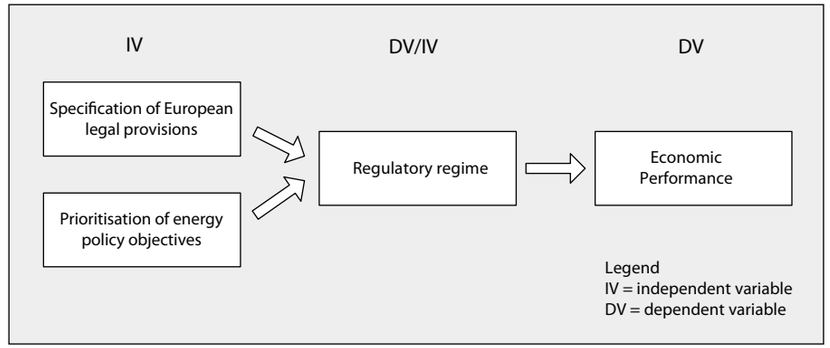


Figure 6: Research design I

Next, the variables and their values are specified. The operationalisation of the regulatory regime variable involves the creation of an index. Given its complexity, the specification of this variable is developed separately in chapter 5. This is also partially true for the economic performance variable (see section 3.4.4 and section 9.3). In assessing the first independent variable (specification of European legal provisions), a dichotomic distinction is applied: the European legal provisions that constitute the European gas reform are considered to be either precise or

imprecise. A legal provision qualifies as precise when a regulatory instrument or goal has been determined by European law. Alternatively, where the best-practice regulatory instrument is not determined by European law, the value is regarded as imprecise. The degree of specification is assessed in chapter 7, and this is complemented by inductively formulating, in the same chapter, more precise expectations which will be addressed in the concluding considerations (chapter 12). For this purpose, the pertinent European legal texts serve as the main sources (specified in chapter 7).

In section 3.6, we argued that ambiguous or competing energy policy objectives decrease the probability that member states will adopt best-practice. The second independent variable considers which energy policy objectives were prioritised at the European level during our period of examination The variable selection is based on the assumption that first-order economic regulatory objectives should be at the forefront of the European gas market liberalisation to guarantee the application of best-practice in terms of regulation-for-competition. The variable indicates both changes in the relative importance of sector-relevant energy policy objectives and any re-prioritisation of regulatory goals. To detect if any ambiguity or change in energy policy objectives occurred, we analysed the content of the European energy strategy and investigated prevailing positions vis-à-vis liberalisation and the supranationalisation of gas sector governance as announced by the European Council. Although the main concerns are the sector-relevant energy policy objectives, the analysis also considers whether general policy objectives of the European Union on how to run the economy might conflict with the energy liberalisation agenda. As we do not systematically analyse the evolution of general policy objectives at the Community level we do not treat it as a fully-fledged control variable. Considering general objectives functions as a potential counterbalance to any sector bias which might arise if general policy objectives that determine general economic governance are not taken into account.

The perception of economic performance is influenced by the public regulation approach (chapter 2 and conclusions) which suggests a broader conception of performance than the classical economic interpretation. According to the public regulation approach, markets are organised by a combination of two objectives: first-order economic regulation which predominantly addresses the structure, conduct and economic performance of quasi-markets (e.g. price development); and second-order political and social regulation, predominantly addressing the politically defined performance of quasi-markets (e.g. security of gas supply) (Cox, 1999). The indicators are grouped reflecting this distinction by dividing the dependent variable into neoclassical economic performance indicators on the one hand, and a performance indicator oriented towards public

service obligation, accounting for the guarantee of security of gas supply in the form of investment, on the other. The dependent variable includes indicators such as natural gas prices, gas network tariffs, efficiency and investments in downstream activities of the European gas markets. When referring to natural gas prices, we use wholesale prices and household and industrial consumer prices (end-user prices without taxes). With regard to gas network tariffs, we distinguish between transmission and distribution tariffs. Efficiency is interpreted as productive efficiency (see section 3.4.4). In the context of natural gas markets, the utilisation rate of pipelines functions as an indicator to assess productive efficiency. Another way to perceive an improvement in efficiency is the lowering of operating costs, which regulatory authorities term the efficiency factor. Investments cover costs linked to the transmission grid and import infrastructure such as import pipelines and LNG terminals. The indicators and the empirical practicality of assessing them are further discussed in chapter 9.

4.3 Qualitative case study design

The third part of the thesis contains two interpretative case studies based on a comparative design. The qualitative case studies concentrate on the post-delegation phase. According to the literature on regulation studies, the post-delegation phase is initiated by the delegation of regulatory responsibilities to an independent regulatory authority (Thatcher, 2005: 351). After the establishment of a regulator, realignments of regulatory regimes still take place. Realignment implies either the introduction or removal of regulatory instruments or adjustments to an existing instrument. Whereas the independent variables in the quantitative analysis mainly describe factors which are located at the European level, the qualitative investigation includes additional variables that are embedded in the national context. In combining factors from the national and European levels, the analysis takes into account multilevel governance in Europe (section 2.1.3). Below, the case study design is outlined and the relevant variables identified and operationalised. Then, the case study selection is explained and some possible pitfalls in scientific inference are addressed.

4.3.1 Causal relationships and their operationalisation

As is common in interpretive case studies, theoretical variables are deduced to provide historical explanations of particular cases (Bennett, 2004: 22). To deduce such variables for our study, we draw on the conceptual work of Williamson in the form of his four-layer model that has been assessed and then modified to interpret the evolution of gas regulation in a more dynamic way (section 3.3). The model suggests a complexity of variables that influence regulatory

choices and economic performance. Rather than a static sequence of factors, some factors may unfold their effects simultaneously and others may include feedback processes. Moreover, the starting position of a country with regard to its existing policies or energy mix might foster a path dependency. In this sense, the dynamic interpretation of the four-layer model suggests multi-causality and equifinality (see explanation in section 4.3.2 below). In the previous theoretical chapter, the variables and causal relationships shown in Figure 7 were identified

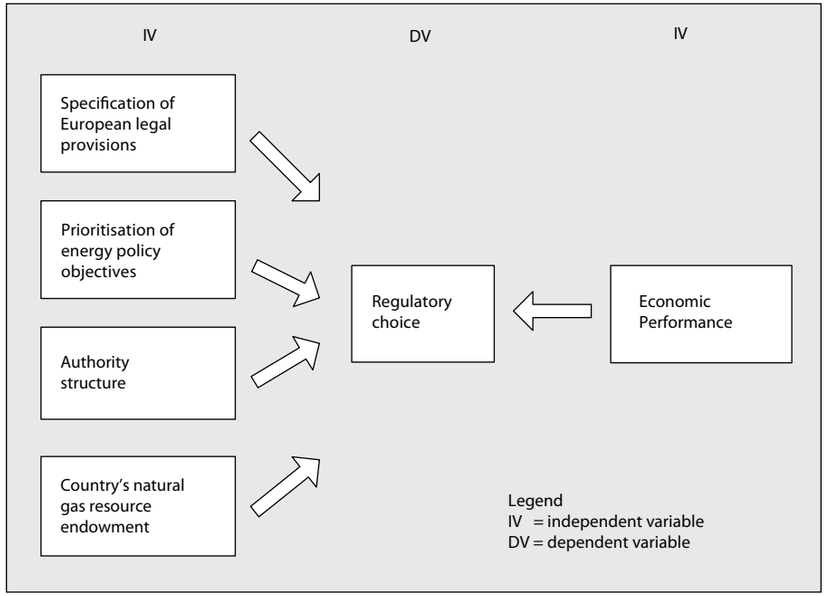


Figure 7: Research design II

Our research design does not set out to determine a sequence in which the variables deliver their effects on regulatory choices. All the five variables invoke and influence regulatory choices, but the prioritisation of energy policy objectives is considered as the key independent variable. In this sense, economic performance, European legal provisions, a country's natural gas resource endowment and an authority structure are seen as the necessary set of independent variables. Together with the prioritisation of energy objectives, a set of variables is compiled which is seen as sufficient to explain regulatory choices in the context of the European gas reform.

The attentive reader will have spotted some similarities with the quantitative research design. Indeed, the first independent variable, specification of European legal provisions, is identical to the first independent variable in the quantitative analysis. Here, the variable's operationalisation also adopts the same binary distinction as proposed earlier. The economic performance variable also shows some similarities but it is further specified in its qualitative analysis application. As we discussed in the introductory chapter, public interest theory conceives negative economic performance to be a result of market failure due to such things as externalities, market power, natural monopoly and information problems. Transaction cost economics shares the view that negative economic performance is a trigger for regulatory change but offers a wider explanation for poor economic performance. From this perspective, a misalignment in the characteristics of transactions and governance structure can be responsible for a realignment which ultimately translates into changes in the governance structure (section 3.4). Williamson foresees feedback processes from economic performance influencing beliefs (first layer), or invoking the reformulation of legal provisions or institutional arrangements, such as commercial contracts, or changing or realigning regulatory choices. Above, when referring to the public regulation approach, we distinguished between those economic performance indicators which primarily serve first-order economic regulation and those that primarily relate to second-order public service obligations. In the qualitative case studies selected, natural gas prices (wholesale) and the tariffs for using the transmission system are the relevant indicators. In the UK case, we refer to wholesale prices and, in the Dutch case, we consider transmission tariffs. The indicators are not scaled in percentages, but assessed as to whether a negative development is perceived to have negative effects on the national gas sector and the economy as such. For us, the precise monetary increase in percentage terms in a given time is not that important: rather, it is sufficient for regulatory authorities to explicitly refer to negative economic performance as the reason for their regulatory choices. Based on these two conjunct criteria, the possible values of the indicator span a continuum from a poor end with weak economic performance to favourable economic performance at the other end.

In sections 3.3 and 3.6, we elaborated the way in which the prioritisation of energy policy objectives is embedded in informal institutions and the customs of how economic governance is coordinated. We distinguish between those energy policy objectives which prioritise the introduction of competition on the grounds of market-based solutions (regulation-for-competition) and those concerned with security of gas supply through invoking other more-consensual ways of coordination (regulation-for-security-of-supply). For the operationalisation, it is important how one detects any such prioritisation in energy policy objectives.

Whereas the economic research tradition theoretically assumes the preferences of actors by referring to methodological individualism, political science approaches are more eager to determine preferences empirically. In general, we do subscribe to the behavioural assumptions inherent to NIE (see section 3.2). Earlier, in building our theory, we concluded that ministerial regulatory authorities will be inclined to prioritise politically sensitive issues such as security of gas supply and opt for more coordinated mechanisms of economic governance.

Despite this, our variable necessitates estimating an actor's preferences with regard to prioritising energy policy objectives. This undertaking is not without its problems. With regard to the justification of actors preferences or beliefs, Ganghof remains sceptical: "this is far from easy because these preferences and beliefs can never be measured directly but have to be inferred from the very behaviour that is to be explained; there is thus a permanent threat of circularity" (Ganghof, 2003: 5). For this reason, we keep policy declarations, statements and pursued regulatory instrument options, on the one hand, apart from the regulatory choices in which those policy declarations are supposed to be realised, on the other. The first of these dimensions expresses the independent variable 'prioritisation of energy policy objectives' and the second dimension captures the dependent variable, 'the regulatory choice'. Ultimately, our justification strategy is based on the triangulation of primary and secondary sources. To identify which of the two opposing objectives a regulatory authority prioritises, we review policy declarations and statements, and analyse whether an authority recommends regulatory instruments which primarily safeguard security of supply or favour regulation-for-competition in the policy process and application. Moreover, we conducted explorative interviews during which we investigated the policy dispositions of the interviewed representatives as well as checking these against others regulatory authorities. For instance, we asked regulatory authority A whether regulatory authority B was in favour of regulation-for-competition, and whether there was any dissent over regulatory instruments between them.[60] The interview technique is explained below in more detail. First, we will discuss the structural variables.

"Institutions matter", and so do authority structures. We distinguish between single authority and multi-authority structures. Our theoretical and empirical considerations suggested analysing the authority structure and, more precisely, specifying the multi-authority structures (sections 2.1.3 and 3.6). By analysing the institutional set-up and the distribution of competencies among the regulatory authorities involved in decision-making, we can identify the hierarchical structure that principal agent approaches take into account. By assessing the polity dimension, for instance, the lead ministry, the regulators and the competition authorities responsible for gas market regulation are

identified. In the case study analysis, the multi-authority structure is therefore outlined in a descriptive qualitative manner.

The importance of a country's natural gas resource endowments was originally deduced from the structure-conduct-performance paradigm. Such basic conditions, or physical characteristics, are subsumed in the first layer of Williamson's four-layer framework (section 3.3). In general, we would anticipate that a country which is less dependent on natural gas imports would be less inclined to favour a regulatory choice that prioritises security of gas supply. The reasoning behind this is, simply, that if a country provides its own gas resources, then the country is able to adapt its supply to match demand. While, in the long run, dependence on natural gas imports can be decreased through changes in the energy mix, in the short term, demand and supply flexibility are key factors in the prioritisation of energy policy objectives. For this reason, the natural gas resource endowment of the countries under investigation is assessed and integrated in the analysis. This variable is assessed on the basis of three criteria: reserve/production ratio (indicator 1), supply contract situation now and in the short term (indicator 2) and degree of demand flexibility provided by gas storage or swing production capacity (indicator 3).

The first of these indicators is based on the reserve/production ratio (R/P ratio) that British Petroleum publishes in the annual Statistical Review of World Energy. The OECD countries in general, and the European member states (EU-15) in particular, with 13.7 and 14.5 years reserves as of 2001, have fewer reserves than other regions in the world. The Middle East has the most reserves, followed by Africa with 76.6 years and the Asia Pacific region with 36.9 years. To operationalise the countries individual resource endowment we compare the relative reserve/production ratios within Europe at the end of 2001. Within the EU-15 group, the UK is at the lower end of the range with 6.9 years of reserves, and the Netherlands with 25.1 years is at the upper end of R/P ratios across Europe. Countries in a mid-position include Denmark (9.2 years), Germany (20.1) and Italy (14.8).[61] The second indicator addresses the contractual supply situation. Here a distinction is made between the present situation ($t_{(contractual\text{-}supply)}1$) and a mid term outlook ($t_{(contractual\text{-}supply)}2$) looking two years ahead. The supply situation can be characterised as under-contracted (when demand exceeds supply), sufficient (when demand more-or-less equals supply) or over-contracted (when demand is below supply). The third criterion attempts to capture a country's flexibility in meeting the demand for gas storage and/or swing capacity. The same three-way classification is applied as for the contractual supply situation. The contractual situation is indirectly assessed by referring to the import capacities of planned infrastructural projects such as LNG import facilities and import pipelines. Our procedure assumes that these huge investment projects only progress to the

planning process stage once sufficient natural gas has been commissioned to ensure they are economically viable. We included two different points of time, namely t1 and t2, because it is not only important to reflect the current resource endowment situation, but also how it is foreseen since politicians and regulatory authorities take the current and future supply situations into account when considering regulatory changes. These considerations usually do not go beyond a mid term horizon, reflecting re-election cycles. In our analysis, we examine the ways in which regulatory authorities refer to the resource endowment and their actual regulatory choices.

4.3.2 Case study selection

The selection of case studies is based on Mill's Method of Difference (Ragin, 1989: 34-52). Benneth summarises the classic design of a least similar case comparison as follows: "the investigator would look for antecedent conditions that differ between two cases that have different outcomes, and they would judge that those antecedent conditions that were the same despite differing outcomes could not be sufficient to cause either outcome" (2004: 31). The method assumes that two cases are, in fact, the same in all but one independent variable. In this sense, the method is very demanding, and some even claim unrealistic, in its assumptions because two cases are hardly ever that similar. A second objection might arise where equifinality occurs. Equifinality exists "when the same outcome can arise through different pathways or combination of variables" (ibid). In other words, one or more independent variable(s) *might* lead to a certain outcome *only* in conjunction with others. As such, a least similar case comparison cannot fully guard against equifinality or multi-causation (King et al., 1994: 87). Shortcomings in Mill's method in non-experimental social research are extensively discussed in the literature (Gschwend and Schimmelfennig, 2007: 150-151). Despite its critics, we argue that the method generates significant confidence in our inferences from analysing our key independent variable: the change in the prioritisation of gas policy objectives. Nevertheless, multi-causality or equifinality problems cannot be ruled out.

There are at least two common ways to control for equifinality and reduce selection bias in qualitative case studies with a limited sample size. Firstly, the number of cases can be increased and, secondly, a 'hard' case can be chosen. "Such 'hard' cases are also called 'a fortiori' cases: if a theory beats alternative theories in a particularly difficult context it should all the more hold under more favourable conditions" (ibid: 152). In a nutshell, if a causal relationship can convincingly be explained within a difficult situation, then it gains more general support. A rule of thumb in comparative case studies is that the number of variables should not exceed the number of cases (ibid: 153) if a causal interference is to be proven

rather than only explored. As such, an increase in the number of cases would not only be helpful in achieving explanatory power, it might also be a strategy to exclude multi-causality and equifinality problems. Regretfully, given our limited number of possible cases, our research must remain explorative.

Based on our theoretical considerations, a change in the prioritisation of gas policy objectives is decisive if it occurs across the multi-authority structure. In this sense, a combination of variables is supposedly responsible for the outcome. However, we face the dilemma that we cannot fully control for one variable to prove our causal inferences through case selection. Even if we left Mill's Method of Difference to one side, and focused on the first two independent variables and the dependent variable in conducting a differential analysis, we would not be able to find a case without a multi-authority structure during the post-delegation phase. As shown in chapter 2, multi-authority structures prevail in the European Union (section 2.1.3 and also section 8.5). Although an independent regulator may be given certain responsibilities, national ministries and the European regulatory authorities are involved in regulating the overall sector. Although an increase in the number of cases would enhance generalisation, it would not solve the problem of multi-causality or equifinality.

In the literature, it is claimed that the resource endowment of a country is influential in prioritising energy policy objectives and the subsequent related regulatory choices (Bunn and Weinmann, 2004). For instance, a country whose natural gas supply situation is worsening is likely to shift its natural gas objectives to give more weight to security of supply concerns, and it is likely to favour those regulatory choices which emphasise achieving security of supply as opposed to competition. In this sense, the UK is a 'hard' case and an outlier (Gschwend and Schimmelfennig, 2007: 152-153). Further, the UK was considered as the raw model and forerunner of liberalisation policy, providing, of the European countries, the most developed regulation-for-competition approach and liberal attitude. Our quantitative analysis confirmed this by the UK having the highest score in terms of meeting best-practice (see Table 17). In addition, the UK found itself in the historic situation of experiencing rapid resource depletion, turning from a net exporter to a net importer of natural gas during our research period. In contrast, the Netherlands continues to export gas to neighbouring countries. Hence, we would expect regulatory authorities in the UK to realign their regulatory choices in the direction of regulation-for-security-of-supply, i.e. reflecting that security of gas supply is becoming more important than regulation-for-competition. Instead, however, market-based solutions are applied in the sense that regulatory authorities within the UK stick with their anti-intervention attitudes and rely on the market to deliver a secure gas supply. These findings suggest that natural gas resource endowment is not a decisive variable. The UK situation indicates that the

'prioritisation of energy policy objectives' variable is independent of a country's natural gas resource endowment. Furthermore, the UK study provides evidence that the prioritisation of energy policy objectives is the key independent variable.

Variables	Case 1: The Netherlands	Case 2: United Kingdom
Independent variable Change in the prioritisation of gas policy objectives	Yes	No
Multi-authority structure	Yes	Yes
Poor economic performance effects	Yes	Yes
Obligation or specification by European legal provisions	No	No
Resource endowment (natural gas)	Decreasing (relatively high)	Decreasing (relatively low)
Dependent variable Re-alignment of regulation towards security of supply	Re-alignment of regulation towards security of supply	No re-alignment of regulation towards security of supply

Table 7: Case study selection

The reasoning behind the case selection demonstrates the attempt made to minimise any potential selection bias. Nevertheless, our qualitative research design does not allow us to claim a definitive explanation, but remains, for two reasons, explorative in nature. Firstly, equifinality or multi-causality cannot be excluded or respectively explained sufficiently. Secondly, including a 'hard' case to strengthen the generalisation potential does not fully counterbalance the problem of having only a small number of cases.

4.3.3 Pitfalls of drawing interference, and triangulation of data sources as a counter strategy

The methodology literature warns against the pitfall of drawing inferences from non- representative processes (Miles and Huberman, 1994: 264). One can fall into this pit by either choosing extraordinary events or selecting over-restrictive informants. In our study, the two selected cases for qualitative analysis are considered to be representative. In practice, poor economic market performance is not a moment of crisis or an extraordinary incident, but rather a cyclical

recurrence. Nevertheless, the UK example can be seen as a 'hard' case, because the outcome did not reflect the changes in the natural gas resource endowment.

To prevent any bias stemming from choosing over-restricted informants, triangulation was adopted as a counter-strategy. "Stripped to its basic, triangulation is supposed to support a finding by showing that independent measures of it agree with it or at least, do not contradict it" (Miles and Huberman, 1994: 266). In the qualitative analysis, triangulation is employed through the method, the data sources and the data types applied. An actor's beliefs and preferences with regard to regulation-for-competition are not only deduced from official documents, such as press releases, statements, media coverage, scientific articles and reports, they are also counterchecked through standardised, semi-structured elite interviews. According to Dexter, such interviews have the advantage that any initial bias of the researcher is likely to be challenged: "a good many well-informed or influential people are unwilling to accept the assumptions with which the investigator starts; they insist on explaining to him how they see the situation, what the real problems are as they view the matter" (Leech, 2002: 663). However, there is a danger that a researcher might be influenced by informants, and this is especially a risk if the informants are non-representative.

In our study, the selection of interviewees has involved a conscious identification of representative relevant actors combined with a 'snowballing technique' (Erickson, 1979). The identification of relevant actors draws on the concept of the organisational field.

> Explaining institutional change requires looking at the broader organizational ***field*** actors (Leblebici et al., 1991; DiMaggio, 1991; Hoffman 1999). The concept of 'organisational field' is similar to that of 'industry', but more inclusive. Whereas, 'industry' typically refers to a group of firms producing similar outputs and their economic relationships [with] buyers and suppliers, an 'organisational field' is a social location of interaction between competing firms, suppliers, buyers, regulators and policy makers; that is, the field level includes the 'totality of relevant actors' (DiMaggio and Powell, 1983, 48) and their social and economic relationships. Examining field-level dynamics is particularly important in the study of power industry because consumer groups, legislators, and policy analysts are central actors. (Sine and David, 2003: 186)

In conducting 25 interviews, we did not interview all the relevant actors but we did choose representatives of relevant actor groups such as regulators, ministries, competition authorities, incumbents, new market entrants, independent experts, various consumer groups representing industry as well as private households.

After each interview, the individuals were asked for the names of other possible interviewees in their own organisation and in other institutions. This snowballing technique helped us identify the most appropriate interview partners while also covering the entire organisational field. The purpose of these interviews was not fact-finding as such, but primarily to enable triangulation with the data sources and the methods. This procedure allowed us to check whether official actors' beliefs and preferences were repeated and confirmed during semi-structured interviews.

4.4 Summary

The dissertation is divided into qualitative and quantitative comparative analyses of the evolution of European gas markets, for which the separate research designs have now been outlined. The quantitative research design is based on a two-step causal relationship. First, the two independent variables (prioritisation of energy policy objectives and the specification of European legal provisions) are analysed for their effect on shaping regulatory regimes. In the second step, this dependent variable becomes an independent variable to analyse to what extent the effect of regulatory regimes on economic performance can be empirically studied. In giving values to the first two independent variables, a dichotomic distinction is applied. Reform objectives can either prioritise regulation-for-competition or emphasise public service obligations such as security of gas supply. Where both these energy policy objectives are apparently combined and to be achieved at the same time, they are seen as ambiguous. In a similar way, the specification of European legal provisions may be either precise or imprecise. Regulatory regimes are operationalised separately in the next chapter. Economic performance is indicated using natural gas prices, tariffs, efficiency and investment. Our quantitative analysis covers the largest possible population within the European Union by incorporating all twelve of the old member states which were required to reform their gas markets. Observations are made at six measurement points distributed fairly equally throughout the period from the beginning of 2000 to the end of 2005.

The second empirical part consists of two qualitative case studies. The research design is less parsimonious than the quantitative analysis and contains five independent variables which are seen as determining regulatory choices. The prioritisation of energy policy objectives is considered as the key independent variable. Economic performance, European legal provisions, the country's natural gas resource endowment and the given authority structure are conceived of as the set of necessary independent variables, complemented with the prioritisation of energy policy, to form a sufficient explanation. Economic

performance focuses in the UK case study on the wholesale prices of natural gas, and in the Dutch case on transmission tariffs. European legal provisions are operationalised in the same manner as in the quantitative analysis. The country's natural endowment with natural gas is based on three indicators: reserve/production ratio (indicator 1), supply contract situation now and in the short term (indicator 2) and the degree of demand flexibility provided by gas storage or swing producing capacity (indicator 3). The authority structure variable distinguishes between single and multi-authority structures. The prioritisation of energy policy objectives variable captures whether regulation-for-competition or regulation-for-security-of-gas-supply is put at the forefront by regulatory authorities. The regulatory choice variable assesses whether a realignment of regulation towards security of supply has taken place or not. On the basis of Mill's Method of Difference, we selected two cases for review: the UK gas storage regime, and the revision of the Dutch incentive regulation regime. The UK case covers the period between the winter of 2002 when the price rise in UK wholesale gas prices started raising concerns and January 2006 when the UK government decided against introducing a new gas storage regulation. For our Dutch case, the time frame of the analysis is set by the implementation date of the revenue regulation in combination with the x-factor in January 2005 and the announcement of the Minister of Economic Affairs to revise the applied incentive regulation in March 2007.

The chosen design has two shortcomings. First, it cannot fully control for equifinality. Second, the limited number of cases in relation to the number of independent variables does not allow generalisation. For these reasons, the qualitative analysis should be seen as explorative in nature.

5. Methodology to assess regulatory regimes in European gas markets

5.1 Introduction

In this chapter we outline the methodology for the assessment of regulatory regimes in European gas markets. A brief literature review demonstrates how regulation was perceived in early studies researching the structure-conduct-performance paradigm and how it progressed towards regulatory indices. We deal with some of the obstacles that occurred while generating panel data of regulatory regimes in European gas markets after their liberalisation. Then, the task of operationalising regulatory regimes is accomplished by the exposing the choice of indicators and giving reason for the scoring of their values. At the end of the chapter, a summary displays different regulatory regime models.

5.2 Regulatory variables and the use of regulatory indices in econometric models

Early econometric models analysing the impact of regulation on the performance of industry performance started with very simple designs. Then, the regulation variable was reduced to dummy variable asking as to whether an independent regulator is or is not present (Jon Stern, 2007; Wallsten, 2001; Zhang, Parker, and Kirkpatrick, 2002). While progressing on the research agenda, more complex operationalisations are applied (Cubbin and Stern, 2006; Edwards and Waverman, 2006; Gutierrez, 2003; Jon Stern, 2003). Those indexes vary between four to 12 indicators. In the context of developing countries, the variable regulation is interpreted in the form of policy credibility. Then, the independence of

jurisdiction and overall stability of the political system ensuring property rights of foreign investors stays at the forefront, whereas the institutional endowment and independence of regulatory authorities is addressed in studies focusing on developed countries (Bergara, Henisz, and Spiller, 1997). According to Jon Stern, studies analysing the telecommunication and electricity sector commonly confirm that regulation does have a significant positive impact on infrastructure industry (2007: 162). Moreover, the impact of regulation is more accurately estimated, when an index of regulatory characteristics is applied and when more index elements are included. According to Zhang, the positive correlation is reinforced in case independent regulators is in place in conjunction with the sectors privatisation. From this follows greater electricity availability, more generation capacity, and higher labour productivity (Zhang, Parker, and Kirkpatrick, 2002).

Those studies referred to take only the formal dimension of regulation into consideration. Indices describe de jure regulation or properties of regulators Currently, the actual implementation practice or regulatory quality is not analysed, but future research attempts to expand in this direction (Stern, 2007). Oxera Consulting offers an example for a wider interpretation of regulation. In their report commissioned by the UK Department for Trade and Industry, Oxera measures the competition in electricity and gas markets across the European Union and G7 countries. With the applied index, the consulting company assesses not only de jure regulatory instruments, but also de facto institutional arrangements in form of contract characteristics, industry structure and costumer behaviour. Furthermore, indicators are grouped along the different parts of the value chain (upstream, wholesale, downstream, network-related activities) which allows to assess the degree of competition on different market levels (Oxera, 2003). The Oxera study may serve as a starting point and source of inspiration for developing a more complex index assessing regulatory performance. However, due to Oxera's competition focus, their index is not applicable to assess the convergence of regulatory regimes in European gas markets. An index to assess the convergence of regulatory regimes still has to be developed. This task will be accomplished in this chapter.

5.3 Generating panel data: sources and obstacles

Since 2001, the European Commission has annually published benchmarking reports (BR) to assess the regulatory performance of member states. This set of data, describing the implementation of the Gas Directives and related Regulations, offers the opportunity to create a time series and apply a longitudinal design. The publication of a BR is treated as a measurement point, although changes

of regulatory instruments took place within a certain period of time, usually one year.

At the time of this study, five benchmarking reports on the implementation of the internal electricity and gas market have been published: the first benchmarking report (3.12.2001 = t1), the second benchmarking report (2.10.2002 = t2), the second benchmarking report including accession member states (2nd plus benchmarking report) (7.4.2003 = t3), the third benchmarking report (1.03.2004 = t4), the fourth benchmarking report (5.1.2005 = t5), and the so-called 'Report on progress in creating the internal gas and electricity market' (15.11.2005 = t6) which we treat as the fifth benchmarking report. Formally the latter two reports were published in the same year, but being nearly one year apart, they are treated as separate measurement points: one describing the reality in 2004 and the other in 2005. We then have a total of six measurement points. Data sources have been triangulated[62] by including survey research. Complementary data has also been collected from the national regulatory authorities through a standardised, self-administrated questionnaire and the CEER Regulatory Benchmarking Report (Council of European Energy Regulator (CEER), 2005). The response rate of the survey reached 100%. Sometimes this procedure brought about contradicting data. We then considered the benchmarking reports published by the EC as the primary source, because this data has been handed in by the regulators within their legal binding monitoring requirements.

The European Commission compiled the benchmarking reports by incorporating information from various sources: Accordingly,

> the reports have been compiled using information collected from market players and government agencies following a detailed survey. A number of individual studies have also been completed by DG Energy and Transport using both its own resources and external consultants. (European Commission, 2001: 1)

Special attention has to be paid to the data describing the tariffs in European gas markets, because the assessment of tariffs in a single country results in approximated rather than precise figures. During the reform period, methodologies for accessing and regulating tariffs were developed and implemented in an evolutionary process. Therefore, data on tariffs is often not completely available and moreover is not based on the same standardised definition. This is also the case for the data used to access the tariffs in EU-12 between 2000 and 2005. The second and third benchmarking reports are based on the European Commission's own calculations, assessing tariffs for transmission services of large users with an annual consumption of 25mm^3 with a daily

peak of 100,000 m^3 and an hourly peak of 4100 m^3. This differs from the fourth and fifth benchmarking reports, in which the national regulators contributed to the data based on comparatively broad definitions. To describe the tariffs in the latter reports, we applied the Eurostat categories for large users. Large users of category I4 are defined as consumers with an annual consumption of 4,186,000 GJ, and load factor of 250 days (4000 hours) (European Commission, 2001: 54; Eurostat, 2006). However, 4,186,000 GJ is treated by the Commission as equivalent to the category of 10 mm^3. The difficulties in assessing comparable tariffs exposed above thus lead to the conclusion that the primary data on tariffs is rather tentative and trendsetting.

Yet, high tariffs form a significant barrier to new gas market entrants and are therefore an integral part of market regulation. To include the tariff level, we must make two adjustments. First, there is no valid observation of the component tariff contributing to the first indicator "Gas network access conditions and tariffication" in the First benchmarking report (t1). Treating it as a missing value would automatically translate it into high tariffs. Thus, stability is assumed for missing tariffs in 2001. Tariffs from 2002 are chosen to facilitate this (European Commission, 2002: 38). Second, in the second and third benchmarking reports two levels of tariffs for large users are measured in minimum and maximum tariffs (European Commission, 2002: 38; 2003a: 43; European Commission, 2004d: 35), indicating the range and variety of tariffs in each country. To put it into operation, we create a mean of the two indicator components. The degree of convergence is not fully mapped, but the overall trend can be demonstrated. Estimations of tariff levels on the transmission level are tentative and express a certain trend, but do not reflect precise tariff developments in the European gas markets.

5.4 Assessing the comprehensiveness of a regulatory regime

In the following sections, the concept of regulatory regimes is operationalised. In a first step, Indicators are selected along the two dimensions, regulatory function and competences. Then, in a second step, the values of these Indicators are scored.

In previous chapters we pointed out that there is no such thing as an ideal-type competitive market, nor has the EU Commission explicitly defined and officially announced a best-practice model for a competitive European market that would allow us to assess the comprehensiveness of regulatory regimes in the gas market.

Reviewing the literature on gas market regulation, the interested reader is instead confronted with a complex litany of measures and specific terminology.

This complexity is reflected by a high number of indicators describing the characteristics of gas market regulation. Due to the lack of a best-practice model, the choice of indicators and their scaling for our analysis is inspired by the literature and publications that served as a preparation for the regulatory reform of the gas market and were generated during the Madrid Forum process. There, national Regulators, the European Commission, and industry and consumer associations incrementally discussed and developed indicators to monitor the regulatory performance. In particular, the Council of European Energy Regulator (CEER) and the Brattle group (Council of European Energy Regulators (CEER), 2002; Brattle Group, 2002) worked extensively on tariff methodologies for intrastate, cross-border, and transit flows in European gas markets to facilitate the gas market liberalisation. These indicators and definitions were supposed to - if not enter at least influence - the choice of required instruments and wording of the text of the second Gas Directive which came into force in 2004. However, the appropriateness of indicators is by nature controversial, as each indicator and the interpretation of its values added to the interpretation of measures and therefore might potentially imply far reaching influence on the organisation of the gas markets (Brattle Group, 2002). Nevertheless, I claim the indicators proposed in the framework of the Madrid Forum are sufficiently consensual to assess comprehensiveness of regulatory regimes in the gas sector.

As a matter of fact, the lack of a best-practice model of a competitive gas market posed some challenge to put into operation the comprehensiveness of regulatory regime. We suggest a bottom-up approach, starting with indicators applied by the European Union and then weighting and scoring the indicators to create an index. In this context, three critical questions had to be solved: First, which indicators sufficiently describe a regulatory regime in the gas sector and second, how should these indicators be weighted in an index? And even more important, how shall the instruments be scored? The following section is organised according to these questions.

5.5 Choice of Indicators

The following section explains the choice of indicators for the first dimension of the variable “comprehensiveness of regulatory regime”, the regulatory function. Then, in a second step, I define the indicators for the second dimension, the regulatory competences. The choice of indicators is based on the assumption that the regulatory measures of the whole downstream part (wholesale, network activities, and downstream) of the gas value chain matter.

5.6 Indicators for the dimension of regulatory function

I refer to the concept of regulation the Madrid Forum applied to describe the choice of indicators for the variable regulatory comprehensiveness in its dimension regulatory function. In the beginning of the Madrid Process, the participants basically distinguished between two groups of aspects: first, the

> technical and commercial conditions applying to the access to the system, with particular attention to the aspect of tariffication (“conduct regulation”). The second (“structural regulation”) concerns the decision regarding the structure of the gas industry, in particular the obligations imposed to gas companies with regard to the limits to vertical integration (unbundling). (Madrid Forum, 1999: 1-2)

This very general grouping serves as a starting point to present the chosen indicators which are based on the suggestions made in the benchmarking reports and the documents accompanying the Madrid Forum. In the following paragraphs define the indicators and give further explanations where necessary. The indicators are often based on several components which are exposed in detail in the tables (10 and 14).

Indicator number	**Indicator name**
Indicator 1	Market opening
Indicator 2	Gas network access conditions and tariffication
Indicator 3	Balancing rules
Indicator 4	TPA storage
Indicator 5	Gas release programme
Indicator 6	Trading facilities
Indicator 7	Network unbundling Transmission System Operator (TSO)
Indicator 8	Network unbundling Distribution System Operator (DSO)

Table 8: Grouped indicators for operationalisation of the variable “comprehensiveness of the regulatory regime” for dimension regulatory function

The legal provisions of the Gas Reform required a gradual market opening (Indicator 1) that has been introduced in the course of the reform. The facilitation of the market opening and its precise requirements is addressed in section 7.3.1. Indicator 2, 'Gas network access conditions and tariffication', incorporates such information as type of capacity booking as well as minimum booking period and tariff structure to describe the flexibility and transparency of the access regime. Indicator 3 includes 'balancing rules', accounting for the fact that certain balancing measures can be a powerful tool to increase the entrant barriers for flexible trade. The latter focuses on the required balancing period, because it is regarded as a key measure to ensure network access, flexible trade, and a balanced network system alike (Office of Gas and Electricity Markets (Ofgem, 2002). Other balancing rules, such as the arrangement of tolerance bands or the allowance for pooling and trading in the balancing regime, are not included, weighting the gain of adding secondary measures and loss through over complexity of the measurement.

Discussions centred on storage issues during the second half of the Madrid Forum process. These discussions clarified the significance of 'Third party access (TPA) of storage' (Indicator 4), in order to guarantee a balanced gas transport system and equal trading opportunities for transmission operators and gas traders alike (European Commission, 2003; International Energy Agency, 2000: 100; Madrid Forum, 2004). The last but not least indicator is the 'Gas release programme' (Indicator 5). In markets which are dominantly supplied by long-term import gas contracts, market liquidity can either be achieved by gas release programmes for "over-the-counter" (OTC) or by gas trade in the on-the-day commodity (OCM) market stemming from balancing arrangements. Therefore, the existence of a gas release programme is an essential tool to accelerate the intensity of competition in the market by requiring dominant market players to release certain amounts of their long-term contract gas import to other market players such as new entrants.

This leads to indicator 6 which assesses whether there are significant trading facilities in place. The EU provisions do not prescribe the establishment of trading facilities such as gas hubs or gas exchanges. Instead, it is left to the incumbent, the market, and member states to establish trading facilities. In general, liberalised markets are characterised by a growing complexity of transactions (Ingwersen, 2004, 14 April). Whereas monopolistic markets are dominated by confidentially contractualised bilateral trade, so called OTC trade, standardisation, and transparent pricing is significant for transactions in liberalised markets (Wright, 2005: 21).

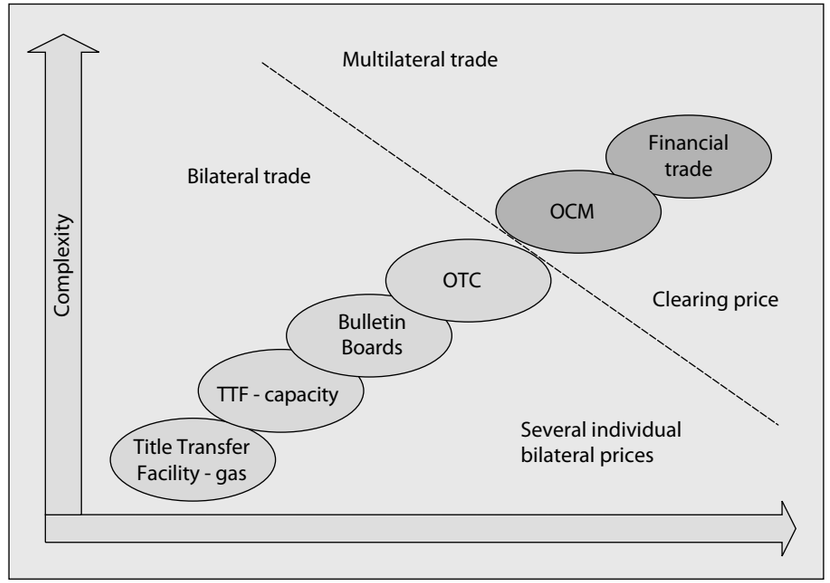


Figure 8: Complexity of gas trade in a liberalised gas market

More advanced liberal markets such as the UK are characterised by a very differentiated market landscape. Wright identifies four different gas markets in the UK, a retail and three different wholesale markets. On the wholesale level, in addition to the classical long-term bilateral contract market there is the OTC market and the on-the-day commodity market (Wright, 2005: 52). The latter initially evolved from system operator's need to balance the pipelines system and later served as a vehicle to promote the development of trade. Since liberalisation, more trading opportunities evolved within other European gas markets as well. Mainly, due to the creation of gas hubs and or virtual trading points, new traders could enter the markets. Therefore, the existence of complex trading facilities offering clearing prices can be interpreted as an indicator for market openness, a necessary precondition for achieving competition. More precisely, the volume of traded gas at the OTC and OCM markets in relation to gas trade conducted within bilateral long term contracts could serve as an indicator for the degree of competition. As we see later, the assessment of the indicator is not based on this ratio. Instead, a more technical approach is followed by asking whether there are significant trading facilities such as gas hubs or gas exchanges. The European

Commission did not monitor this indicator in most of its benchmarking reports. Instead, the data is collected from primary and secondary literature.

To describe the process of vertical 'dis-integration', the so called unbundling of trade and distribution or transmission services within a formerly integrated utility (structural regulation), has been incorporated. In this respect, we chose a group of indicators to describe the network unbundling of Transmission System Operator (TSO) (Indicator 7) and network unbundling Distribution System Operator (DSO) (Indicator 8). Through distinguishing between TSO and DSO a more precise picture of the different levels of services can be achieved. In doing so, we expect to show different rates of implementation with regard to unbundling of gas industry.

5.7 Indicator for the dimension of regulatory competences

According to Arentsen, the dimension of 'regulatory competences' refers to competences, capacities, and instruments of the regulator. Elaborating on the latter dimension, he distinguishes two aspects: competences and capacities on the one hand and the degree of autonomy of the regulator on the other. (Arentsen, 2004: 88)

Indicator number	Indicator name
Indicator 9	Type of decision-making by regulatory authority (Ex ante/ex post)
Indicator 10	Capacity allocation rule decided by
Indicator 11	Balancing conditions approved by
Indicator 12	Dispute settlement
Indicator 13	Type of Regulator
Indicator 14	Ratio of consumption of national gas market and staff number of national regulator
Indicator 15	Ratio of consumption of national gas market and budget of national regulator

Table 9: Grouped indicators for operationalisation of the variable "comprehensiveness of regulatory regime" for the dimension regulatory competences

Regulatory competences – in terms of competences, capacities, and degree of autonomy – basically deal with different aspects of decision-making regarding

network access conditions. Hence, Indicator 9 'Type of decision-making by regulatory authority' refers to the timing of the network access regulation and the existence of a regulatory authority to regulate third party access. In this context,

> two approaches can be distinguished: one applied by a majority of Member States consists of 'ex ante' regulation, i.e. it provides for a requirement for operators to submit a schedule for network access tariffs to the regulator for approval prior to its application. The second approach is 'ex post' regulation. Under this approach grid operators would, for instance, publish or notify network tariffs applied by them to the regulator, who then has the possibility to intervene or not. (European Commission, 2001: 66)

The next set of indicators describes the degree of autonomy the national regulator has towards the governmental institutions (such as ministries of economic affairs). These indicators inform which authority or authorities jointly decide on 'capacity allocation rules' (Indicator 10), 'balancing rules' (Indicator 11), or are in charge of 'dispute settlement' (Indicator 12). In other words, the governance dimension is addressed.

The remaining three indicators map the formal competences and capacities of the national regulator. First and foremost, we assess whether a 'regulator' has been set up and distinguish between pure sector regulation and multi-utility regulators (Indicator 13). This is complemented by the next two indicators, which qualify the institutional endowment the regulator received from the member states. By assessing the staff number (Indicator 14) and the budget of the national regulators (Indicator 15) and setting these numbers in relation to the size of the natural gas market (market size/staff or budget) it allows us a tentative judgment about the strength or formal competences of the member states regulator. Gas consumption (in million tonnes oil equivalent) in the year 2000 serves as a reference point for describing the market size. The staff number and budget numbers comprise the energy regulator as such and don't distinguish between sectors such as gas and electricity. Often they even refer to a multi-utility regulator, including telecommunication.

5.8 Index: Aggregation and weighting of Indicators

Due to the lack of a best-practice model of a competitive gas market which precisely outlines the characteristics of an ideal regulatory regime, there was no applicable concept available for the formulation of an index. The aim and conceptual contribution of this study is therefore to formulate an index that

indicates the relative distance of the member state's regulatory regimes to an anticipated best-practice model. In doing so, we apply a bottom-up approach to weight indicators. Based on the choice of 15 indicators and its 23 components to describe a regulatory regime, we determine that all 23 components together correspond to 100%.

The alternative would have been to determine criteria according to which the weighting of indicators is carried out. We briefly illustrate why a weighting of indicators is important and at the same time ambivalent if its criteria driven. This involves discussing the comparative impact of two indicators, third party access, and balancing rules. In this context a reasonable question might be: do balancing rules have the same impact as network access rules on the market reality? The answer must certainly be no. Third party access is a crucial instrument that enables new market entrants to trade their gas through a network; balancing rules are rather complementary. Nevertheless, balancing can be used as a tool to influence the amount of available capacity and the market liquidity. At the same time, balancing rules allow sharing responsibility for the optimisation of gas flows in the grid between the network operator and trading companies. The discussion accompanying the European gas reform clearly demonstrated that all the downstream activities of the gas chain have to be taken into account (transmission, storage, distribution) and this necessitates including instruments regulating the entire downstream sector (European Commission, 2003). In other words, it can be considered moderately consensual to include the proposed instruments, whereas the question of how to deal with different impacts of instruments is analytically pretty nebulous. Indeed, it becomes more complicated and controversial if one tries to express the comparative importance of for instance, TPA and balancing rules in exact figures. Experts may find common ground in the fact that both instruments are relevant and even consider the overall impact of the chosen network access rules to be more decisive than the balancing rules. However, it is unlikely that they would reach an agreement on the impact of one instrument on the whole comprehensiveness of a regulatory regime expressed in percentage. Due to the lack of a clearly defined best-practic model and the ambivalence of expressing the comparative importance of indicators in exact figures, there is no optimal solution for creating an index.

We identified two criteria the index is based on: one, it should allow the same hierarchical scaling for the values of each indicator, and two, it is supposed to reflect differing significance of indicators regarding their impact on promoting competitive market conditions. These two criteria are carried out by the proposed bottom-up approach. According to this logic, the index is created first by choosing indicators and then calculating the indicators share or impact on the regulatory regime. The indicator's share can be grouped according to

the indicator's dimension (e.g., regulatory function) or single indicators (e.g., balancing rules).

Accordance to the calculations, the comprehensiveness of regulatory regime is 70% determined by indicators related to the regulatory function dimension and 30% by indicators describing the second dimension, the regulatory competences (see Figure 9). The result is in line with the assumption that the two dimensions - regulatory function and regulatory competences - do not have the same impact on the regulatory comprehensiveness.

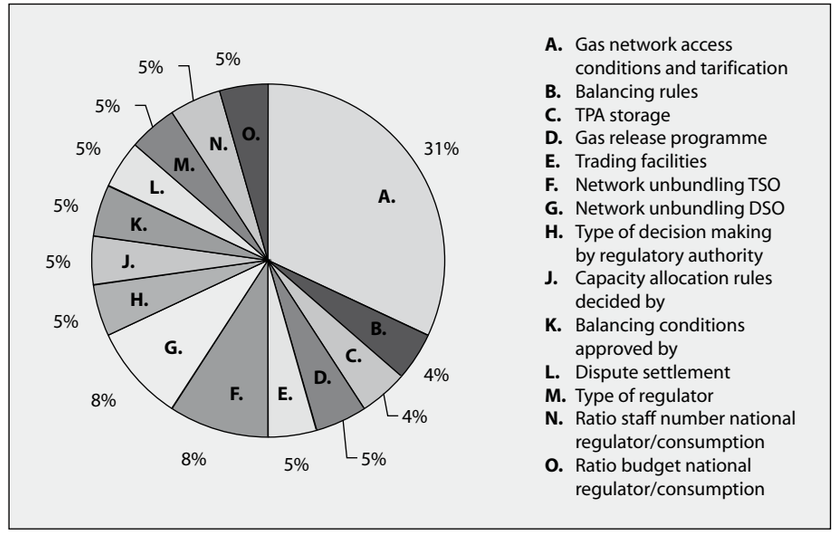


Figure 9: Indicators' share of a comprehensive regulatory regime

Figure 9 illustrates each indicator's share describing the regulatory regime. The previous section identified 15 Indicators to describe the regulatory regime. The regulatory function is expressed by 8 Indicators, comprising 16 components, while the regulatory competences are assessed with 7 Indicators. Cumulating the indicators components and calculating their shares, the following composition evolves: 'Gas network access conditions and tariffication' (Indicator 2) hold a share of 31% and 'network unbundling at TSO and DSO' each represents 8% (Indicators 7 and 8). The other indicators are all incorporated with a share of 5%. These are: 'Gas release programme' (Indicator 5), 'Trading facilities' (Indicator 6) 'type of decision making by regulatory authority' (Indicator 9), 'capacity allocation rules decided by' (Indicator 10), 'balancing conditions approved by'

(Indicator 11), 'dispute settlement conducted by' (Indicator 12), 'type of regulator' (Indicator 13), 'ratio of staff number of national regulator and consumption of national gas market' (Indicator 14), and 'ratio of budget of national regulator and consumption of national gas market' (Indicator 15). Due to mathematical reasons Indicator 3, 'balancing rules' and Indicator 4, 'TPA storage', deviate from this scheme and receive only 4%.

The bottom-up approach suggests that the indicators describing the regulatory competences make up approximately 1/3 and regulatory function 2/3 of the regulatory regime. The latter mainly stems from the comparative importance inherent in the indicators gas network access conditions and tariffication (31%) and network unbundling at TSO and DSO levels (8%). One can argue that the comparative importance is achieved by several components forming the indicators, whereas the other indicators are only based on one component. This is certainly a correct observation, but a different grouping of indicators (e.g., through a split of indicators, all indicators equally based on one component) is still not favourable for analytical reasons.

5.9 Index: Components and scaling of Indicators

The scaling of the variables values is arranged along the logical distance to the necessary condition for the promotion of a competitive market model. Each indicator is ranged from 0 to 10, assuming equal distance between the values. In terms of scaling, there is no distinction made between the nominal and interval measurement of the indicator values. Nominal measures like time, percentage, and other numbers are also grouped and expressed with the 0-10 scaling; otherwise the nominal indicators would gain more weight in the index than transformed interval indicators. The main reference point serves as the distance or closeness to the best practice model. The index applies a scoring rule to each indicator ranging from 0 to 10, where 10 is the most competitive.

Not every indicator has an equal number of values or categories, although the total number of categories does influence the score. One might criticize the scoring method to be value sensitive or even biased. To minimise this effect, the values have been grouped into categories.

5.10 Scoring of Indicators describing the dimension of regulatory function

The scoring is based on the reform's inherent theoretical assumptions as well as the concrete provisions and principles of the reform (see chapter 2, 3 and

7). Thereafter, the chosen regulatory instruments should meet the principles of objectivity, non-discrimination, (information) transparency, efficiency, being economical, and safeguarding security of supply. Moreover, prices should be fair and instruments should be cost-reflective, environmentally friendly, and consumer protective. Both principles and instrument-related European legal provisions were elaborated earlier and serve as a reference for the scoring.

5.10.1 Legal market opening

The scoring of 'legal market opening' takes the legal provisions of the Gas Directives as reference points (see section 7.4). Accordingly, a low market opening is defined as 20-28%, a middle market opening 29-42%, and a high market opening is reached if more than 43% of the market has been formally opened. The Directives distinguish between new and advanced market openers. In terms of scoring, this differentiation is reflected in the percentages of market opening and is later stated by the empirical data.

Indicator	Data type	Values and scores
Legal market opening	Numeric	High (10) = >43% Middle (5) = 29-43% Low (0) = 20-28%

Table 10: Legal market opening (Indicator 1)

5.10.2 Network access conditions and tariffication

In the first years of the gas reform, the EU was especially concerned with measures that promised to open the market for competition and serve market integration by lowering the barriers for cross border transport. In this regard, network access conditions and tariffication were seen as the spearhead. Often cross-border or even inter-European transport has not been economical because the nationally applied tariff system often resulted in so-called "double-counting" or "pan-caking" (European Commission, 2000a: 7). The second indicator is therefore assessing gas network access conditions and tariffication. The indicator is based on seven components, and thereby reflects different aspects of a tariff system and network access conditions (Brattle Group, 2002: 35). Although the indicator third party access is a genuine part of the network access, this is subsumed under regulatory competences and treated in the next section (Indicator 9) due to the fact that the question of whether third party access is regulated or unregulated reflects the decision mechanism the network access conditions are based on.

Tariff system

The distinction between tariff structures, type of capacity booking, and allocation method is often not clear, or sometimes the terminology is simply mixed up. This is often due to the fact that the tariff structure corresponds with the type of capacity booking. Germany for instance, used to have a distance-based tariff type and applied for the capacity booking a point-to-point method. In contrast, the Brattle Group pointed out several examples where capacity is defined one way and tariffs are set in another way. The different aspects of a tariff system can be described as follows: whereas the type of capacity booking defines the access, the tariff structure determines the pricing rules. In distinction, the allocation method determines the mechanism the network capacity is allocated by. No tariff instruments are prescribed by the European gas market regulation, but left to the member states to decide.

Tariff structure

The Madrid Forum repeatedly stressed the need for convergence in terms of tariff structure (European Commission, 2002: 16; Madrid Forum, 2001, 2002, 2004), but the legal norms do not prescribe the tariff structure itself. In this context, the Council of European Energy Regulators stresses the "diversity of tariff structure in Europe in itself could impose transaction costs (associated with gathering the information and understanding it) on new entrants to the point where new entry is deterred" (Council of European Energy Regulator (CEER), 2000: 9). The discussion paper of the Madrid Forum indicates that entry-exit tariff structures are considered to be much more effective in promoting gas trade and market liquidity. Furthermore,

> the Regulators, the Commission and most member states expressed serious doubts that distance-related point-to-point tariffs would effectively achieve this and therefore invited Regulators, Member States, GTE, and individual TSO´s to consider more cost-reflective and trade-promoting tariff systems such as entry-exit systems. (Madrid Forum, 2001: 3)

The general acceptance of entry-exit tariffs later resulted in the presentation of a report that documents on the implementation of the "a road-map to entry-exit systems" (Madrid Forum, 2004: 3). To sum up, entry-exit tariffs systems are considered to be cost-reflective, flexible, transparent and non-discriminatory.

Reading these statements still leaves us with the question of why entry-exit tariffs are favoured by the European Commission and the majority of participants of the Madrid Forum. The Brattle Group offers this explanation:

> Under an entry-exit system, the total transportation charge is the sum of separate charges for entry and exit capacity. The charges vary by entry and exit point, and should be set to make the total charge for any transportation route as close as possible to the associated cost. (Brattle Group, 2002: 42)

Following this line of interpretation, the tariff allows to transparently reflect costs for the transport itself and the costs stemming from keeping up the flexibility of the network, and thereby reduces the risk of monopolistic rents. The claim entry-exit based tariffs are cost-reflective is contested. In either case, entry-exit tariffs have two characteristics that meet the aims of the liberalisation process. First, entry-exit significantly promotes the transparency of tariffs. As a result, new entrants are able to calculate transportation costs without facing high transaction costs that would otherwise discourage participation in the market. Secondly, it is argued that entry-exit systems give locationally and temporal signals that allow identifying and reducing congestion in the grid. Manifested through high prices at certain entry-exit points, this tariff type is supposed to additionally indicate where investment might be necessary (Council of European Energy Regulators (CEER), 2002: 4).

In contrast to entry-exit tariffs, distance related tariff structures have to fulfil certain conditions to be cost-reflective and non-discriminatory. According to Brattle Group (2002), these conditions are not given in reality. As they point out "in more complicated networks with multiple entry and exit points physical flows will deviate significantly from contractual flows. In these instances, distance-based systems no longer provide cost-reflective charges and therefore are potentially discriminatory" (Brattle Group, 2002: 38). It is argued that this deviation allows operators to ask for higher transportation costs, which discriminate against new entrants. In other words, distance related tariff structures permits incumbents (supplying and transporting) to determine the increase of marginal costs for transporting additional gas.

Postal tariffs, so called postage stamp tariffs, can be thought of as a special case of entry-exit tariffs - with the same entry tariff at every entry point and vice versa (Brattle Group, 2002: 35). The CEER working Group elaborates,

> if postage stamp (average cost) tariff is applied where the network modelling implies locationally differentiated tariffs, there will be a cross-subsidisation from 'low cost' entry points to 'high cost' entry points. The tariff will not be cost-reflective. Post-stamp tariffs allow incumbents and new entrants to compete on an equal cost basis. Cost reflectivity is, however, very important because tariffs distort the market. In view of the Working Group (CEER), therefore, the best approach is to set cost reflective tariffs for all and simultaneously ensure capacity arrangements provide for non-discriminatory access. (Council of European Energy Regulators (CEER), 2002: 5)

The benchmarking reports also designate the category "mixed" for countries in which different tariff zones still exist. Some zones may have already introduced entry-exit, whereas others still use distance related or postalised tariffs. In other words, a national market can contain a favourable and an unfavourable tariff system at the same time. Nevertheless, the least optimal solution is no publication of tariffs as such, which is covered by the values 'not applicable' or 'not published'. Thus, we argue mixed systems are less favourable as well, because they offer a lower degree of tariff harmonisation and transparency which in return results in higher transaction costs for the companies. Distance related and post stamp tariffs receive the same score as we could not identify a qualitative difference between their disadvantages (one cross-subsidising different transport cost areas and the other offering the ability to increase the TSO profit due to the deviation of contractual and physical flows). Entry-exit tariffs receive the highest score, mainly because the EC considers it to be the best practice tariff that promotes transparency and non-discrimination.

Type of capacity booking

In practice. tariff structure and type of capacity booking often correspond. However it is also possible to deviate, as they express different functions of network access. The benchmarking reports distinguish eight values that describe capacity booking and group them into four categories. The first category form entry based, entry-exit based, and so-called cost-reflective types of capacity booking, and the second group consists of distance related types postalised and point-to-point based capacity booking. The third category incorporates mixed types of capacity booking and the fourth is reserved for countries that do not provide any information about the way capacity booking services are organised. The most favourable are the most flexible and cost-reflective in the first category. Due to the similarity between the values of tariff structure and type of capacity booking, we apply the same reasoning then for the tariff structure (see above). In this context it is noteworthy that the type of capacity booking described here

does not indicate duration. In other words, the different type of capacity booking does not reflect the phenomenon of capacity congestion in some of the European gas markets.

Allocation method

The next indicator describes the allocation method used to distribute transport capacity. Three different types of allocation methods are applied in the EU gas markets that are considered to have different degrees of efficiency and impact on discrimination. The auction mechanism is the first. In the European context, this method was introduced in the UK in 1999 to replace the negotiation based allocation of capacity rights. Under an auction mechanism, available capacity is published and thereafter auctioned. This mechanism allows a transparent and non-discriminatory proceeding to allocate capacity. Moreover, it is claimed that an auction mechanism provides market signals for investment in transport capacity. Since high auction prices are a sign of scarce capacity, it can set incentives to upgrade transport capacity. (McDaniel and Neuhoff, 2002)

The second category 'Capacity goes where costumers are' describes the mechanism used in Sweden. Unlike the other European gas markets, the Swedish gas market enjoys an oversupply of capacity and therefore capacity goes where the costumers are. Although the Swedish situation is comfortable from a regulatory point of view, it is not applicable to other European countries that lack transport capacity. Nevertheless, capacity-goes-where-consumers-are is a very favourable allocation method and therefore receives a high score. The same holds for the value "not applicable", which is used to express that there is no congestion, but sufficient capacity for all market players.

'First come first served' (fcfs) forms the third category. Under this mechanism capacity goes to the shipper that first requests transport services (American Gas Association, 2006). Here, the pipeline operator is only obligated to provide service to a particular customer to the extent that capacity is available. Although the fcfs can be considered an improvement over the old negotiation practice, it is not the most favourable as it might result in the phenomenon of grandfathering. Under an fcfs arrangement, the system operator publishes available capacity. For potential shippers this means they have to constantly update their information on available capacity while relying on the TSO to publish the necessary information in the right manner. Incumbents could generate a comparative advantage due to their information power, which might enable their transport arm to react much faster than new entrants. In other words, if the 'Chinese walls' are not very high, the trading part of the incumbent will receive the information much faster and perhaps of better quality than other market players gaining a comparative advantage.

The benchmarking report uses the value 'others' without specifying or giving any further explanation. Following the Latin principle *in dubio pro res*, we subsume the value 'others' not under the least favourable measures. The least favourable situations for supporting competitive market conditions occur if the value information is 'not available' or the implementation of a general allocation method of the capacity is 'planned'.

Tariff

The Brattle Group sheds some light into the tariff formulation principles by offering us a straight forward formula: "an aggregate tariff can (therefore) be conceived as the sum of two components: tariff = "scarcity charge" + "charge to recover balance of fixed costs" (Brattle Group, 2002: 38). Accordingly, we can deduce that there is an individual fixed cost component and a relative profit margin component. Though there is a certain degree of discretion stemming from differences in individual network costs, in general higher tariffs are an indicator that network operators are charging above the marginal (long run) costs. As a consequence of high transportation costs in the form of tariffs, the profit margins of all players are reduced. In general, the causality holds true that the higher the tariff, the higher the entrance barrier for new entrants. The tariffs in the European Union show a huge disparity. Between 2002 and 2005, tariffs on the transmission level ranged from 0.75-5.5 Euro/Mega Watt hour (MWh). To score the level of tariffs, we group the values in low (0-2 Euro/MWh), middle (2,1-3 Euro/MWh) and high (3,1-5.5 Euro/MWh), and then score accordingly.

Incentive regulation

The literature distinguishes between four methods of incentive regulation: price-cap regulation, rate-of-return regulation, revenue-cap regulation, and the so called discretionary regulatory regime of tariff determination. (Alexander and Irwin, 1996, September: 3).

The price-cap mechanism imposes a ceiling on prices the network company is allowed to charge as tariffs. The regulatory authority reviews and determines a price-cap regulation for a period of three-to-five years based on a complicated formula. Components of this formula determine the degree to which inflation, operating costs, return of investment (cost recovery), return on investment (profit), and efficiency gains are taken into consideration. The formula and scope of its variables vary for each country. In other words, the method itself does not inform about the strictness of the regulation per se but enables the generation of an efficiency factor, also known as x-factor. In this context, x represents the expected annual gain in the utility's efficiency that the regulator imposes on the gas network operators. Price-caps often distinguish between generic and

individual efficiency factors. For instance, the Dutch regulator Dte formulated not only a generic x-factor of 1% per year, but also individual x-factors for the operating companies. During the Dutch price review period between 2005 and 2007 the companies specific x-factors ranged from -0,4% (NRE Energie) to 6,5% (Essent). The Dutch example demonstrates how considerably the company specific x-factors vary. (*Directie Toezicht Energie* (DTe), 2007)

Under a rate-of-return regulation utilities are permitted a set rate of return on capital. In contrast, revenue-cap regulation takes the total revenues as the variable on which the ceiling is imposed. For the process of rate-of-return regulation and revenue-cap regulation the estimation of regulatory asset base values is crucial. Regulatory asset base value refers to

> the capital value of the assets used by regulators in setting prices or price limits for utility companies. A basic formula in utility rate-setting is: Required Revenue = Operating Costs + Depreciation + Return on Capital. That is to say, utility charges should be designed to recover no more than reasonable operating costs (including taxes), plus capital charges that provide investors with a competitive return equal to what they would have earned on other investments of equivalent risk. Capital charges include both a return ***of*** investment (also known as depreciation) and a return ***on*** investment (known as profit). Both depreciation and return on capital require an approach to asset ***valuation***, i.e., the determination of the Regulatory Asset Base. (Woodman, 2004)

The last method 'discretionary regulatory regime' is not defined and serves as an umbrella for methods other than the two mentioned. Often a mixture of several elements of price-cap regulation and rate-of-return regulation, it is sometimes labelled as a hybrid form.

The European Union did not prescribe any kind of incentive regulation and the European Commission did not declare or promote any preference in this regard. The legal provisions refer only indirectly to incentive regulation through the principles of economic and cost-reflectiveness. For our assessment it is therefore crucial whether any kind of incentive regulation is in place. A more differentiating ranking of the four forms of incentive regulation is not suitable. Moreover, the effect of these forms of incentive regulation vary in their country specific application, which makes an instrument based rating less meaningful.

Minimum booking service firm service

The indicator minimum booking service of firm services describes the flexibility of transport arrangements. The minimum booking period of firm services varies yearly, monthly, weekly, daily, and can also have no minimum. The values

are ranked by their degree of flexibility and grouped into scoring categories accordingly (see below).

Use it or lose it (UIOLI)

'Use it or lose it' is a voluntary mechanism that can be applied to enhance the market liquidity and foster non-discrimination with regard to transport capacity access. It is supposed to force shippers to release initially booked but ultimately unused capacity. The use it or lose it mechanism is a powerful tool to prevent capacity hoarding for strategic or speculative reasons (Cavaliere, 2007: 16). The benchmarking reports introduce four values to describe the application of the use it or lose it mechanism. The scoring is self-explanatory except for the value 'not applicable'. In this context the value 'not applicable' is used to describe countries without capacity congestion and is therefore given a high score. Moreover, if information is unavailable to the European Commission it is assumed not to support the transparency principle and is therefore considered unfavourable.

Component	Data type	Values and scores
Component 2.1: Tariff structure	Nominal	Entry-exit (10) Distance, postalised (6.7) Mixed (3.3) Not published (0)
Component 2.2: Type of capacity booking	Nominal	Entry, entry-exit, cost-reflective (10) Point-point, postalised (6.7) Mixed (3.3) Not applicable, not available (0)
Component 2.3: Allocation method	Nominal	Auction, cgwc, not applicable (10) Fcfs (6.7) Others (3.3) Planned/not available (0)
Component 2.4: Tariffs	Numeric	High (3.1-5.5 Euro/mwh) (10) Middle (2.1-3 Euro/mwh) (5) Low (0-2 euro/mwh) (0)
Component 2.5: Incentive regulation	Nominal	Yes (10) No (0)
Component 2.6: Minimum booking period firm Service	Nominal	No minimum, 3.3=1-3 Days (10) Day/month, week (6.7) Month (3.3) Year, no congestion/not applicable/ no information (0)

Component	Data type	Values and scores
Component 2.7: Use it or lose it (UIOLI)	Nominal	Yes, not applicable (10) Short-term/partial (6.7) Planned (3.3) No, not available (0)
Gas network access conditions and tariffication		Sum of the indicators scores (listed above, max. 70 Scores)

Table 11: Gas network access conditions and tariffication (Indicator 2)

5.10.3 Gas balancing rules

Regulation 1775 determines principles for the balancing provisions in Article 7. Thereafter balancing rules should be fair, transparent, and non-discriminatory, reflecting costs; the rules should not hamper cross-country trade and transport within Europe (see section 7.3.4). Balancing regimes were a subject of the Madrid Forum earlier within the context of the formulation of the Guidelines for Third Party Access Services (Madrid Forum, 2000; Madrid Forum, 2002). In contrast to the tariff structure, the Madrid Forum did not reach a consensus about whether hourly or daily balancing is more favourable. Moreover, the European Commission did not formulate any preference with regard to the duration of balancing periods. So far, it is contested whether hourly or daily balancing is more favourable. The benchmarking reports distinguish between monthly, daily, hourly, and mixed balancing arrangements. These are scored according to their degree of flexibility.

5.10.4 Third party access to storage

The introduction of competition in all parts of the gas chain including gas storage aims to offer equal business opportunities to new entrants and to optimise system flow at the same time. Access to gas storage has not only proven to be relevant for optimising the transport system, but can serve as a powerful tool to meet the balancing requirements and also offers trade opportunities. For instance, gas bought and stored during summer time could be profitably sold at a higher price in winter time. Consequently, third party access to gas storage has been introduced within the acceleration Directive, leaving it open whether to apply negotiated or regulated TPA for storage. A minimised variant of TPA presents the offer of "modulation services only".

5.10.5 Gas release programme

The introduction of a gas release programme frees up gas to the market, which is originally imported through existing long-term contracts. In the European context, the UK first introduced a gas release scheme in 1991 to open the

market to competitors of British Gas (Helm, 2004-253). Although many countries implemented a gas release programme, it is not mandatory according to EU legislation. Yet, competition in the market is stimulated by forcing dominant vertical integrated gas companies to auction certain amounts of gas from their gas import 'bags' to other market players. For this reason, we consider the introduction of a gas programme as favourable and a forceful measure to weaken dominant market positions and foster gas-to-gas-competition (Madrid Forum, 2002: 6). There are some countries in which a gas release programme is not applicable, due to a lack of capacity congestion or a competitive market structure. In the latter case, the countries therefore receive a high score.

5.10.6 *Trading facilities*

To assess the physically available trading facilities, we distinguish between three categories. First, fully-fledged mature trading facilities are characterised by a gas hub or/and virtual trading point in conjunction with a functioning spot market and future market, resulting in a relatively high total traded volume. Second, evolving trading facilities also provide a gas hub and/or a virtual trading point, but do not offer the whole variety of contracts that full-fledged spot and future markets ensure, and are signified by a limited volume of trade. In the third category fall those markets which have not established a gas hub or virtual trading point, or if so, only offer a limited variety of contracts and trade.

Indicator/component	Data type	Values and scores
Indicator 3: Gas balancing rules		
Balancing period	Nominal	Hourly, hourly/daily, daily (10) Daily/monthly (5) Monthly (0)
Indicator 4: Third party access to storage		
Third party access to storage	Nominal	Yes (10) Modulation only (5) Non available (0)
Indicator 5: Gas release programme		
Gas release programme	Nominal	Completed, yes, not applicable (10) Planned (5) No (0)

Indicator/component	Data type	Values and scores
Indicator 6: Trading facilities		
Trading facilities	Nominal	Mature (10) Developing (5) Infancy (0)

Table 12: Indicators gas balancing rules (3), third part access to storage (4), gas release programme (5), and trading facilities (6)

5.10.7 *Unbundling*

Although we suggest separate indicators for unbundling, the values to describe unbundling at the transmission and distribution level are identical. Both indicators' scoring are based on the degree of unbundling. Ownership unbundling is the most far reaching variant and implies splitting the companies vertically into a trade company and a distribution or transmission company. Legal unbundling has been mandatory since the second Directive. It preserves the ownership structure, but creates independent organisations under one roof, predominantly in the form of a company holding. For legal unbundling the expression 'Chinese walls' is often used to expose the closeness of the separated organisation in real life. Introduced by the second Directive, management unbundling is an advanced form of legal unbundling because it explicitly requires separating the staff working for the trade and transporting parts of the gas undertaking. The minimal form of unbundling is so-called unbundling of accounts. There an existing and integrated company separates only the accounting for trade and transport services (Brunekreeft and Keller, 2001: 7-9). In the progress report from 2005, the Commission only distinguishes between those countries which have implemented ownership unbundling or legal unbundling. 'Unbundling of accounts' is subsumed under the label 'no' legal unbundling. Management unbundling which implies legal unbundling is not taken into consideration. If countries do not offer legal unbundling by 2005, we assume the country fulfils the initial minimum of separated accounts and score them accordingly. (European Commission, 2005a: 81-82)

Published accounts

With the introduction of legal unbundling in the first Directive (see section 7.3.3), the European Union requires the separation and publication of the accounts. Consequently, the question is whether the transmission system operator and distribution system operator of a formerly integrated gas company in one country meet the implementation requirements as outlined in the legal provisions.

Indicator/component	Data type	Values and scores
Network unbundling TSO		Sum of the indicators scores (listed above, max 20 scores)
Component 7.1: Basic unbundling model TSO	Nominal	Ownership (10) Management, legal/management (7,5) Legal (5) Account (2,5) Non (0)
Component 7.2: Published accounts TSO	Nominal	Yes (10) No (0)
Network unbundling DSO		Sum of the indicators scores (listed above, max 20 scores)
Component 8.1: Basic unbundling model DSO	Nominal	Ownership (10) Management, legal/management (7.5) Legal (5) Account (2.5) Non (0)
Component 8.2: Published accounts DSO	Nominal	Yes (10) No (0)

Table 13: Network unbundling TSO and DSO (Indicator 7 & 8)

5.11 Scoring of indicators describing the dimension regulatory competences

All indicators subsumed under regulatory competences inform us about how economic governance in the European gas sector is organised and to whom decision power is transferred to (Arentsen, 2004; Arentsen and Künneke, 1996). In our discussion of formal rules (section 7.3.5), we showed that a regulator is neither mandatory nor are the member states obliged to transfer all decision making power to one of the member states' regulatory authorities. We also showed that the European Commission prefers the establishment of an independent regulator in charge of regulating the gas sector with regard to network activities and trade related transactions. This preference is in line with the dominant view the current regulation theory holds on the organisation of regulation in the utility sectors (see section 2.2.2).

The scoring of the indicators describing regulatory competences distinguishes different degrees of state intervention. Hence, if an independent national regulator obtains the regulatory competence it is perceived as most

favourable, whereas the distribution of competences among multiple authorities is less desirable. In contrast, the absence of regulatory authorities or market based coordination mechanism is considered the least favourable.

5.11.1 Third party access

The first Gas Directive introduced third party access but left the decision to the member states whether to vote for regulated or unregulated TPA. With the second Directive, regulated TPA became mandatory (see section 7.3.2). The legal provisions thus make a clear statement that regulated third party access is considered less discriminatory than negotiated TPA. We would still like to elaborate briefly on this appraisal and thereby discuss why ex ante regulation is more favourable than ex post regulation.

The day-to-day gas business has shown that it makes a huge difference whether the operator's access conditions are regulated ex ante or ex post. Within an ex ante system, the operator has not only to publish the network access conditions prior to its operation, but they also have to be approved before its operation. Consequently, the information and decision power is widely transferred to the regulatory authority. In contrast, ex post systems enable opportunistic behaviour by incumbents. For instance, a network operator can set high tariffs and generate a monopoly rent in the first place. Although regulatory authority may intervene ex post and revise the tariff methodology, it would be the market reality for a certain amount of time. And more importantly, it would necessitate that the regulator has to prove the tariffs to be inappropriate. By applying an ex ante system, transparency and reliability or rules can be enhanced and discrimination and the number of court cases reduced. In other words, ex ante regulation lowers transaction costs. A considerable delay of fair and transparent market conditions could also be prevented. In some countries the decision-making by the regulatory authority received ex ante and ex post competences, depending on the regulatory function. For that type of decision-making the value 'hybrid' is introduced.

Before transferring regulatory power to regulators or any other regulating authority, the member states had the option to vote for negotiated TPA (European Commission, 1998). This option is certainly less favourable than any ex ante or ex post regulation by a regulatory authority. In the course of the reform the majority of member states established sector regulators. A special latecomer with regard to TPA is Germany who kept negotiated third party access without simultaneously establishing a regulator. To capture this phenomenon, we introduce the value 'negotiated third party access without a Regulator'. Both nTPA and nTPA without a regulator therefore receive the lowest score.

5.11.2 Decision of capacity allocation rules

The benchmarking reports distinguish between capacity rules made by a single regulator or made together by the regulator and a transmission system operator. The third option foresees that one or more transmission system operator(s) receive(s) the decision-making power. The scoring of the indicators values follows the reasoning given above.

5.11.3 Approval of balancing conditions

In European gas markets, balancing conditions are usually approved by the regulator or ministry alone, or the competence is shared by the transmission system operator and one of the former two authorities. In some countries decision-making capacity is transferred to the market respectively to one transmission system operator. If the market holds the power of approving the balancing conditions it is crucial to have a mature market in conjunction with a comprehensive regulatory regime. If the latter is not ensured, we argue that the balancing conditions may turn out to be less favourable for other market participants than for the transmission system operator in charge of their approval.

5.11.4 Dispute settlement

Dispute settlement is one of the crucial instruments for the functioning of gas markets and a constituent part of faith in regulatory competences. In some member states this competency is transferred to the regulator, in other gas markets governmental authorities such as the ministry, minister (e.g. economic affairs), competition authority, or regional government settle disputes. To facilitate the scoring of the indicator's value we distinguish three categories: the regulator, single-authority arrangements, and multi-authority variants of decision making. The fourth category foresees the option that no authority has been appointed to settle. This is not perceived as good for building trust or enhancing the credibility in the national regulatory frameworks and therefore receives the lowest score.

5.11.5 Type of regulator

As elaborated earlier, the competences, capacities, and degree of autonomy of the regulator play an important role in determining regulatory competences. The next three indicators describe the competences of the national regulator.

When analysing the effect of regulation on economic performance, the existence of an independent regulator serves as a proxy to describe the variable regulation (Wallsten, 2001; Zhang, Parker, and Kirkpatrick, 2002). In our operationalisation, we not only distinguish between countries with a regulator

and those without, but also differentiate between types of regulators. We distinguish between a multi-utility regulator and an energy specific regulator, incorporating gas, electricity, or other energy sectors such as nuclear or renewable energies. We argue that a regulator whose focus and expertise is related to energy issues only is more likely to build up more expertise and ambition to perform with regard to energy regulation. The internal organisational agenda of an energy specific regulator is likely to be solely determined by the energy sector regulation, whereas in a multi-utility regulator other regulatory actions might be considered more important than for instance, the launch of an energy sector inquiry or comparable sector investigations. In addition, the staff and budget numbers should be interpreted in conjunction with the type of regulator. A high ratio describing the market size in relation to the budget or staff indicates more capacities when describing an energy specific regulator. Otherwise the ratio expresses the capacity of a multi-utility regulator with several sectors to oversee. For this reason, energy specific regulators receive the highest score, followed by multi-utility regulators with the middle score; countries with no regulator get the lowest score.

5.11.6 Ratio market size/staff number of the regulator

The scoring of Indicator 14 'ratio market size/staff number of the regulatory authority' necessitated a quite similar treatment as the grouping and scoring of the tariff data. The ratio is based on the market size, respective to the consumption of each country in 2000 and divided by the staff number of the regulatory authority in that particular year. The ratio ranges from 0.1 to 1.05. Accordingly, it has been subdivided into the following three groups: high (0.1-0.19), middle (0.20-0.49) and low (0.50-1.05).

5.11.7 Ratio market size/budget of the regulator

The formulation of Indicator 15, describing the "ratio market size/budget of the regulatory authority", followed the same scheme. It is equally based on the consumption of the respective country, but then divided by the budget of the same country. Here, the ratio ranges between 0 and 11.86. However, the statistical spread is rather concentrated in the first half. Taking this into account, a high ratio is considered less than 1, middle ratio between 1 and 2, and a low ratio corresponds with any value above 2.

Indicator/component	Data type	Values and scores
Indicator 9: Type of decision-making by regulatory authority (Ex ante/ex post)		
	Nominal	Ex ante (10) Ex post (5) Ntpawr (0)
Indicator 10: Capacity allocation rule decided by		
	Nominal	Regulator (10) Regulator/TSO (5) TSO (0)
Indicator 11: Balancing conditions approved by		
	Nominal	Regulator (10) Ministry (7.5) TSO/ministry-TSO/regulator (5) TSO (2.5) Market, not known (0)
Indicator 12: Dispute settlement		
	Nominal	Regulator responsible (10) Minister; competition authority (6.6) Ministry + regulator responsible; Regulator/regional government; hybrid (3.3) Not regulated; no regulator (0)
Indicator 13: Type of regulator		
	Nominal	Energy specific regulator (10) Multi-utility regulator (5) No regulator (0)
Indicator 14: Ration market size/staff number	Numeric	High (10) Middle (5) Low (0)
Indicator 15: Ratio market size/budget		
	Numeric	High (10) Middle (5) Low (0)

Table 14: Indicators (9-15) describing regulatory competences

5.12 Summary

The literature review and related political discussions show that the term regulatory regime enjoys pluralistic interpretations and is usually not explicitly defined. As a consequence there is no common understanding about what a regulatory regime consists of or which indicators are constituent. In a wide interpretation of the term, contractual arrangements such as for instance long term Take-or-pay contracts or indicators for cross-border interoperability might be included. We suggest that the definition of regulatory regime and its operationalisation focuses on the formal institutional factors of the regulatory performance. The proposed operationalisation of regulatory regimes in European gas markets may be insufficient for a competitive European gas market in future, but we argue that our anticipated best-practice model is reasonably influential in shaping current market reality to legitimate our proceeding. With the limited scope of the concept of regulatory regime in mind, the conceptual work exposed here will certainly inspire controversial discussions and hopefully enjoy further improvements.

For the assessment or regulatory regimes in European gas markets we applied the concept of convergence. Thereafter, we distinguish between sigma, gamma and delta convergence. This allows us to assess the degree, speed, and direction of convergence. All three approaches are based on the 15 Indicators that describe the regulatory regime of a national gas market. These are grouped into two dimensions, regulatory capacity and regulatory competences, thereby differentiating between policy and polity. Accordingly, a decrease of variance indicates sigma convergence. Gamma convergence occurs if some countries move faster than others towards a best-practice model. The overall decrease towards a best-practice model can be detected by assessing delta convergence. For this reason we developed a methodology that allows us to deduce what the European Union represented by the European Commission considers to be best practice. To facilitate this, we created an index based on 15 indicators consisting of 20 components. The sum of these 23 components, each allowing a ceiling of 10, amounts to 230 maximum scoring points. The table (below) displays how the values of the indicators are attributed to the three models referred to in section 2.3.1. A countries' distance towards best-practice regulation is measured with the help of the index' scoring. On a regime level, 100% of gamma or delta convergence is reached in case all 12 countries have achieved best-practice. Subsequently, we distinguish between a low degree of gamma/delta convergence (0-33%), moderate degree of gamma/delta convergence (34-66%), and high degree of gamma/delta convergence (67%-100%).

	Model type	Best practice	Emerging	Minimal
Indicators describing regulatory functions	Legal market opening	> 43% legal market opening	< 43% legal market opening	< 28% legal market opening
	Tariff structure	Entry-exit	Point-to-point, postage stamp tariffs	Mixed, not published
	Allocation method	Auction	First come, first served	Planned, not available
	Minimum booking (firm services)	No minimum, day	Month	Year
	Use-it-or-lose-it	Yes	Short-term, partial or planned	No
	Balancing period	Hourly, daily	Daily/monthly	Monthly
	Third Party Access to storage	Yes	Planned, modulation services only	No
	Gas release programme	Yes, not applicable	Planned	No
	Unbundling (TSO/DSO)*	Ownership unbundling	Management or legal unbundling	Separation of accounts
Indicators describing regulatory competences	Type of decision-making by regulatory authority	Ex ante	Ex post	Negotiated TPA without a regulatory authority (regulator)
	Capacity allocation rules decided by	Regulator	Regulator/TSO	TSO
	Balancing conditions approved by	Regulator	Shared responsibilities	TSO/market
	Dispute settlement	Regulator	Shared responsibilities	Not regulated
	Type of regulator	Energy regulator	Multi-sector regulator	No regulator
	Staff of the regulator in relation to the market size	Well equipped	Sufficiently equipped	Low number of staff/ market ratio
	Budget of the regulator in relation to the market size	Well equipped	Sufficiently equipped	Low number of budget/ market ratio

* Within the unbundling indicator, we distinguish between the unbundling modes of the transmission system operator (TSO) and the distribution system operator (DSO). Further, we separately assess whether accounts are separated.

Table 15: Regulatory regime models in European gas markets

6. European gas market reform, 1998 - 2007:

a road map

6.1 Introduction

This chapter outlines the main developments of gas market reform, focusing on the European level.[63] This broad outline certainly does not fill the gap or the need for an exhaustive analysis or history of gas sector reform in the European Union. It would be worth a book of its own, not to mention a book on European Energy policy incorporating the different energy policy fields. For the pre-liberalisation phase, there are only a few in-depth analyses on energy policies in general and gas sector reform in particular. Hanne Matlary, Peter Cameron, and Jonathan Stern proved to be the pioneers and distinguished connoisseurs of the European energy sector. Matlary (1997) offered a theory-guided analysis of the evolution of European Policy between 1985-1995, stressing the relative power distribution of EU actors on the one hand and actors such as state and market actors on the other. She explains why a common energy policy stranded before the single market act initiated in 1986 finally reached the gas and electricity sector by end of the 1990s. Peter Cameron (2002) gives a comprehensive expose of how the legal framework of the gas and electricity framework evolved between 1988-1998. Jonathan Stern (1998) not only covers market developments in the 1990s and the evolution of the first Gas Directive, but analysed ex ante "how competition and liberalisation may emerge in Continental European countries, and to investigate how these models may differ from those of Britain and North America" (Stern, 1998: 201). Before assessing ex post the development of regulatory regimes as part of the market model, we first expose the road map of the European gas market reform, emphasising the policy dimension. The aim of this chapter is to identify impulses stemming from energy policy that stimulate convergence of regulatory regimes. We explore whether major changes of general or energy policy objectives occurred. Thereby, we contribute to our first research question and answer the sub question 1.1 "Does the prioritization of energy policy objectives induce converging effects on regulatory regimes?" On the basis of this inductive approach, we then formulate expectations with regard to convergence of regulatory regimes.

6.2 Evolution of the reform

For the analyses of institutional change, Groenewegen and Künneke propose an evolutionary perspective to understand institutional reforms in infrastructure industry. The idea of evolutionary change of economic governance is based on institutional economics formulated by Williamson who suggests that internal institutional and external factors shape the emergence and revision of economic governance. In this more dynamic interpretation of institutional change, institutions are not only given constraints, "...but under certain conditions institutions can erode and discontinue." (Groenewegen and Künneke, 2005: 12) Instead, "In processes of institutional change equilibrium and stability are considered to be the exception and contradiction and change are the rules" (ibid: 12). In this interpretation of institutional change, actors can influence and change institutions – a process which is constantly observable when analysing the European gas market reform.

Applying this evolutionary perspective, we argue that the adoption of each relevant Directive and Regulation constituting the gas reform represents a moment of stability which might be perceived as a kind of equilibrium situation. Hence, we can identify four moments of regulatory equilibria. Figure 2 shows these moments in time and indicates that the fifth moment has not yet been reached in summer 2007. The proposed allegory describing the reform process has its limitation. It suggests that there is a linear sequence of events or processes. On the contrary, we see that some discussions and processes either overlap or even take place in parallel. Although identifying regulatory equilibria may be a simplified way to describe the reform process, it allows us to define a path through what some people perceive as regulatory jungle. The road map of the European gas market reform is organised along these equilibra and distinguishes five phases.

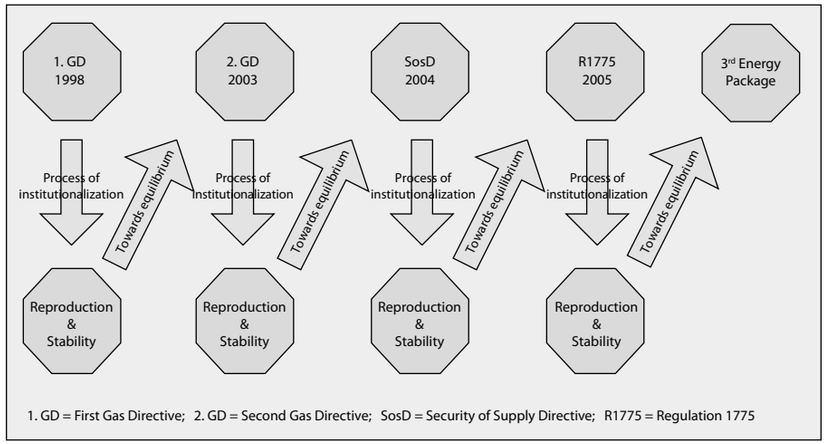


Figure 10: Evolutionary process of the European gas market reform[64]

6.3 First phase – first Directive

On 11 May 1998, the energy ministers adopted the first Gas Directive after the European Parliament (EP) had accepted the Council's common position without any amendment. Thereafter, a period of relatively little activity on the community level followed; activity was supposed to take place at the national level. The old member states, except for Finland, Greece, and Portugal which were granted derogations, had time to transpose the first Gas Directive by 10 August 2000. On the European level, the Madrid Forum (MF) had been established and the European Commission, the regulatory authorities, and industry representatives met for the first time 30 September 1999. The first Directive required the European Commission to monitor those harmonisation requirements, linked and not linked to the actual provisions to the Council and the European Parliament. Although it was only at the end of 2001 that the first official benchmarking report was published, earlier reports served as forerunners. For instance, on 23 November 1999 the European Commission released a short report trying to grasp relevant regulatory issues. The report mainly paid a lot of attention to barriers for cross-border trade, and the impact of derogations due to 'Take-or-pay' arrangements on the introduction of effective third Party Access without providing any relevant insights or propositions (EC Inform-Energy, 1999, April: 2). The next real assessment of the regulatory reform to come was the review by the European Parliament and the European Council that was designated

by the first Gas Directive. In the meantime, the Commission made use of the iterim period and merged the formerly separate Directorate-General Energy and Transport into DG TREN - a step which had little influence on the reform as such, except directing some internal attention to the reorganisation.

In early 2000, the European Union formulated a wider strategy at its summit held in Lisbon, reacting to a growing economic competition driven by globalisation processes. What became the 'Lisbon Strategy' aimed for nothing less than "making the European Union (EU) the most competitive economy in the world and achieving full employment by 2010" (European Commission, 2006a). Equally ambitious was the input from the European Commission with regard to their energy related targets. To contribute to the Council meeting in March, the EC published a report in which they suggested "the date 2004 to be set for the full liberalisation and integration of European energy markets" (EC Inform-Energy, 2000, March: 3). The Commission's proposed timetable evoked a chorus of surprise and harsh criticism. Considering the amount of work that still had to be done, the claim appeared to be at best unrealistic. Moreover, the liberalisation faced significant opposition across Europe. All in all, the 2004 target could not serve as a threat, but indicated a beginner's mistake. The resistance of the incumbent industry and some governments did not considerably diminish. The summit on 23 and 24 March 2000 did not suggest a clear roadmap for the acceleration of the gas reform, but instead the EC proposition was abandoned. The common denominator was only to agree on a call "...for rapid work to be undertaken to complete the internal market in both electricity and gas sectors to speed up liberalisation in these sectors with view to achieving a fully operational internal market" (Directive 2003/55/EC, Recital 3). Although member states did not withdraw their support in Lisbon, the summit certainly could not be considered breakthrough. The Commission gained more support later that summer when the European Parliament formulated a resolution on 6 July 2000, "requesting the Commission to adopt a detailed timetable for the achievement of accurately defined objectives with a view to gradually but completely liberalising the energy market." (Directive 2003/55/EC, Recital 3)

While there was political stagnation, the Madrid Forum turned out to be the relevant Forum to discuss regulatory instruments on the working level. Held on 11-12 May 2000, participants of the Madrid Forum discussed the results of the Brattle Group's comprehensive study on tariff methodology, capacity rights, and balancing regimes (Brattle Group, 2002). This study had been commissioned by DG TREN and clearly took a stand that differed from the industries' view presented by Eurogas. The Brattle Groups' in-depth analysis allowed the regulators, including the EC, to decrease the information asymmetry between regulators and regulated. At the same meeting, another important move was made. The

European Commission and the national regulators called the industry to form a separate association to represent the interest of the gas transmission operators. The underlying idea was that transmission operators do not necessarily share the same interests as shippers or traders. Following the motto *Divide et impere!*, the regulatory side invited the creation of GTE and thereby attempted to foster the formulation of independent positions of network operators on regulatory measures. Two months later, the Gas Transmission Europe (GTE) was set up within the structure of the Union of Gas Industry (Eurogas) and was placed literally under their roof (EC Inform-Energy, July 2000, 19).

The old member states had to implement the First Directive by the end of July 2000. The cornerstones of the First Directive are set by market opening and initial steps towards changing the industry structure and network access conditions by introducing legal unbundling and negotiated and regulated third party access. The legal provisions and their development in the course of the reform are described in detail in chapter 7. Therefore, our attention now focuses on the political activities on the community level in autumn 2000. At that point, the EC opened infringement procedures against France and Luxembourg for not transposing the first Gas Directive's provisions into national law. Germany and Portugal were deferred with regard to their implementation, but an infringement proceeding was not opened, since the EC had been notified that the Gas Directive's transposition was imminent (EC Inform-Energy, 2001, January: 10). Later, France announced a delay of the transposition of the first Directive and the partial privatisation of Gaz de France until after the French parliamentary elections in 2002. Privatisation of the state-owned company was especially considered too highly politically charged to tackle during the election campaign. As a consequence, the European Commission brought the case to the Court of Justice on 7 May 2001 (ibid; EC Inform-Energy, 2001, May: 12).

6.4 Acceleration phase: second Gas Directive

The hope that the Council meeting in Stockholm in March 2001 or the Energy Council a month later would bring about a timetable, laying down the next steps to accelerate the gas reform, had been in vain (EC Inform-Energy, 2001, April: 4, 2001, June: 2). No policy decisions on energy issues were made during either summit. The energy related discussions mainly centred on the Commission's Green Paper (GP) on security of supply and the European Commission's proposal amending the first Gas Directive. This time, the European Commission's attempt to foster liberalisation policy in the gas sector was supported by a resolution of the European Parliament and from member states such as the United Kingdom, the Netherlands, and Spain. France and Germany prominently opposed any

progress to be reached at the summit (EC Inform-Energy, 2001, April: 4). In this context, EC Inform-Energy argues that there were strong indications that Germany and France coordinated on a bilateral summit and Germany assured its support of France's liberalisation position. Moreover,

> the German Chancellor was quoted as saying that Germany did not want to turn the issue into a conflict with France, and the Finance Minister Hans Eichel was quoted as suggesting that the hard position of France would not change before the next elections (ibid).

Although the prevailing constellation within the Council remained a stalemate, the Commission was prepared to push further. In its proposal amending the first Gas Directive, the Commission called for a liberalised access for business consumers by 2004 and for all consumers by 2005. Additionally, the proposal looked to shift gas market regulation away from governmental supervision to control independent regulators. Moreover, the Directive is supposed to emphasise and introduce more public service obligations. The latter refer to security of supply measures, environmental, and social cohesion concerns (EC Inform-Energy, 2001, March: 2).

That summer offered another arena to push for liberalisation when the fourth meeting of the Madrid Forum was held. The meeting in July vividly demonstrated the MF's function as a platform where the constant battle to gain more information on the functioning of the market and its gas networks was fought to decrease the information asymmetry between the industry and the regulatory actors. The GTE was criticised by regulators, the EC, and most member states, for its unwillingness "to publish detailed indicative available capacities at all major entry and exit points" (EC Inform-Energy, 2001, July), requested during the last meeting of the Forum.

The first official benchmarking report was published in December 2001 and confirmed the expected: market performance in terms of competition was disappointing. So far, European national gas markets were characterised by high prices and tariff differentials, a high degree of market concentration, insufficient unbundling, a lack of market based balancing regimes, and ex ante regulation to name just a few. The prices of gas and electricity were especially of concern. In some European countries, natural gas increases its share in electricity generation. During the 1990's the European industry was paying 40% more for its electricity than its American competitors (EC Inform-Energy, 2004, September: 3). For instance, the average price for households or small commercial businesses in July 2001 ranged from € 52 per MWh in Sweden to

€ 122 per MWh in Germany. The same holds true for average large users in 2001. With € 34 per MWh Sweden has the lowest prices, whereas Italy comes in last with € 77 per MWh (EC Inform-Energy, 2001, December: 2). In this context it is noteworthy that the price level proved to be not only important for the European Commission as a strategic goal to enhance the European competitiveness, but also to prevent protests against rising energy prices, as had happened in the past when fuel prices went up.

For a liberalisation enthusiast, the course of the liberalisation process in 2001 was certainly not encouraging. At the EU energy minister meeting in 4-5 December 2001, the reform stagnation persisted at first. Giving partially in, the then Commissioner De Palacio,

> told the Member states she was prepared to accept a more distant date than 2005 for completion of the internal gas and electricity markets for domestic consumers, but that she was inflexible on the final date for completion of 2003-04 for all professional (including small one-man businesses) and industrial consumers. (EC Inform-Energy, 2001, December: 5)

After extensive discussions on appropriate tariff structures held in the context of the Madrid Forum, the Commission, Council of European Energy Regulators (CEER), consumer organisations and traders formed an alliance and claimed at the fifth Madrid Forum "entry-exit" tariff structures to be most favourable. According to this view, entry-exit meets the principles of cost-reflectiveness and facilitates efficient gas trade, market liquidity and gas-to-gas competition. GTE did not share this clear cut preference. In contrast, gas transmission operators perceive it is a case-by-case question whether entry-exit or point-to-point tariff structures or combinations thereof are more appropriate. Another outcome has been the adoption of the "Guidelines for good practice regarding TPA services, tariff structures and balancing". (EC Inform-Energy, 2002, February: 10; Madrid Forum, 2001 and 2002)

The Barcelona summit on 5 March 2002 fulfilled the hopes that a Spanish EU presidency could bring dynamism back into the stalemate. And indeed, France accepted the market opening for the non-household costumers by 2004. Part of the deal was as well, that most member states had to accept that there will be no concrete implementation date for opening household markets. By offering larger commercial users like for instance the energy-intensive industry the possibility to switch their supplier, the EU could achieve to introduce competition in 60% of the total market. If as a consequence gas prices for large commercial consumers would decrease at least decreasing the monopolistic rents of energy companies,

the EU would have achieved increasing the competitiveness of European industry (EC Inform-Energy, 2002, April: 4).

Some headwind for the so-called acceleration, second Directive came from an unexpected side in 2002. The EP's plenary session on 13 March, closed with 160 amendments the first proposal for the second Directive by the European Commission. Most relevant were the amendments concerning unbundling, and the regulatory authorities on the national and European level. Whereas the EP calls explicitly for ownership unbundling in the electricity sector, it was adherent measures to determine the degree of unbundling. Supporting the European Commissions proposal, the EP says simply "the transmission system operator must be de jure and de facto independent of the gas supply undertaking in regard to access to the assets necessary to maintain and develop the networks" (ibid: 6). The proposal of transferring national regulatory competences to independent regulators was rejected. Instead, the EP opted for allowing also multi-authority structures by replacing the wording on the need for a national regulator to "one or more competent bodies as regulatory authorities' in deference to Germany's position" (ibid: 5). It was also on this occasion that the EP introduced the idea to change the regulatory authority landscape on the Community level, while suggesting that the European Commission initiates a European Regulators Group. One year later, this idea resulted in the foundation of the European Regulators Group for Electricity and Gas (ERGEG) (European Commission, 2003b). Although the nature of ERGEG is best described as an intergovernmental body, it was regarded to become the nucleus for a Common European Energy Regulatory Authority. Hence at the current stage, ERGEG is mainly supposed to provide input to the regulatory process, in order to support the European Commission, but without questioning the Commissions right to initiate legislation. Taking into account the political statements made by the member states and the European Parliament, the EC went back to DG TREN's headquarter in Rue du Mot to formulate a more consensual proposal.

The publication of the second benchmarking Report on 1 October 2002 did not reveal any surprises. Referring to the considerable heterogeneity of regulatory regimes in the old member states, it criticises the overall "patchy progress" (EC Inform-Energy, 2002). Progressive developments in Italy, the Netherlands, and Spain were positively alluded to, whereas Germany was rebuked for its slow progress. Even by late autumn 2002, Germany had still not implemented the first Directive, although the deadline had been August 2001. German authorities had yet to draft legislation, but in the communications with the EC, there was no date stated for its adoption. Consequently, the EC finally decided on 16 October 2002 to bring the German case to the Court of Justice. (EC Inform-Energy, 2002, November: 17)

On 25 November 2002, the Energy Council brought about the final agreement on the opening of the market for households. At last, the opening for all users was set for 1 July 2007 (EC Inform-Energy, 2002, December: 4). The tug of war between France and the Commission ended in a draw. One party could prevail delaying the adoption of the acceleration Directive, and the other could assert the date of the market opening for industrial consumers. Those left out in the cold were in fact the private household costumers. This outcome seemed to have actually encouraged rather than prevented France and Germany to push harder and soften the unbundling provisions for Distribution System Operators (DSO). The compromise foresees two derogations for DSO's, one called for a 100,000 customer exemption and the other a postponement option (see section 7.3.3). For proponents of a strict liberalisation policy, the provisions concerning the third party access to storage, linepack, and ancillary services were especially disappointing. Instead of introducing directly regulated TPA of storage, the second Directive follows the old hesitant scheme applied for the first Directive, allowing both negotiated and regulated third party access to storage.

During the summer months, the proposed second Directive entered the usual legislative process on the EU level: an initial reading in the European Parliament on 12-13 May 2003 followed by a revised proposal from the European Commission, revisiting the European Parliament for the second reading on 4 June 2003 and entering the final stage by the Council statements and the Commissions formulation of a common position, finalising on 26 June 2003 with the adoption of the second Gas Directive. By the time the second Directive entered the legislative process all major decisions concerning the degree of intervention had been negotiated earlier and only fine tuning took place.

The European Union took a little more than two years to reach a consensus on the acceleration Directive. Due to active resistance by France and Germany and the affirmative silence of some other member states, the qualitative progress achieved by the Directive is only limited. Overall the second Directive became a watered down version of the Commission's initially ambitious aims. The market opening for households was carried out two years later than initially intended and the degree of unbundling was not changed in principle, but suggests only a functional improvement by introducing the concept of management unbundling. Moreover, the EC could not prevail with establishing independent regulators in the member states but allows regulatory authorities to share the sector regulation. Noteworthy in this context is that the second Directive places more emphasis on security of supply and other public service obligations. This has been one consequence of the ongoing security of supply debates which has been (re-) initiated by the publication of the Green Paper on

security of supply. Ultimately, the second Directive also laid the foundation for the creation of ERGEG (Directive 2003/55/EC, Recital 14).

In 2003 Directorate-Generals Competition (DG COMP) and DG TREN restructured their internal organisation. Under the aegis of Competition Commissioner Mario Monti, the competition rules had been reformed and streamlined in 2003. Then, Regulation (EC) No. 1/2003 established a basis for cross-national sector investigations. In May 2003, the DG COMP entered the reorganisation phase to prepare for the rising work load induced by the enlargement of the EU in May 2004. According to 2001 estimations, the enlargement was supposed to increase the DG's work load by 30% to 40% (EC Inform-Energy, 2003, May: 10). However, the reorganisation can be also interpreted as a response to the new procedural rules for the enforcement of the anti-trust rules set out in Article 81 and 82 of the Treaty. The major change is that DG Competition was from then on based on sector-specific organisation of merger control in order to allow efficient anti-trust law enforcement. Looking back, the competence to conduct cross-national sector investigations and the sector-specific reorganisation turned out to form the necessary precondition for DG COMP's later activities in the context of the energy sector inquiry. DG TREN also partly reorganised due to the enlargement but unlike DG COMP no significant changes took place. (EC Inform-Energy, 2005, March-b: 2; European Commission, 2005d)

6.5 Security of Supply Directive

After the internal market liberalisation went into the legislative process, the security of supply Directive moved up on the agenda. The EC had been trying since 2002 to harmonise oil stock and gas storage policies and thereby attempt to transfer more competences to the supranational level. The proposal would have implied a substantial shift in economic governance of the natural gas market. So far, gas storage is treated as a commodity which is subject to trade and perceived as private property companies decide over. In turn, introducing strategic storage by regulation would have implied the transfer of substantial decision-making power from private to public. In this sense, the Security of Supply Directive proposed to treat gas storage as public property. During the spring Council meeting on 20-21 March 2003, the Council "underlined the importance of reaching rapidly an agreement on proposals reinforcing cooperation in managing EU gas and oil stocks" (EC Inform-Energy, 2003, April: 3). One would be mistaken to interpret this remark as unanimous approval of the Commission's suggestions by the Council and European Parliament. Instead, the plenary session of the European Parliament on 22 September 2003 revealed

the extensive disapproval of establishing the European Commission as keeper of European security of supply, when even the Parliamentarians forcefully opposed the initiative. This was even truer for oil stocks than for gas provisions. One reason for the stronger opposition to create any common European oil stock mechanism might have been related to the fact that an international mechanism within the International Energy Agency framework was already in place.

In the end, the Directive on petroleum products was rejected while the Directive on gas security of supply received 19 amendments but was finally approved (EC Inform-Energy, 2003, October). The original proposal for the Directive on security of gas supply foresaw for instance that member states should impose minimum storage objectives on undertakings. Prescribing a certain amount of storage would have had an important impact on the gas sector. As the following citation shows, the Commission was not only aiming to intervene in the market, but also to control when to release stored gas. The European Economic and Social Committee refers in their opinion to the Commissions proposal to the Commission by saying,

> in the event of crises and in order to ensure solidarity between member states, the Commission wishes to be able to take decisions to release stocks of gas held in the member states and actually to interrupt supplies to the interruptible market. (European Commission, 2003d: 18)

The Commission also proposed the creation of a European Observation System for supply of hydrocarbons. Finally, all attempts to transfer decision competences from the member states to the European Commission were jointly rejected in the Council, the Parliament, and involved Committees. When the Directive concerning measures to safeguard security of gas supply was published, none of the ambitious aims were included. Instead, the EC increased their sector information by requiring the member states to report the contract durations of supply arrangements. Instead of a full-fledged European gas crisis group equipped with decision-making power, a light version called the 'gas coordination group' was established to enhance the coordination and information exchange between the member states. (Directive 2004/67/EC, Art. 7 and 8)

6.6 Regulation 1775

The main topic during year six of the gas reform was the Guidelines for third party access and the Commission's aim to translate them into a Regulation. These guidelines had been formulated and introduced on a voluntary non-binding

basis by the Madrid Forum in February 2002. After their revision, the guidelines provoked controversy at the Energy Council in June 2004. The opposing camp at the Council put forward three criticisms concerning its timing, the chosen regulatory measure, and the scope of the measure. Firstly, some argued that the regulation came too soon, indirectly blaming the EC for regulatory over-eagerness. According to this line of reasoning, it should have waited until the acceleration Directive (Second Directive) reveals its effects. Second, some member states preferred framework regulation instead of immediate regulation because it offered more discretion and thereby decision-making power to the member states. A regulation reduces the member states influence on the comitology procedure, in which national experts fulfil an advisory role. Third, opponents criticised the scope of the regulation which should have been limited to cross-border access instead of applying to the whole gas network (EC Inform-Energy, 2004, May: 5-6). In particular, industry associations have not been pleased with the proposal to incorporate the Guidelines and felt cheated, because those Measures had been developed under the premise of voluntariness.

Regardless of the considerable effort with which opponents attacked the regulation, the European Commission was eager enough and equally successful "to tackle remaining barriers" (Regulation 1775/2005) concerning network access conditions. As the EC justified in Regulation 1775 "additional technical rules are necessary, in particular regarding third party access services, principles of capacity allocation mechanisms, congestion management procedures and transparency requirements" (Regulation 1775/2005, Recital 1). The European Parliament added some amendments which had been the result of earlier negotiations with the Council before approving it on 8 March 2005. These amendments did not trigger any substantial changes, but stated more precisely the measures emphasising the need to be cost-reflective.

While new legislation was already on its way, the EC had to take action against member states who failed to transpose the second Gas Directive on 16 March 2005, when the EC entered the second phase of infringement procedure. At that point, reasoned opinions were sent to Belgium, Germany, Ireland, Luxembourg, Spain, and Sweden. (Directorate-General for Energy and Transport, 2005).

Looking back at the last two legislative initiatives (Security of Supply Directive in 2004 and the Regulation 1775 in 2005), it is striking that the crucial topics concerning storage could not be solved in either. So far, neither a crisis mechanism for European gas supply nor a minimum storage obligation in the case of supply disruption could be established. Instead, storage was left to the Madrid Forum mechanism. There, the Joint Working Group of the Madrid Forum decided in March 2005 to adopt ERGEG's voluntary Guidelines for Good Practice for Gas Storage System Operators (GGPSSO). Aware of a growing import

dependency of natural gas, this circumstance left some energy experts and politicians concerned. On the one hand, the experience with the first set of Guidelines relating to third party access did not turn out to be a success story of industry self-regulation – the industry's compliance had been too low. On the other hand, a comprehensive gas storage policy has not been introduced so far, and is still in its infancy. As the next section shows, the effects of this hesitancy to tackle natural gas storage became apparent relatively quickly.

6.7 Exploring the potential: evaluation and reinforcement phase

The European Council adopted the revised Lisbon Strategy in March 2005 to foster European competitiveness in reaction to globalisation and its growing competition between geographic locations. The revision mainly tried to revitalise the common European broader economic goals by formulating European-wide targets and implementation procedures. Energy prices were rising high at that time and brought the gas reform back on the agenda. Carried by the Lisbon spirit, the Directorate-General for Competition announced that the EC was initiating sector investigations in the field of financial services and energy. The launch of the energy sector inquiry marked the start of a new phase of evaluation and enforcement. (EC Inform-Energy, 2005, March-a: 2)

The official opening of the energy sector inquiry took place on 13 June 2005. Under the new regulation DG COMP was able to conduct an inquiry "where the trend of trade between member states, the rigidity of prices or other circumstances suggest that competition may be restricted or distorted within the common market." (European Commission, 2005d: 1). In the Commission's Decision, the enforcement policy was justified by the malfunctioning of the European gas market indicated by slow integration, rising prices, and market concentration. Especially the development of gas and electricity prices were Commissions concerns. According to DG COMP, there was distrust in the existing mechanism of price formulation. Although the accusation of price agreements was not stated explicitly, the Commission suggested that the lack of liquidity in the market "leads to price volatility and may give scope for manipulation" (European Commission, 2005d: 1). To strengthen their argument, the EC referred to energy intensive user's experience from different member states having difficulties obtaining competitive offers. In this regard, the Commission repeatedly received tailwind from energy intensive user associations such as the Federation of Industrial Energy Consumers IFIEC-Europe) (EC Inform-Energy, November 2005: 3). It was not only the energy intensive users who pressed for action on the EU level. Later in 2005 the British gas regulator Office of Gas and

Electricity Markets (Ofgem) also requested DG COMP to step in. In November 2005, Ofgem asked DG COMP in an official letter to enquire into the market malfunctioning between continental Europe on the one side and Britain and Ireland on the other side. Ofgem then complained, "much higher prices in the UK compared with continental Europe in October 2005 did not result in a comparable inward flow of gas, which the economics of a competitive market expect" (EC Inform-Energy, 2005, December: 7). For an economist the situation was puzzling: Demand and supply was not matching, wholesale prices went up but no gas could be directed to the UK from continental Europe. Looking back, one can say that the UK was suffering from transitional problems as a result of a self-sufficient gas exporter developing towards a net importer. On the one hand, natural gas production (capacities) decreased more than expected and limited to UK offshore fields to serve as swing producers. On the other hand, the UK did not provide over sufficient gas storage to balance out the demand cap. Being a producing country the UK did not have same degree of storage as other Continental European member states (Office of Gas and Electricity Markets, 2004, October). To prevent such malfunctioning in the years to come and to foster the gas inflows from Continental Europe, Ofgem lobbied for competition in the market. Armed with EC Regulation No. 1/2003, DG COMP was determined to spearhead the promotion of a competitive European gas market by carrying out cross-EU sectoral investigations (EC Inform-Energy, 2005, March-b: 2). What could have started as a concerted action between DG COMP and DG TREN, turned out to be an uneasy alliance in the first place. Instead of involving DG TREN in the announcement procedure, DG COMP voted for a solo under the new lead of competition Commissioner Neelie Kroes. The debut of the competition Commissioner and the new challenge of an energy sector inquiry seemed to induce the need to clarify the role the Directorate-Generals were supposed to play within the enforcement phase. During the next half year coordination between the two Directorate-Generals improved and the competences were redefined. Thereafter, DG TREN was supposed to develop regulation and proposals on the basis of its initiative right regulatory action to the European Parliament and the Council, whereas DG COMP ensured the competition oversight. The benefits of this coordination became evident when DG TREN and DG COMP jointly presented their findings on 15 November 2005. DG TREN published its report on the regulatory performance of the member states and DG COMP presented its initial findings of the energy sector inquiry.

The sector inquiries' initial findings outlined the major malfunctions. In an initial step, the Commission targeted five malfunctions: market concentration, lack of liquidity on the gas market, insufficient market integration indicated by numerous barriers towards cross-border trade, lack of transparency hampering

competition, and high prices in conjunction with a lack of trust in price formation on wholesale level (European Commission, 2005e). In a second step, the EC published the preliminary report four month later which specified some criticism and sketched a way forward in terms of competition law and regulatory enforcement. In the preliminary report, DG COMP elaborates much more on the argument of vertical foreclosure. Accordingly, the prevalence of long term supply contracts in combination with an insufficient degree of unbundling between transport and trade transactions result in vertical foreclosure that hinders the creation of a competitive market. As long term supply contracts and their derogations from third party access are a given, the unbundling came into force under the European Commission (European Commission, 2006c, 16 February: 3). The preliminary report hardly exposed any new facts, but provided evidence of what was known to the industry and energy experts. Nevertheless, this sector inquiry and its precision was a necessary step to prepare for the regulatory enforcement the Commission was heading for. By stressing the need for a stricter unbundling of the gas industry, DG COMP kept its promise to feed some arguments to the regulatory activities DG TREN was preparing.

On 14 March 2006, the Energy Council was held and discussed the Green paper 'A European Strategy for Sustainable, Competitive and Secure Energy'. The Green paper did not contain any groundbreaking changes but posed

> the […] fundamental question [of] whether there is an agreement on the need to develop a new, common European strategy for energy, and whether sustainability, competitiveness and security should be the core principles that underpin the strategy. (European Commission, 2006: 4)

In other words, the EU proceeded in terms of strategy formulation by identifying six priority areas. These ranged from policy areas concerning (i) competitiveness and internal market, (ii) diversification of the energy mix, (iii) solidarity mechanism in energy supply crisis, (iv) promotion of sustainable development, to (v) foster innovation and technology and (vi) coordination of external energy policy. The EC used the Green paper to flank the strategy formulation with several initiatives that then could be discussed at the upcoming Council meeting at the end of March. To ensure that the development of a common European energy strategy stays alive and progresses, the EC proposes a Strategic European Energy Review (SEER) to be presented to the European Parliament and the Council on a regular basis (European Commission, 2006: 5). With regard to the gas reform, the Green paper basically brought together the two strands of the current gas market regulation, internal market integration and

security of supply measures for natural gas. With reference to the first strand, the EC proposed the establishment of a European grid code. To facilitate such a common network access code, the EC considered among other forms of oversight the creation of a European Energy Regulator. The Commission also advertised a 'priority interconnection plan' (European Commission, 2006: 5) to promote investments in cross-border transport capacity. In addition, the Green Paper takes up the view of DG COMP and DG TREN and stresses the significance of an effective unbundling to reach a level playing field to allow new entrants to compete under fair conditions. Following up the other strand, the Commission recommended for the establishment of a European Energy Supply Observatory that would gather information on EU demand and supply developments and detect shortfalls of transport infrastructure. Moreover, the Commission aspired to re-examine the Directive on gas security of supply. The selective list of proposals vividly demonstrates a magnitude of ideas to develop a common energy policy. (Ibid: 8)

Shortly after its publication however, the Green Paper received a sober response from the head of governments during the Council on 23-24 March 2006. There, the intergovernmentalists emerged victorious. The heads of the European governments and their energy ministers rejected the EC's initiative to create a common energy regulator for electricity and gas. Instead, the member states called for more coordination. Some comments reaffirmed the diverging interpretations on how a liberalised European market should look like. For instance "The German Chancellor, Angela Merkel said that the Single Market could only work 'when electricity flows freely and when we accept European champions and not just think nationally'" (EC Inform-Energy, 2006, March: 5). French president Chirac formulated more elegantly "The construction of a Europe of Energy cannot be confined to the liberalisation of markets" (ibid). These comments suggest that it will take much more effort to overcome the divergent visions of a European energy market.

After the harsh disappointment for the European Commission, the European energy regulator group followed the model on the Electricity Regional Initiative and launched a Gas Regional Initiative (GRI) in April 2006. Based on the initiative, seven Electricity Regional Energy Markets were formed as well as three Gas Regional Energy Markets (REM). This divides the European gas market into south, south-east and north-west regions. These Regional Initiatives are supposed to identify and remove barriers to trade at the regional level and thereby to overcome stagnation on the EU-level. ERGEG focuses on developing practical solutions for inter-trade and transport of natural gas in Europe, pinning its hope on increased cooperation of the relevant stakeholders when dealing with concrete tasks and projects. Some therefore see the Gas Regional Initiatives as

'springboards' (European Regulators Group for Electricity and Gas, 2007: 1) and a useful interim step towards a fully integrated, well functioning market. Others are more pessimistic; feeling that a regional approach in the end just delays the supranationalisation of energy policy. Be that as it may, the council meeting in spring 2007 left no doubts regarding political will. There is no sufficient political will, therefore a regional diffusion of liberal ideas and enhanced cross-border cooperation looks the most promising for now.

The year 2007 started with the publication of the energy package, which contained the final report of the energy sector inquiry, the Strategic European Energy Review, and the new energy policy the Commission formulated. The SEER replaced the benchmarking Report and serves as a monitoring tool to examine the performance of natural gas markets with respect to several goals ranging from market structure, security of supply situation, and environmental concerns. For our purposes, the results of the energy sector inquiry and the new energy policy are important and will be addressed in the following paragraphs.

Unsurprisingly, the energy sector inquiry concludes that the overall aim of resolving the barriers currently impeding the development of a fully functioning open and competitive EU wide energy market by 1 July 2007 could not be fulfilled (European Commission, 2007b). The final report expands the list of malfunctions by addressing phenomena occurring in downstream markets, balancing markets, and liquefied natural gas markets (LNG markets). The criticism with regard to downstream markets mainly centres on a lack of competition stemming from the contract durations for industrial and local distribution companies. After the introduction of liberalisation, balancing regimes are often based on short balancing periods, which according to the reasoning of the Directorate-General for Competition, does not encourage new entrants in the market, but rather reflects the interest of incumbents. With regard to LNG markets, DG COMP does address the necessity of competition on the retail market and diversification of LNG supply. Although DG COMP indicates no worrying trend towards concentration within LNG markets, the report emphasises the need to monitor its development. (European Commission, 2007a, January 10: 9-11)

In the context of the energy package, the European Commission made the step from energy strategy formulation to setting out a new energy policy. In the Green Paper the European Commission made the conceptual step to integrate internal market liberalisation, security of supply, and sustainable development. In January 2007, the European Commission translated the integrative concept into a new energy policy. Ultimately, the combination of internal market integration and sustainability will formulate a more coherent European energy policy by bridging both the energy sectors and different policy aims, for instance fighting against climate change. Two subjects were important regarding gas

market regulation: the distribution of regulatory power and the unbundling provisions. Whereas the proposition of establishing a common energy regulator had been rejected at the last Council meeting, the EC's way forward in terms of unbundling awoke the interest of the energy community.

After the defeat regarding the creation of a common energy regulator, the European Commission applied a more moderate strategy by outlining three possibilities for enhancing effective regulation of the European gas markets. The first option looks to preserve the institutional status-quo with the only difference that the national regulators are supposed to take a more active role. In the Commissions interpretation, this option implies that national regulators increase the inter-regulator coordination and prioritise community objectives instead of their national objectives. The second option is described as a European network of independent regulators labelled "ERGEG+". "Under this mechanism the role of ERGEG will be formalised and it would be given the task to structure binding decisions" (European Commission, 2007, January 10: 8). The third option would be a common energy regulator whose tasks are supposed to mainly centre on cross-border regulatory decisions. Although exposing three options, the Commission rejects the first option in the same document by arguing that effective decision-making will not be provided when 27 regulators with different interests are supposed to agree on cross-border issues on a voluntary basis, be it technical or regulatory standards. Accordingly, the Commission prefers the last option and considers the ERGEG+ variant as a minimal approach (ibid: 9).

In this context, it is noteworthy that the EC propositions did not question the regulatory oversight of the national regulators as such. Instead, the EU tries to follow the US example by suggesting a labour division between state and federal levels. Accordingly, internal market affairs such as tariff setting would remain with the national regulator, whereas derogations for investment in cross-border network linkages would be approved by a European authority, the so-called ERGEG+ (ibid: 8-9; Piebalgs, 2007, 7 February). One underlying idea of centralising regulatory oversight of cross-border issues to the supranational level is to make regulation more effective. Currently, anyone planning to invest in a project such as an LNG terminal and aims to receive a derogation of third party access needs the approval of at least two regulatory authorities, the European Commission as supervisor- and the national regulators involved.

Before the publication of the third Energy Package in September 2007, the big question was whether the Commission would call for ownership unbundling to be mandatory, as the earlier announcement of DG COMP and DG TREN might have suggested. In anticipation of the lack of political will from the member states, the Commission did not hold a strong stance. Instead, the EC considered two possibilities. The first option is ownership unbundling, the Commission's

preference. The second option is the designation of Independent System Operators "where the vertically integrated company remains owner of the network assets and receives a regulated return on them, but is not responsible for their operation, maintenance or development" (European Commission, 2007, January 10: 7).

Neither the Energy Council meeting on 15-16 February 2007 nor the following general Council meeting in spring 2007 brought about any progress in terms of unbundling or regulatory oversight. On the contrary, the Council voted for the minimum solution in both instances. Accordingly, the member states opted for Independent System Operators leaving open the degree of regulation imposed on network companies. The initial suggestion from the Commission foresaw a rate of return regulation, whereas the Council spoke of "adequately regulated network system operators" (Council of the European Union, 2007, May: 16). The action plan formulated by the Council did not propose any concrete action which would significantly support the European Commissions attempts.

The third Energy Package contains a bundle of proposals which could have a considerable effect on the governance of the European gas sector once adopted. First and foremost, the Commission continued to strive for ownership unbundling while keeping the option of derogating through designating an Independent System Operator (ISO) by the national government. After the publication of the third Energy Package proposal, the member states and the Parliament divided up in three groups: the proponents of ownership unbundling represented by the majority of Members of European Parliament, the United Kingdom, the Netherlands, Belgium, Denmark, Spain, Finland, Romania and Sweden; the group of undecided consisted of Estonia, Hungary, Ireland, Italy, Lithuania, Malta, Poland, Portugal, Czech Republic and Slowenia; the group of opponents of ownership unbundling was lead by France and Germany and supported by Austria, Bulgaria, Cyprus, Greece, Latvia, Luxembourg, and Slovakia (EurActiv.com, 2007). At the following Energy Council meeting in December 2007, Germany and France announced to propose a third option aiming below the level of ownership unbundling and the ISO option. This strategy has been employed to bottom out the regulatory standard with regard to unbundling and to win time for negotiations with the member states in the group of undecided.

Secondly, the proposed Directive attempts to strengthen regulatory authorities on both levels by extending regulatory powers. For the ISO option accounts that regulators might obtain the right to review and approve 10-year investment plans formulated by the independent system operators and to carry out investigations at the transmission system owner and independent system operators premises (Article 24c), point 2.e). Moreover, regulators shall impose sanctions on companies "not complying with their obligations under this Directive or any decisions of the regulatory authority or of the Agency" (Art. 24c,

point 3.b)). These references to the proposal, illustrate the immanent attempt to move from enacting to enforcing regulation. Into the same direction points the addition of Article 24 f) which requires supply undertakings to keep record of their transaction data. The underlying idea of the Directive is to decrease the information asymmetry by expanding the scope of controlling rights and report duties. To support the national regulators and to extend the room for negotiation, the proposal calls for only one single authority to be responsible for the sector oversight (Article 24a, point 1). At the Energy Council meeting in December 2007, Commissioner Piebalgs indicated the EC would not insist on a single-authority-structure, but certainly is more determined to establish the Agency for the Cooperation of Energy Regulators (ACER). The ACER proposition draws on the earlier mentioned "ERGEG+" option. The aim of this Agency is to enhance the coordination of national regulators and ensure the cooperation between transmission system operators (European Commission, 2007c: 10-11). The proposal of the Agency runs the danger to be sandwiched between its proponents and opponents. Objectors simply reject any kind of increase in regulatory power, whereas the advocates of strong regulation criticise the proposal for not equipping the Agency with sufficient competences to ensure effective regulation that justifies huge administrative costs of establishing a new Agency. It would be mistaken to interpret proposal and limited powers of a new Agency as a lack of ambition; instead it reflects the anticipation of realistic options. The EC employs a piecemeal technique which aims first to ensure the establishment of the Agency and the position of the Commission, then to expand regulatory powers of the Agency in the long run (European Commission, 2007c: 11-13).

Third, the Commission established the practice of releasing guidelines to steer the further liberalisation of the sector reform and plans to expand this practice in future. On several occasions, the Commission proposes the formulation of guidelines and determines the compliance mechanism of those guidelines (Article 24 e). Last but not least, the possibility to receive derogations for new investment projects or considerable upgrading of infrastructure like for instance interconnector between Member States, LNG or storage facilities is still guaranteed by Article 22.

6.8 Concluding considerations

The nine years of gas market reform were characterised by constant power struggles on the one hand and learning and adaptation processes on the other. Altogether, we identified five phases ranging from one to four years. In our interpretation, the fifth phase is currently ongoing because, until 2007, no new

legislative or regulatory act has found sufficient political support and approval among the member states. The release of the Third Energy Package including the third Gas Directive is expected for 2009.

6.8.1 Conclusion and expectation

This conclusion evaluates observations concerning the first layer of Williamson's model by initially asking whether major changes of general or energy policy objectives occurred. This makes it possible to formulate in a second step an expectation regarding the effects of this layer on the convergence of regulation.

Regarding European energy policy, the member states' statements and behaviour in the course of the formulation of gas market policy and its related legislation on the European level indicated that the attitude of the majority towards gas market liberalisation remained reluctant during the entire period of examination. Some showed a pro-active attitude; for instance the United Kingdom, Spain, the Netherlands, and the European Parliament in 2001 called for earlier implementation deadlines of the second Directive than the Commission proposed itself. Nevertheless, numerous Council meetings confirmed the general reluctance of the majority of member states to vote for a fully fledged liberalisation policy. A vivid example is the negotiation of the implementation date for the legal market opening during 2000 and 2002. Another illustration offers the evolution of Regulation 1775, characterised by lengthy discussions questioning the need for regulatory action to deepen the liberalisation of the market – just to name a few.

Our findings in terms of prioritization of energy policy objectives support our expectation formulated in our first hypothesis, where after a misalignment between transaction characteristics and modes of governance as inherent to the regulation-for-competition in European natural gas markets, is likely to result in a reluctance to apply what the EU perceives as best-practice. In chapter 8, we investigate further the sum of member states holding back to move towards (delta) convergence in terms of best-practice regulation-for-competition, before concluding on our overall results in the last chapter.

6.8.2 Outlook

Since 2005, stagnation and regulatory inertia is apparent. Unlike the first stalemate, which evolved with regard to the legal market opening provisions, the obstacles might not be overcome by waiting until an election of one opposing member state has passed. During the European Council meetings the ownership unbundling of trade and transport branches was rejected repeatedly and by unanimous agreement of the member states. On the contrary, instead of voting for a fragmentation of the industry structure along trade and transport, the

consensus among the member states appeared to be the support of the evolution of European champions in the gas sector. Most European gas markets have been characterised by vertical foreclosure and concentration processes (re-bundling). As a consequence, regulatory instruments besides unbundling itself could not enfold their full effect. Moreover, both attempts of the European Commission to shift regulatory competences to the supranational level failed. Neither a common EU mechanism for releasing stored gas in the situation of supply disruption nor a common European energy regulator could be established. The idea of Regional Gas Initiatives (RGI) emerged in light of a lacklustre political will in the majority of member states to deepen the liberalisation provisions and supranationalise gas market regulation. The RGI appear to function as an interim step and current playing field, where substantial progress in terms of market integration and harmonisation is facilitated.

The negotiations on the third Energy Package will continue in 2008. The Director General for Competition Philip Lowe estimated at the Flame conference in 2007: "It will probably take until 2009 to pass into law and in the meantime, member states must anticipate the change and plan for it" (Gas Matters Today, 2007, March 14). Considering the preferences member states voiced with regard to unbundling during the Energy Council meeting in December 2007, it was very unlikely that ownership unbundling will become the dominant mode of unbundling. And indeed, the member states opted for a third way. This would imply a serious setback for the Commissions attempt to reach a full-fledged regulation-for-competition approach in terms of unbundling. Thus, the reform would run the danger to be "stuck in the middle", while at the same time raising the immediate transaction costs on both sides (regulators and regulatees) without changing the industry structure and its underlying incentives.

7. Regulatory requirements of the European gas market reform:

how much leeway do member states have?

Introduction

The European Union began with a classical soft-power approach by choosing a framework regulation. Instead of prescribing a rigid market design for national gas markets, member states could gradually develop the appropriate regulatory regimes, "[...] to allow the industry to adjust in a flexible and ordered manner to its new environment and in order to take account of the different market structures in the Member States" (Directive 1998/30/EC, Recital 7). In other words, the member states had the freedom to choose the instruments to meet the provisions given by the EU legislation. Often the margins for regulatory regimes were set by compliance with the objectives and principles formulated in the legal provisions. By examining the legal texts constituting the Gas Reform in more detail, we first demonstrate that only a few instruments were compulsory. Second, this proceeding allows identifying which effect the introduction of the new legislation had on the convergence of particular instruments and the regulatory regimes of European gas markets in general. We address here sub question 1.2 "Does specifying the European legal provisions for gas market reform induce convergence of national regulatory regimes in the natural gas sector?" by reviewing the legal provisions. This examination later serves as a reference to facilitate the formulation of an index to describe a 'best-practice' model in the methodology chapter (6). And last but not least, the investigations of the variable allow to answer our first question in our concluding chapter.

Either in anticipation of the EU legislation or as a reaction to the EU's Gas Reform, member states brought additional and complementary energy legislation into place. Our reference point is supranational law however, and this analysis

concentrates on the member states' choice of instruments. Consequently, we do not expect to learn about how member states precisely transposed the EU legislation into national law, or find an exhaustive and in-depth discussion of the two Directives and related documents. Instead, we aim to show how much room for manoeuvre the member states were given by the framework regulation regarding their choice of instruments. To facilitate this, we first state the major legal acts that form the bases of the European Union's Gas Reform. We continue with a description of the general objectives and principles as laid out in the legal texts. Finally, we show which regulatory instruments became mandatory for the member states to integrate into the national regulatory regime and formulate expectations with regard to the convergence of the applied instruments.

7.1 Legal framework of the European gas market reform

European gas market reform is mainly based on three legislative acts introduced by the European Union as secondary legislation between 1998 and 2005. The first (Directive 98/30/EC, European Commission 1998) and second Gas Directives (Directive 2003/55/EC, European Commission), are both framework regulations. By definition, "Directives bind the Member States as to the results to be achieved; they have to be transposed into the national legal framework and thus leave margin for manoeuvre as to the form and means of implementation" (European Commission, 2006b). The measures were supposed to be implemented by 10.8.2000 for Directive 1998 (equivalent with t0=2000) and by 1 July 2004 for Directive 2003 (equivalent with t4=2004).

The EU did not formulate a third Directive in the later reform process, but first chose the legal instrument of Regulation. Regulations do not give the same flexibility to the member states compared with Directives, but are directly applicable and binding for all member states. In addition, Regulations do not necessitate national implementation of legislation as it follows the principle of subsidiarity, where national laws are not allowed to be in conflict with European secondary laws (such as Regulations). With the release of Regulation 1775/2005 in 2005 however, the EU overruled national laws with the justification that, "It is now necessary to provide for structural changes in the regulatory framework to tackle remaining barriers to the completion of the internal market in particular regarding the gas trade" (Regulation 1775/2005, Recital 1). They also added that,

> […] since the objective of this Regulation, namely the setting of fair rules for access conditions to natural gas transmission systems, cannot sufficiently achieved by member states and can therefore, by reason of the scale and effects of action, be better achieved at Community level, the Community may adopt measures […] (Regulation 1775/2005, Recital 23)

The Regulation had to be implemented by 1 July 2006 (beyond t6).

7.2 Objectives and principles of the reform

The first Recital of the first Directive not only states the overall objectives of the gas reform, but also reflects the tension between Europe's old and aspiring market design. According to the first and third Recitals, the completion of the internal market and a competitive natural gas market are the major objectives of the reform. Ironically, these two embrace the second Recital, that allows member states to take into account differences in their economies and to derogate from the Directives provisions (Directive 1998/30/EC, Recitals 1-3). One could argue whether the root for divergent gas market regulation is already disposed. Further constraints might stem from Recital 12 which foresees the fulfilment of public service obligations as objectives, and might interfere with competition goals. Thereafter, "[...] for some Member States the imposition of public service obligations may be necessary to ensure security of supply and consumer and environmental protection, which, in their view, free competition left to itself, cannot necessarily guarantee" (Directive 1998/30/EC, Recital 12). Despite the given ambivalence of objectives, the European Union considers the completion of market liberalisation to be pivotal in order to meet these public service obligations. In other words, the EU continuously expressed the aim to create one common European gas market. Attesting to this declaration, the EU identified the completion of internal market as the first of six priority areas in its recent strategy paper: "Sustainable, competitive and secure energy will not be achieved without open and competitive energy markets, based on competition between companies looking to become European-wide competitors rather than dominant national players." (European Commission, 2006: 5).

The second Gas Directive complements the first by stating objectives the EU wishes to achieve through gas market reform. Thereafter, the EU aims to increase efficiency, reduce prices, raise standards of service, and increase competition (Directive 2003/55/EC, Recital 2).

7.2.1 General principles

In a framework regulation, principles are of considerable importance due to the lack of tailor-made rules. Hence, we start off by exploring the role of principles in the gas reform. In this regard, the ninth Recital of the first Directive appears to be insightful, as it prescribes not only the Gas Directive as framework regulation, but also defines the role of principles to constitute the Gas Reform:

> Whereas a certain number of common rules should be established for the organisation and operation of the natural gas sector; whereas, in accordance with the principle of subsidiarity, these rules are no more than general principles providing for a framework, the detailed implementation of which should be left to Member States, thus allowing each Member State to maintain or choose the regime which corresponds best to a particular situation, in particular with regard to authorizations and the supervision of supply contracts. (Directive 98/30/EC, Recital 9)

This clearly indicates that the European Union was not aiming to determine measures or instruments, but instead formulate general principles. Moreover, the EU further specifies in Article 3 section 1 the context in which the general principles are set and thereby leaves no doubt about the binding character of the principles:

Member States shall ensure [....] natural gas undertakings are operated in accordance with the principles of this Directive with a view to achieving a competitive market in natural gas, and shall not discriminate between such undertakings as regards either rights or obligations. (Directive 1998/30/EC)

Given the relative importance of principles in this legal document, one is driven to search for articles in the Directives which summarise the reform principles. Surprisingly however, there are none. Instead, the principles are defined in relation to the objects of regulatory functions and grouped under the pillars 'Transmission, storage, LNG', 'Distribution and supply', 'Unbundling', 'Network access', and 'Organisation of access to the system'. This still leaves us with the question: what are the constituting principles of the gas reform? A further question is whether these principles changed in light of altering legislation or whether additional principles evolved.

The first Directive names six principles: objectivity, non-discrimination, (information) transparency, efficiency, economics, and security. Within the second Directive, the EU expanded the list by another four principles: fair prices, cost-reflectiveness, environmental friendliness, and consumer protection, meaning that the choice of measures should be in line with the environmental policy of the EU.

Introduced in Directive 1998/30/EC	Added in Directive 2003/55/EC
• Objectivity • Non-discrimination • Transparency • Efficiency • Economics • Security	• Consumer protection • Fair prices • Cost-reflectiveness • Environmental friendliness

Table 16: Principles of the European Gas Directives[65]

Regulation 1775/2005 aims to specify regulatory functions rather than revise principles. Thus, it does not add new principles but instead contributes to the principle formulation by specifying the transparency requirements (Regulation 1775/2005, Article 6) and the principles which have to be applied for the regulatory function of capacity allocation mechanism and congestion management procedures.

In summary, the European Union postulates nine core principles member states have to comply with. There is no indication that one can deduce the relative importance of one principle to another by referring to the order in which they are stated in the Directives. The Directives' inherent logic suggests they are of equal importance and complementary in nature.

7.2.2 Issue related principles

Having stated the general core principles, we now look closer at which principles are formulated with regard to different regulatory functions and how they changed over time. In doing so, we adopt the structure of pillars suggested by the Directives.

Unbundling does not specifically rely on principles as the formal requirements are given in the legal text. It is therefore dealt with in more detail in the next section that explores the Directives requirements.

Article 7 is quite central concerning the formulation of principles, as it introduces principles in application to the transmission, storage, and Liquefied natural gas (LNG) business. Section 1 states "each transmission, storage and/or LNG undertaking shall operate, maintain and develop under economic conditions secure, reliable and efficient transmission, with due regard to the environment" (Directive 1998/30/EC, Art. 7 (1)). The next two sections expand the set of principles by non-discriminatory behaviour and information transparency (Directive 1998/30/EC, Art. 7 (2-3)). The principles for the distribution and supply follows the same scheme as those for the former pillar and literally the same principles are outlined for the distribution and supply sector (Directive 1998/30/EC, Art. 10 (1-3)). Directive 2003/55/EC takes over the first Directive's principles

and adds environmental friendliness to the catalogue. Complementary to Articles 8 and 12 of the second Directive, Recital 31 requires that "measures should be taken to ensure homogenous and non-discriminatory access regimes for transmission, including cross-border flows of gas between Member States" (Directive 2003/55/EC, Recital 31). This legal provision clearly shows the European Union's intention to harmonise network access conditions.

Due to the discussions of the relative importance of balancing rules to guarantee equal and non-discriminatory transport services, balancing conditions receive much more attention in the second Directive and the proceeding Regulation. Accordingly, balancing rules should be objective, transparent, non-discriminatory, and cost-reflective (Directive 2003/55/EC, Recital 15, Article 8 (2), Article 12 (5).

Independent from the member states' preference with regard to negotiated or regulated third party access, the organisation of the network access shall be "in accordance with objective, transparent and non-discriminatory criteria" (Directive 1998/30/EC, Article 14.). These principles were accompanied by Article 21 (1), where "Member States shall ensure that the parties negotiate access to the system in good faith and that none of them abuses its negotiation position to prevent the successful outcome of such negotiations". (Directive 1998/30/EC, Article 21 (1). The EU addresses here the comparative advantages of incumbent companies and the somewhat moral appeal not to use their grandfathering rights.

The EU repeatedly emphasised the necessity of network access and therefore declared in the second Directive, "[...] non-discriminatory access to the network of the transmission and distribution system operator is of paramount importance" (Directive 2003/55/EC, Recital 8). In terms of principle formulation, Directive 2003/55/EC does add the principle of fairly priced network access, which might be interpreted as a growing awareness of highly heterogeneous and intransparent network tariffs (Directive 2003/55/EC, Recital 7, Article 18 (1). New elements of the second Directive are certainly the introduction of third party access for storage and the requirement to establish regulatory authorities. Like the third party access for the network, TPA for storages must be in line with the principles of objectivity, transparency, and non-discrimination.

7.3 Mandatory instruments

After elaborating on the gas market reform objectives and principles, our attention is now directed towards the instruments the legal provisions require. These are discussed along with the regulatory functions concerning legal market opening, third party access, unbundling, balancing, and regulatory authorities.

7.3.1 Legal market opening

To achieve a gradual and incremental market opening, the EU chose the definition of eligible customer as the key variable to facilitate legal market opening. The Directive distinguishes between those countries that started to open their markets (e.g., Germany) and those that entered the reform process with a considerable degree of market opening (> 30%) such as the United Kingdom. The first category of new market openers "shall ensure that the definition of eligible customers referred to in paragraph 1 will result in an opening of the market equal to at least 20% of the total annual gas consumption of the natural gas market" (Directive 1998, Article 18 (3)). Article 18 continues prescribing the market opening in later states. Accordingly, a legal market opening of 28% by 2003 and 33% by 2008 is compulsory. Countries in the category of advanced market openers shall ensure a market opening of 38% by 2003 and of 43% by 2008 (Directive 1998/30/EC, Art. 18 (6).

> The Directive requires that Member States specify 'eligible customers', defined as those customers inside their territory that have the legal capacity to contract for or to be sold natural gas according to the procedures set out in Articles 15 and 16. It requires that initially two categories of customers – at least- be included as eligible customers. These are:
>
> (1) all final consumers consuming more than 25 million cubic meters of gas per year on a consumption site basis; and
> (2) gas-fired power generations, irrespectively of their annual consumption level. (Cameron, 2002: 178)

In short, member states are obliged to use the definition of eligible customer as an instrument to facilitate the required market opening. In the end, it was the member state's responsibility to define the eligible customer in terms of consumer classes, assuming the achievement of the above mentioned targets. For monitoring purposes, the European Commission asks for the annual publication of the countries definition accompanied by all other appropriate information to justify the fulfilment of market opening (Directive 1998/30/EC, Art. 18 (9)).

In 2003, the second Directive set more ambitious targets. Amending the first Directive, the acceleration Directive foresees the freedom of choice of supplier for all European non-households from 1 July 2004, and for all costumers from 1 July 2007 (Directive 2003/55/EC, Art. 23 (1)).

7.3.2 Third party access

Third party access is a crucial instrument in introducing competition in the downstream part of the natural gas sector and has therefore already been a major topic within the pre- liberalisation debate. The first Directive foresees both negotiated third party access (nTPA) and regulated third party access (rTPA). The circumstance that only Germany did not have an independent regulator at that time shows the incumbents inclination to employ delaying strategies. Moreover, it reflects the strong resistance of former integrated companies who function as transport operators to open their grids and allow other firms to gain market shares. In general, one could say that the TPA provisions given in the first Directive introduce the objective and idea of third party access rather than ensuring a rigid European-wide implementation. By choosing negotiated third party access, member states can still vote for transaction based transmission and distribution services. Although Article 15 section 2 requires the publication of the undertakings main commercial conditions for the use of the network, it leaves the information power and thereby negotiation power in the hands of the incumbent firms (Directive 1998/30/EC). In contrast, regulated third-party access is based on published and common tariffs that offer more transparency and non-discriminatory network access to new entrants. Moreover, the first Directive foresees for both nTPA and rTPA, the possibility of temporary derogations, "if a natural gas undertaking encounters, or considers it would encounter, serious economic and financial difficulties because of its Take-or-pay commitments accepted in one or more gas purchase contracts" (Directive 1998/30/EC, Article 25, section 1). In addition, Article 17 explicitly allows the refusal of network access in the case of capacity congestion caused by pre-liberalisation Take-or-pay contract obligations. There is no doubt that in this context the possibility of derogations functions as a clear lock-in mechanism that turned out to have massive effects on the amount of available capacity. DG Competition revealed in their energy sector inquiry that "on the Benelux-Italy axis [...] primary capacity on these pipelines is booked until 2022" (European Commission, 2006c, 16 February: 61).

One of the major revisions of the second Directive was the abolition of the negotiated third party access. Directive 2003/55/EC and Regulation 1775 confirm and emphasise the regulated third-party access and determine more detailed terms and conditions for this instrument. Accordingly, tariffs and their methodology shall be approved and published before their entry into force (Directive 2003/55/EC Article 18, (1). Regulation 1775 specifies

> […] where a transmission system operator offers the same service to different customers, it shall do so under equivalent contractual terms and conditions, either using harmonised transportation contracts or a common network code approved by the competent authority. (Art. 4 (1a))

The mentioning of a common network code reflects the continuing evolution of network access regimes in the reform process: beginning with nTPA under which the main terms and conditions were required to be published and moving on to rTPA with published tariffs and methodologies and envisaging a common network code in Regulation 1775.

The latter regulation focuses on adding technical rules "in particular regarding third party access services, principles of capacity allocation mechanisms, congestion management procedures and requirements" (Regulation 1775, Recital 1). One might expect that after seven years of gas market reform, the EU would alter the level of coercion by naming concrete instruments. One could argue that Regulation 1775 fills existing regulatory gaps; nonetheless the scope of regulation is complementary rather than deepening or widening. This argument will be exemplified with reference to the provisions concerning capacity congestion and tariffs.

As we saw earlier, the Regulation aims to specify capacity allocation mechanisms and capacity congestion mechanisms. To prevent capacity hoarding of incumbent firms under new or renegotiated transport contracts, the following provision entered the legal text:

> When transmission system operators conclude new transport contracts or renegotiate existing transportation contracts, these contracts shall take into account the following principles: in the event of contractual congestion, the transmission system operator shall offer unused capacity on the primary market at least on a day-ahead and interruptible basis. (Regulation 1775, Article 5, section 3 (a))

The Regulation clearly states that unused capacity must be offered to other parties. It is worth noting that those derogations due to Take-or-pay commitments are not tackled per se by this provision, since it refers not to transportation contracts but to trading contracts.

Tariffs are a crucial but very complex area in gas market regulation. In general, tariff systems are based on diverse instruments that reflect different dimensions such as the type of capacity booking, allocation method, and tariff

structure. In this context, the absence of explicitly determined instrument is striking. The furthest community law goes is mentioning auctions as a possible instrument: "Member States may decide that tariffs may also be determined through market based-arrangements, such as auctions, provided that such arrangements and the revenue arising there from are approved by the regulatory authority" (Regulation 1775, Article 3 (1). The tariff system and its instruments are not determined by the EU provisions. Accordingly, one should not expect a convergent impulse in terms of instrument choice.

Third party access to storage is introduced in the second Directive. The EU applied the same approach for the general TPA provisions, by offering the member states the choice between regulated and negotiated TPA for storage. If national regulatory authorities vote for nTPA,

> Member States shall require storage system operators and natural gas undertakings to publish their main commercial conditions for the use of storage, linepack and other ancillary services within the first six months following implementation of this Directive and on an annual basis every year thereafter (Directive 2003/55/EC, Art. 19 (3).

In contrast, regulated third party access is based on published tariffs and other terms and obligations for the use of storage and linepack (Directive 2003/55/EC, Art. 19 (4).

7.3.3 Unbundling

The first Directive requires the publication of accounts of integrated gas undertakings (Directive 1998/30/EC, Art. 13 (3)), but does not prescribe any further measure to ensure the separation of trade and transport in the natural gas markets. In contrast to the Electricity Directive, the first Gas Directive does not impose legal or management unbundling (see below). Instead, "integrated natural gas undertakings shall, in their internal accounting, keep separate accounts for their natural gas transmission, distribution and storage activities" (Directive 1998/30/EC Article 13 (3)). The publication and separation of accounts apply equally to transmission and distribution operators. "The aim of this requirement is to ensure non-discrimination and fair tariffs to avoid cross-subsidisation and the distortion of competition" (Cameron 2002: 181).

Legal unbundling was subject of the second Directive. Thereafter, vertically integrated distribution system operators and transmission system operators are required to be independent in legal form and in terms of organisation and decision-making from other activities not related to distribution or transmission

(Directive 2003 Art. 9 (1) and Art. 13 (1)). The provision of legal unbundling as a minimum standard remains; instead of heading for ownership unbundling, an intermediate step has been taken by introducing the concept of "functional unbundling". The characteristics of functional unbundling are usually subsumed and referred to as management unbundling.

The unbundling idea is based on the Transmission System Operator or Distribution System Operator having efficient decision making rights to allow them to make decisions in their own right and interests, independent from the interests of the trading branch of the integrated company. To ensure the independence of the transmission and distribution operators the European Union formulated a number of criteria which have to be fulfilled. Thereafter,

> […] the provisions of the Directive on management separation require firstly that the management staff of the network business do not work at the same time for the supply/production company of the vertically integrated company. This applies to both the top executive management and the operational (middle) management. (European Commission 2004c: 8)

Furthermore, the operators are obliged to establish a compliance programme and report annually how the criteria are met; thereby discriminatory conduct shall be excluded.

The legal provisions of the second Directive allow two exemptions to the unbundling provisions, the so-called 100,000 customer exemption and the postponement option. According to the former, member states have discretion to exempt distribution service operators from the legal and functional unbundling requirements in circumstances where they serve less than 100,000 customers (Directive 2003/55/EC, Article 13). The postponement option allows member states to delay the implementation of the legal unbundling of the DSO beyond 1 July 2007 (Directive 2003/55/EC, Article 33 [2]).

The chart below summarises the legal and functional unbundling requirements of the Gas Directive. Regulation 1775 does not cover unbundling and as a result does not formulate additional provisions.

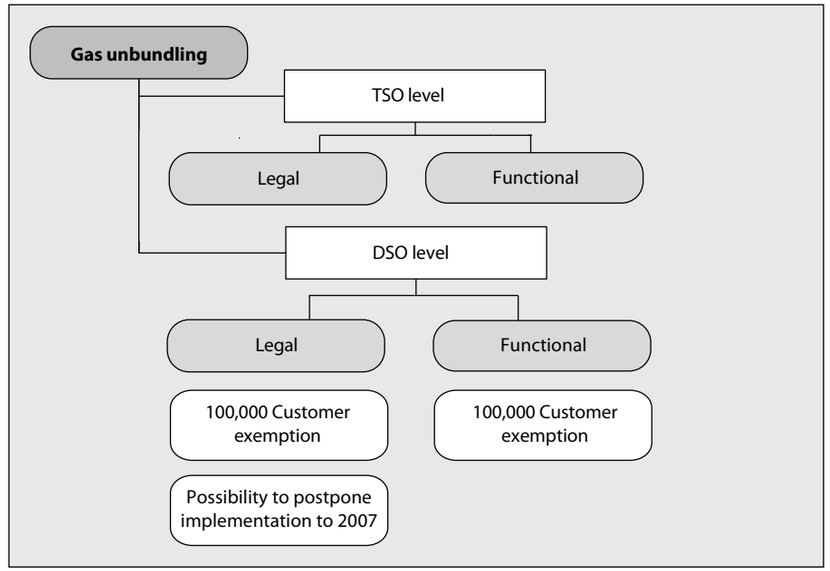


Figure 11: Unbundling requirements of the 2nd Gas Directive[66]

7.3.4 Balancing

As a result of the separation of gas trade and gas transportation due to the unbundling requirements, the formerly centralised model of gas flow management moved to a decentralised model. This necessitates the rearrangement of responsibilities between the transmission/distribution system operators and the shippers. In the course of the reform, each member state tried to develop a balancing regime that equally guaranteed the fair distribution of responsibilities and business opportunities among the new entrants and the incumbent formerly integrated companies. According to the legal provisions, the European Union is generally in favour of a market based mechanism. Acknowledging the fact that liquid markets (the precondition for those instruments) have not been realised, the European Union calls for regulatory authorities to step in and set up the necessary balancing rules. These balancing rules are not further specified and left to be determined by the member states. (Directive 2003/55/EC, Recital 15) In Regulation 1775, the conditions balancing regimes have to fulfil are described in Article 7. Thereafter, balancing conditions should be non-discriminatory, transparent, and cost-reflective. Additionally, the compatibility of balancing regimes across Europe shall be ensured (Regulation 1775, Article 7).

7.3.5 Regulator

The first Directive does not foresee a common EU energy regulator or national regulatory authorities as separate and independent institutions. Reference is only made to the delegation of dispute settlement. In this context, member states are asked to designate a competent authority to settle disputes that may arise from negotiations or refusals of access to the national network. The criteria this competent authority has to fulfil are not further specified. In the case of cross-border disputes, the competent authorities of each member states shall consult each other and settle the dispute in accordance with the Directives provisions. (Directive 1998/30/EC, Article 21)

The introduction of national regulatory authorities in the context of the acceleration Directive had a significant impact on the governance of the European gas markets. Though most of the NRAs were already established before the entry into force of the Directive, the anticipation of its coming legal requirement together with the necessity of dealing with other regulatory requirements in light of the EU gas reform clearly pushed member states to establish independent regulators.

According to the Directive 2003/55/EC,

> the Member States shall designate one or more competent bodies with the function of regulatory authorities. These authorities shall be wholly independent of the interests of the gas industry. They shall, through the application of this Article, at least be responsible for ensuring non-discrimination, effective competition, and efficient functioning of the market [...] (Article 25 (1))

DG TREN explicitly states that the legal provisions do not require a regulator to be separated from other governmental bodies, "[...] even though a separate regulator is the most common and desirable model" (European Commission, 2004b: 1). The Directive also foresees the possibility of ministry involvement in the regulatory processes. More precisely, the ministry may either accept or reject a Regulator's decision, but does not have the right to make amendments (Art. 25 (3). The member states have considerable leeway and can either vote for the centralisation of regulatory functions or a distribution of regulatory functions among several authorities. It is noteworthy that the traditional labour division between competition functions and regulatory functions is kept. As a consequence, competition authorities and regulators or regulatory bodies within ministries share the overall governance of the gas sector.

In general, the core responsibility of the regulatory authority should be the approval of network access tariffs, and conditions, including transmission,

distribution, and LNG facilities. Methodologies for tariffs and balancing services have to be set up ex ante (Art. 8 together with Art. 25 (2)). The change with regard to the timing of decision making by shifting from ex post control to ex ante control is substantial and should be highlighted (Directive 2003/55/EC, Article 25 (1, 2 & 4)).

In particular, the Regulator is responsible for monitoring and intervening if necessary in the following areas:

1. management and allocation of interconnection capacity;
2. mechanisms to deal with congested capacity within the national system;
3. the time taken by transmission and distribution undertakings to make connections and repairs;
4. publication of appropriate information;
5. the effective unbundling of accounts to avoid cross subsidies and the unbundling compliance programme;
6. connecting new producers;
7. the access conditions to storage, line pack and to other ancillary services;
8. overall compliance of transmission and distribution system operators with the Directive
9. the level of transparency and competition. (European Commission, 2004b: 2)

With the requirement to determine regulatory authorities and transfer dispute settlement functions and ex ante control over network access and balancing rules to these authorities, a significant change in the governance of the gas sector has been undertaken. The sector was formerly based on self-regulation, whereas the aim of the legal provisions was to introduce and define public regulation.

7.4 Conclusion and expectations

The conclusion summarises the general aims and principles of the reform. Next, the further development of the legal provisions is portrayed along indicators describing provisions regarding legal market opening, third party access, balancing, unbundling, and regulatory oversight. Our analysis assumes that legal provisions influence the choices of member states designing their regulatory regime. The success of harmonisation depends on the degree of legal specification. In our fifth hypothesis we formulated our expectation more concrete: The more specified the subjects (indicators) of the gas market reform are by European provisions (level 2), the more likely is the application of best practice, resulting at a regime level in a move towards (delta) convergence (on

level 3). Examining these provisions, we identify several instruments for which an effect towards convergence can be expected.

The European Union's main reform goals are the completion of an internal market and the creation of a competitive natural gas market. They have been expanded in the second Gas Directive by postulating efficiency gains, price reductions, and higher standards of service and increased competition as objectives that are supposed to be achieved through the implementation of the legal provisions. The legal framework of the gas reform is mainly based on ten principles. In the first Directive: objectivity, non-discrimination, (information) transparency, efficiency, economics, and security are introduced. In the second Directive by: fair prices, cost-reflectiveness, environmental friendliness, and consumer protection, meaning that choice of measures should be in line with the environmental policy of the EU (Directive 2003/55/2003, Recital 5, 7 and 27). The Directives inherent logic suggests that they are of equal importance and rather complementary in nature. The principles also have been portrayed with regard to their application of regulatory functions.

With regard to the member states' choice of instrument, the legal provisions proved to be either surprisingly ill-defined or rather complex, leaving the information power with the incumbent companies to a large extent. Such was the case for the advent or increase of legal market opening facilitated by the definition of eligible customer. Depending on their initial degree of liberalisation, the legal norm requested for those countries, which may be called liberalisation beginners, is a market opening of 20% of the total annual gas consumption of the natural gas market, increasing by 2003 to 28% and by 2008 to 33%. For the category of advanced markets, the margins were set higher, a market opening of 38% by 2003 and of 43% by 2008. Later, the second Directive prescribed a full legal market opening for non-household consumers by 1 July 2004 and for all costumers by 1 July 2007. Accordingly, one can expect that the converging effect on legal market opening towards full market opening is most likely to be limited between 2000 and 2004, and not very strong (expectation 1) Due to the legal market opening of non-household consumers, the level of legal market opening should increase after 1 July 2004.

In the course of the reform, the provisions concerning TPA underwent profound improvements: beginning with nTPA as a minimum requirement, under which it was mandatory to publish the main terms of conditions (Directive 1998/30/EC), moving on to rTPA with published tariffs and methodologies (Directive 2003/55/EC) and envisaging a common network code in Regulation 1775. In this light, the shift from ex post to ex ante control of third party access can be considered one of the major achievements of accelerating the regulatory process. In the second Directive, the EU followed the same path for the

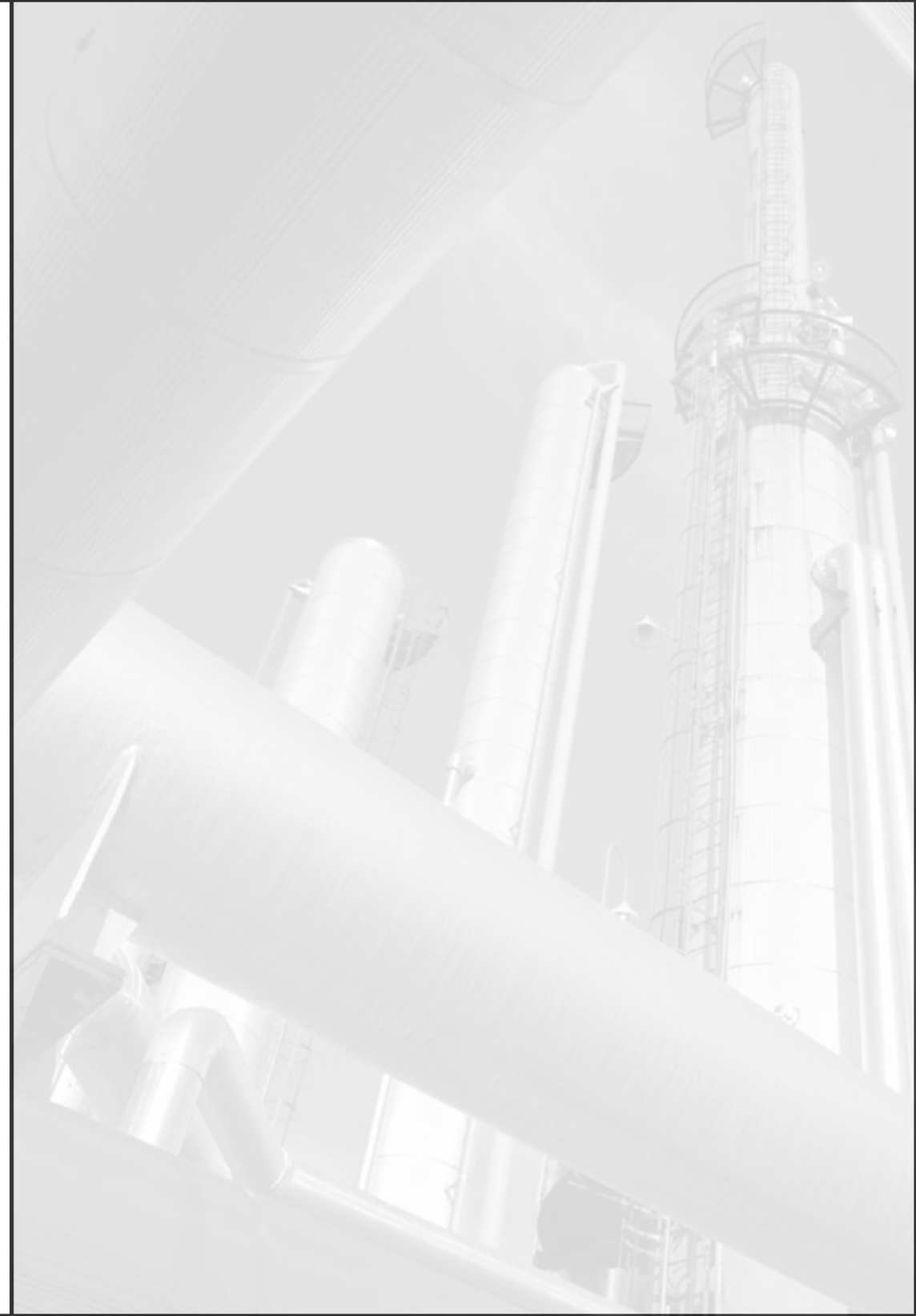
introduction of third party access rules for storage, allowing the member states to apply negotiated or regulated TPA for storage. It is noteworthy however, that no instruments concerning allocation method, tariff structure, type of capacity booking, minimum booking periods of transport capacity, level of tariffs, incentive regulation, and the 'use it or lose it' principle have been explicitly commented on. The same holds for balancing requirements. Although the EU expresses a general favour for market based mechanism, no balancing rules are prescribed. The legal provisions do not prescribe balancing instruments, gas release programmes or certain trading facilities. We therefore do expect a low converging effect (delta convergence) stemming from the European legislation (expectation 2). On the contrary, regulated third party access had to be implemented by 1 July 2004 and we should observe a high degree of delta convergence in the last two measurements of the analysis in 2005 (expectation 3). The same applies to negotiated third party access to storage (expectation 4).

The first Directive introduced legal unbundling, but did not prescribe it as a minimum requirement in Directive 1998/30/EC. Thereafter, the unbundling requirements have been gradually enhanced by demanding first of all legal unbundling and the introduction of so called management unbundling (functional unbundling), instead of voting for a rigid unbundling regime such as ownership unbundling. Concerning the unbundling provisions, we formulate three expectations with regard to the convergence of regulatory instrument choices. According to the first Gas Directive (GD), separate accounts should be published by 10 August 2000. Therefore, we should detect a full convergence throughout the entire observation period (expectation 5). Legal unbundling of transmission system operators should be the norm by 1 July 2004 (expectation 6). With regard to the legal unbundling of distribution system operators, the second GD allows two exemption options reaching beyond 1 July 2007. Consequently, we expect a low degree of convergence in terms of legal unbundling and no convergence towards ownership unbundling on the DSO level (expectation 7). As a result, the degree of convergence of unbundling measures on the DSO level should be lower than the TSO level (expectation 8).

The acceleration Directive introduces, apart from rTPA, TPA for storage, balancing rules, and management unbundling, and the quest for defining national regulatory authorities. Again, the legal text offers the member states considerable leeway and they can either vote for a centralisation of regulatory functions under the roof of one regulator or a distribution of regulatory functions among several authorities. Nevertheless, DG TREN's interpretive note leaves no doubt that the EU prefers the creation of independent national regulators and along with it the centralisation of regulatory oversight. So far, the legal provisions do not allow the expectation that the member states transfer competences to the

national regulator. In other words, it is unlikely that the legal provisions induce a high degree of delta convergence for the indicators belonging to the polity dimension during our time of examination (expectation 9). The indicator based expectations will be examined and answered while assessing regulatory choices in a quantitative manner in the next chapter.

Community legislation started as a rather principle-based regulation and gradually developed. In other words, the nature of the reform (framework regulation) has been preserved and no qualitative shift from a bottom-up approach towards a top-down approach, which determines the member state's instrument choices, has been detected.



8. European gas market regulation:

do regulatory regimes converge towards best practice?

8.1 Introduction

This empirical chapter analyses converging and diverging trends within regulatory regimes in European natural gas markets. The first section outlines the main results of our empirical analysis and answers our first hypothesis. We then leave the regime level and show how these results were generated from an indicator level. In the sequence and grouping suggested in the methodology section, we examine three different modes of convergence (sigma, delta, and gamma) for each indicator. Accordingly, the indicators subsumed under the dimension regulatory function are tackled first, followed by the analysis of those indicators belonging to the dimension regulatory competences. In our definition, sigma convergence indicates harmonisation, whereas delta convergence expresses the direction and degree of harmonisation. Both forms of policy convergence are complementary. Moreover, gamma convergence mainly informs us about countries whose performance is somehow outstanding, be it because some countries move faster towards best-practice or former best-practice countries revise their policy in a less favourable way. Additionally, the index developed earlier allows measuring the degree of delta convergence and thereby seeing how far the old member states are from best practice in terms of gas market regulation (see chapter 5). Last but not least, we confront our expectations concerning the correlation between the success of delta convergence and the degree of legal specification with our empirical observations.

8.2 Regulatory comprehensiveness at a glance

On the basis of our analysis we conclude that the regulatory comprehensiveness in the EU-12 natural gas markets reached only a moderate degree by the end of 2005. A correlation between the legal specification of the European legal provisions and the degree of delta convergence appears to be positive but not very strong. Accordingly, European law that prescribes regulatory instruments can be interpreted as a necessary but insufficient condition to achieve best practice.[67] These two main results will be specified in three steps. First, we summarise the occurrence of the three types of convergence approaches. An indicator-specific analysis is provided in the next sections and the results are discussed in more detail in the related overviews of the dimensions. Second, we analyse the impact of the two dimensions, regulatory function and competences. Third, we assess the increase of delta convergence towards best practice and identify implementation patterns by taking a country perspective.

The analysis of sigma, gamma, and delta convergence is based on 15 indicators consisting of 23 components. A decrease of variance in the form of sigma convergence could be found for 15 of 23 components. Whereas gamma and delta convergence are adequately described from an indicator or country perspective, expressing sigma convergence is better facilitated by comparing changes regarding mean, range, and variance of indicator values. The overall mean of the regulatory comprehensiveness across the old member states decreased by 35 points between 2000 and 2005. At the first measurement point in 2001, the mean was 123 points with a minimum score of 63 in France and a maximum score of 205 in UK. This range of 135 points shows a high degree of variation. The mean gradually increased from 138 points in 2002, to 143 points in 2003, 152 points in 2004, 157 points in the beginning of 2005, and topped by 159 points at the end of 2005. The overall range decreases from 142 points to 88 points, suggesting a moderate sigma convergence.

The majority of gamma convergence was positive, meaning that countries caught up towards best-practice application. Up to 22 components showed positive gamma convergence. The degree of positive gamma convergence reached a high degree for seven components, a moderate degree for 10 components, and a low degree for the remaining five components. The only component that was lacking any movement towards best-practice was ‘allocation method’, because member states considered first-come-first-serve arrangements sufficient and preferred those to the auction mechanism. With 12 of 23 components, the degree of negative gamma convergence is comparably lower. Ten of these indicators showed only a low degree of negative gamma convergence, indicating that a considerably small number of member states were falling behind by applying less favourable instruments. By 2005, only 54% reached best practice, suggesting a moderate delta convergence. From an indicator perspective, the components are relatively evenly distributed, reaching from high to low degree of delta convergence.

With the two dimensions of regulatory comprehensiveness in mind, one might ask which dimension had more impact on minimising the distance to the best-practice model. To answer this, we compare the overall mean change of both dimensions, one expressing the policy and the other the polity dimension in this period. Accordingly, the mean of regulatory functions increased by 28 points, whereas the mean of the regulatory competences only increased by seven points. Therefore, we conclude that the overall mean change for the regulatory comprehensiveness stems mainly from the increasing mean of the regulatory function. This result suggests that countries are more reluctant to change their institutional arrangements by transferring decision power to the regulator than by revising a regulatory instrument. At the end of the period, there is a plus mean change of 36 points. Although the number suggests progress, the overall mean in 2005 is still 71 points under the maximum score.

Another way to approach the impact of the two dimensions on the overall comprehensiveness of gas market regulation in EU is to analyse whether countries deviate much in the two dimensions. The underlying question can be stated 'are policy and polity pointing in the same direction?' To examine this question, we created a scatter plot in which the scores of both dimensions are set in relation to each other and their position is measured in 2001 and 2005. If countries deviate considerably, we would expect countries' positions to be in the upper left corner or lower right corner of the figure. Countries predominantly were positioned in the lower left corner however, and moved upwards towards the higher right corner. Accordingly, the upward trend can be described as a diagonal upward trend from bottom left to top right. The United Kingdom and Spain are the only exemptions, first located in the higher right corner before moving slightly to the left.

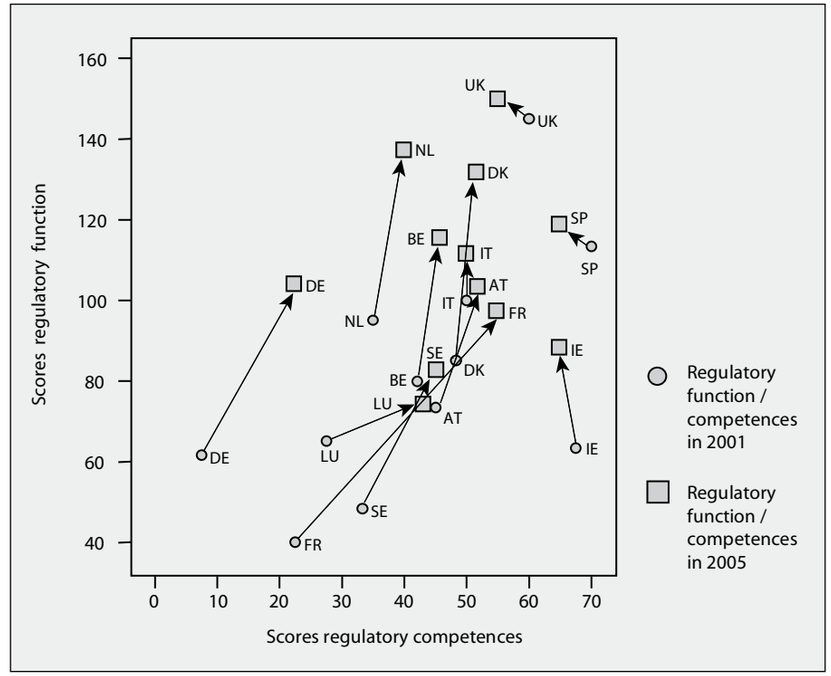


Figure 12: Relation of the dimension regulatory function and regulatory competences in 2000 and 2005

Four patterns can be identified when comparing the degree of delta convergence of the regulatory regimes in European gas markets (EU-12) between 2000 and the end of 2005. First, there are countries whose scores form a steadily increasing slope. Second, some countries' indicators score can be best described as a plateau, suggesting a high degree of stability. Third, we observe scoring patterns shaped like a roof characterised by an increase of scores in the beginning and decrease towards the end of the examination period. The latter phenomenon is partly related to negative gamma convergence or a gradually backward trend. Fourth, there is the group of countries whose scores do not form a pattern or are a mixture of those described.

The overall scoring results of France, Germany, the Netherlands, and Sweden in general steadily increase over time. The Netherlands is a less obvious case of increasing scores due to a small dip in the beginning of 2005. Then, changes in the governance of dispute settlement and capacity allocation abrogated the formation of a stringent slope pattern. The same holds true for Sweden, with a

little dip in the beginning of 2005. The downward trend of 117 points in 2004 to 110 points at the beginning of 2005 is based on changes of the minimum booking period from one-three days to one year and a shift of capacity booking from entry to point to point system. The upward trend, reaching 127 points, stems from the introduction of ownership unbundling and changes of competences regarding the decision of balancing conditions and capacity allocation.

In contrast, the regulatory regime in the UK stayed relatively stable, ranging between 200 and 205 points; its regulatory performance is therefore best described as a plateau pattern. Countries following the roof pattern and eventually becoming more hesitant to implement best-practice measures are Austria, Belgium, Denmark, Ireland, Italy, and Luxembourg. A closer look at these countries reveals that no common behaviour other than applying less favourable measures can be found. These countries do not revise the same indicators, nor do they do it to the same extent (downgrading ranges between 7-20 scoring points). It is also not related to the policy or polity dimension. We can observe only a shared hesitation to move further towards best-practice amongst these countries.

The regulatory regime in Spain achieved quite high and relatively stable scores during the entire period. Still its changes are too severe to speak of a plateau pattern. Especially the dip during 2005 from 193 points to 183 points suggests a mixed pattern. According to our indicator analysis, the lack of published accounts induced some negative regulatory performance. Other than that, no real outstanding cases could be detected.

The countries are grouped into high, low, and middle degree of delta convergence. Into the lowest category fall those countries whose score is below 150 in 2005. The group applying a minimal model consists of Germany, Luxembourg, and Sweden. Although these countries might have been progressive in applying one or two best-practice measures, the overall regulatory comprehensiveness of the regulatory regime is considered less favourable. The middle degree of delta convergence is reached by a score ranging between 150-189 points. An emerging model could be identified in France, Ireland, Austria, Belgium, Italy, Netherlands, Spain, and Denmark. The latter three countries significantly and steadily increased their regulatory comprehensiveness. Therefore, they may be considered forerunners within the group of the emerging model. The most comprehensive regulatory regimes are expected to reach a score above 189. In 2005, only the United Kingdom could reach this level of best practice. The table below exposes the scoring results of each country in more detail between 2000-2005. The United Kingdom held the first rank for most of the time period with either 200 or 205 points. By 2005, Denmark reached the second and Spain the third rank.

	RC 2001	RC 2002	RC 2003	RC 2004	RC 2005	RC 2005 (end)
Austria	118.4	150	171.5	181.5	175.1	155.1
Belgium	122.6	140.9	135.9	165.1	160.1	160.1
Denmark	133.4	140.1	153.4	170	193.4	183.4
France	62.6	67.6	77.6	112.5	147.5	152.5
Germany	69.2	92.6	92.6	92.6	97.5	126.7
Ireland	130.9	155	158.4	143.4	138.4	153.4
Italy	150	171.6	171.6	176.7	169.2	161.7
Luxemburg	92.6	119.2	119.2	120.9	135.9	117.5
Netherlands	130.1	145.1	151.7	159.2	157.5	176.7
Spain	183.4	183.4	188.4	185.1	193.4	183
Sweden	81.7	91.7	91.7	116.7	110.1	127.5
United Kingdom	205	200	200	200	200	205

Table 17: Countries scores for regulatory comprehensiveness

Overall, our results confirm our hypothesis 1 where after a misalignment between transaction characteristics and modes of governance as inherent to the regulation-for-competition in European natural gas markets, is likely to result in a reluctance to apply what the EU perceives as best-practice which in sum hold member states back to move towards (delta) convergence in terms of best-practice regulation-for-competition.

8.3 Convergence of regulatory functions

The following section analyses the eight indicators comprising 15 components in order of their description in the methodology chapter.

8.3.1 Legal market opening

Since the first Directive left considerable leeway to the member states decision, especially in early reform years, the indicator legal market opening is well suited to identify whether member states followed the liberalisation by letter or in spirit. It was only the second Directive accelerating the process of legal market opening by bringing forward the date of full market opening to 1 July 2007. In foresight of the approaching implementation deadline, the Commission did not

pay much attention to the indicator after the fourth benchmarking report was published in 2005.

Originally, the legal provision differentiated between new market openers and advanced market openers. This suggests not only different entry positions, but also creates opportunities for the occurrence of so-called gamma convergence, characterised by different speeds of legal market opening. During the first year of the reform, UK and Germany were the only countries who offered a declared legal market opening of 100%. Both countries, one an advanced market opener and the other a new market opener, suggest a very proactive attitude towards competition supporting market designs. In reality, it may serve as an illustrative example why one single instrument left alone does not translate in a proactive regulation-for-competition. Whereas, inter alia effective third party access in UK assured the practical application of legal market opening, Germany only offered negotiated TPA when legally opening its market. As a result, customers had the legal possibility to switch and change their natural gas provider, but the third party access regime did not support this competition-induced behaviour. In other words, on a formal level Germany appears to be a fast mover, indicating gamma convergence. Nevertheless, this result has to be set in the context and treated with caution.

In terms of legal market opening, the Gas Directives clearly induced converging effects. In 2002, Austria opened its market. Spain and Italy followed the year after. Next, Denmark implemented 100% legal market opening in 2004 and the Netherlands in 2005. By opening their market by 2005, a total of seven countries met the obligations earlier than required. Countries such as Belgium, France, Ireland, and Luxembourg gradually increased the legal market opening up to a high level without reaching 100% in 2005. The exception was Sweden, who only opened half of its market until 2005. Starting as new market openers, France and Denmark demonstrated good process over time. France started off with a legal market opening of a concise 20% and by 2005 offered 70% market opening. Denmark's case is not only remarkable, but at the same time indicates gamma convergence: With a ceiling of 35% market opening in 2003, Denmark then jumps up to 100% in the following year.

As explained earlier, sigma convergence occurs if there is a decrease in variation of policies among the countries under consideration. The decrease of variation is indicated by a decreasing range and standard deviation. Taking into account the 12 cases and observing the legal market opening between 2000-2005, sigma convergence evidently occurs. In 2001, the mean of legal market opening accounted for 62% and gradually accrued to 89% by 2005. In that period, the range was reduced from 80% to 50%, accompanied by a decrease of standard deviation from initially 27 points down to 17 points. By 2005, 7 of 12 countries

had fully opened their gas markets legally. To sum up, 11 of 12 countries legally opened their market more than 70%. The overall mean accounted for nearly 90% legal market opening even before the Directives required full market opening. As a matter of fact, there is evidence for sigma convergence: most of the countries gradually increased the legal market opening between 2000 and 2004, showing through moderate positive gamma convergence 50%. By 2005 a moderate level of delta convergence (58%) was reached, confirming our expectation (1) that legal provisions concerning legal market opening are not ambitious enough to induce a high degree of delta convergence.

8.3.2 Network access conditions and tariffication

The indicator gas network access conditions and tariffication consists of six components and reflects different aspects of the tariff regime and network access conditions. The following portrays each component individually.

Tariff structure

At the beginning of the Reform, the old member states applied a considerable variety of tariff structures. For three (Ireland, Luxembourg, and Sweden) the tariff structure was either not published or its publication was due to limited network capacity considered insufficient to offer market possibilities that would warrant the set up of a tariff structure for third party access. In 2001, only the United Kingdom and Italy offered entry-exit arrangements. In Austria, Belgium, France, and Netherlands network tariffs were distance based; Denmark and Spain started with postalised tariffs. Germany's tariff landscape was too fragmented and based on a variety of tariff structures to find a single label other than "mixed". The different categories Germany received to describe its tariff structure does not indicate several nationwide tariff reforms but shows the difficulties Germany had integrating and harmonising its tariff structures (Lohmann, 2006). In contrast, Ireland and the Netherlands belong to the group of early movers, introducing entry-exit based tariffs in 2002-2003. Belgium and France followed in 2004. The late movers appeared to be Austria, Denmark, and Germany, implementing entry-exit tariffs in 2005. Spain partly revised its postalised system in 2006 by introducing entry-exit tariffs for transport devoted to natural gas re-exported to third countries. At the end of 2005, nine of 12 countries followed the road to entry-exit based tariffs, as promoted by the Madrid Forum and European Commission. Sweden and Luxembourg had earlier applied postalised tariffs, but in 2005 the regulator preferred to choose the category 'not applicable/information not available'. To conclude, sigma and delta convergence occur simultaneously. Moreover, the UK, Ireland, the Netherlands, Belgium, France, Austria, and Denmark suggest positive gamma convergence. By

2005, delta convergence reached a high level (75%). Accordingly, a low degree of precision of European legislation did not translate into a lack or low degree of delta convergence and as a result expectation 2 cannot be confirmed.

Type of capacity booking

In 2001, capacity across Europe was booked based on postalised, point-to-point or entry-exit arrangements and showed a significant degree of variance. Denmark, Spain, and Sweden applied postalised capacity booking, whereas Austria, Belgium, France, Luxembourg, and Netherlands voted for the distance related point-to-point variant. Ireland, Italy, and the United Kingdom started off either entry or entry-exit types of capacity booking. These were followed by Sweden and Luxembourg in 2002 indicating positive gamma convergence. At the same time, Ireland switched back from entry-exit based capacity booking and introduced point-to-point capacity booking (negative gamma convergence). Interestingly, Denmark took a three step approach by first applying postalised capacity booking then point-to-point in 2002, before finally implementing an entry-exit based method. The same can be observed in Austria, starting with a point-to-point capacity booking, moving to cost-reflective variant, and then finalising with entry-exit based capacity booking. Both show how the parties involved, be it regulator, ministry, or transmission system operator, try to find the most appropriate regulatory instrument or label for their practice. A wave of entry-exit application occurred in 2004, when Austria, Denmark, France, and the Netherlands changed their type of capacity booking. By the end of 2005, 10 of 12 member states had implemented entry-exit based capacity booking. The only two exceptions were Ireland and Belgium: Ireland stayed with its point-to-point system and Belgium offered mixed types of capacity booking.

All three types of convergence could be found for the component 'type of capacity booking'. By moving towards an entry-exit system there is proof for sigma and delta convergence. In addition, positive and negative gamma convergence occurred. The former applies to the UK, Ireland, Italy, Sweden, Luxembourg, Denmark, Austria, France, and the Netherlands. Ireland showed the latter with some time delay as well. Expectation 2 does imply a low degree of delta convergence when European provisions do not prescribe the type of capacity booking. Contrary to our expectation, we observe a high degree of delta convergence (83%). One may conclude that the member states dominantly followed the road map to entry-exit system promoted in the context of the Madrid Forum between 2001 and 2004 (see section 5.10.2).

Overall, we observe a decrease of variation with regard to tariff structure and types of capacity booking across the old member states towards entry-exit tariffs. The Commission emphasised that disparity between tariff structure and

capacity booking might cause disadvantages for the network access. The table below demonstrates that seven countries adapted an entry-exit system for both tariff structure and capacity booking. Not covered by this study is the number of entry-exit zones and their effect on harmonisation. Nevertheless, some countries like France and Germany have either reduced the number of entry-exit zones or will in the near future. (European Commission, 2005a: 68-69)

Type of capacity booking	**Tariff structure**		
	entry-exit	**postalised**	**not published/not applicable**
entry-exit	Austria, Denmark, France, Germany, Italy, Netherlands, UK	Spain	Luxembourg, Sweden
point-to-point	Ireland		
mixed (entry-exit/ point-to-point)	Belgium		

Table 18: Tariff system in 2005

Allocation method

In contrast to other components of the tariff system, the allocation method showed almost no variance during the six years of implementing the European gas reform. From the beginning, first-come-first-serve was unchangeably the dominant allocation method in the 12 member states. Accordingly, no sigma convergence occurred. In the UK market auctions are allocating network capacity. Reflecting the demand side orientation of the small Swedish market, the Swedish regulator introduced the allocation principle 'capacity goes with customer' in 2005. As the Swedish authority did not change their practice but instead found a more adequate label, we find no evidence for gamma convergence. Delta convergence occurred only to a low degree (17%). The allocation method chosen by the member states was not determined by the legal provisions. Accordingly, the result confirms our expectation that only a low degree of delta convergence is supposed to be induced by legal institutions.

Tariffs

The previous chapter alluded to the relatively low quality of the data on tariffs. The available data does however, give us some indication of entry barriers new market participants are facing. To compare the tariffs between 2001 and 2005, three tariff groups were created. High tariffs (3.1-5 Euros/MWh) receive low

scores, middle tariffs (2.1-3 Euros/MWh) receive middle scores and low tariffs (0-2 Euros/MWh) receive high scores. According to our classification, the transit countries in the north-west, Belgium, and Netherlands offered low average tariffs in 2001 and 2005, and therefore receive high scores. Tariffs in Austria and Spain appeared equally stable, representing the middle category. In contrast, France, Luxembourg, and Sweden continuously gained low scores due to their high average tariffs in 2001 and 2005. In the first year, the United Kingdom and Italy offered comparably low tariffs, but an increase of the average tariffs by 2005 resulted in middle scores at the end of the examination. Ireland developed exactly the other way around. High scores in 2001 shifted to the low score category in 2005. Germany and Denmark also downgraded. In 2001, Germany and Denmark were in the middle score category, but changed over time to the low score group.

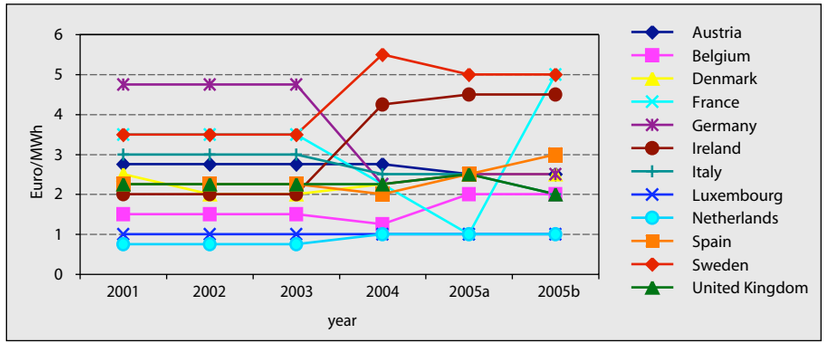


Figure 13: Tariffs in EU-12 between 2001-2005

The lowest tariffs could be found in the two transit countries in north-west Europe, the Netherlands and Belgium. During the entire period, average tariffs in the Netherlands were the lowest across the EU-12. The Netherlands offered an average tariff of 0.75 Euros per MWh during 2000 and 2001. These stunningly low tariffs were only increased up to one Euro per MWh in the subsequent three years. Only Luxembourg was able to compete with the low Dutch tariffs by constantly providing an average tariff of one Euro per MWh as well. Belgium followed closely with a tariff level between 1.25 and 2 Euros per MWh during the same period, starting with 1.5 Euros per MWh in 2001 and levelling at 2 Euros per MWh. We also find relatively low tariffs throughout the examination period in UK, ranging between 2 and 2.5 Euros per MWh.

In contrast, Italy's average tariffs decreased from initially 3 Euros per MWh between 2000-2001 to 2.5 between 2002 and 2003 and shrunk again to a favourable 2 Euros per MWh. Average tariffs in Austria remained pretty stable at 2.75 Euros per MWh. One exceptional year was 2003, when Austrian tariffs averaged 2.5 Euros per MWh. In Spain average tariffs started at moderately low level of 2.25 Euros per MWh in 2000, but more or less steadily increased to 3 Euros per MWh by 2004. Only during 2002, Spanish average tariffs went down from 2.25 E/MWh to 2.00 E/MWh, to jump up to 2.5 Euros the following year.

Positive gamma convergence was found in the case of Germany. Average German tariffs started with 4.75 Euros per MWh and halved by 2002. During 2004, the German average tariffs constituted 2.5 Euros per MWh. Nonetheless, the reverse trend occurs as well. In Denmark for instance the average tariffs double between 2004 and 2005 from 2 to 4 Euros per MWh. The same can be observed in Ireland between 2001 and 2002. Tariffs in France even first decrease from 3.5 Euros per MWh in 2000 to 1 Euro per MWh in 2003, before jumping up to 5 Euros per MWh in 2004.

There are at least three cases of negative gamma convergence. Moreover, in Spain and Sweden tariffs are gradually increasing. Whereas Spain started with a moderate 2.25 Euros per MWh in 2000 this rose to 3 Euros per MWh in 2004. Sweden even started with high average tariffs of 3.5 Euros per MWh, and rose to 5.5 Euros per MWh in 2003, declining only to 5 Euros per MWh in 2004.

The overall range of network charges did not decrease between 2001 and 2005, levelling at 4 Euros per MWh.[68] Instead, it even goes up to 4.5 Euros per MWh during 2002. Looking at the minimum and maximum of the tariffs over time, no decrease of tariffs could be measured. In 2000 and 2001 the minimum tariff accounted 0.75 Euros/MWh and the maximum tariff was 4.75 Euros/MWh. During 2004, the tariff minimum accounted 1.0 Euros/MWh and reached a maximum of 5 Euros/MWh. The reform goal, harmonisation and increasing efficiency in the form of lowered tariffs could not be reached; at least our data suggests little progress in this regard. This observation is confirmed when analysing the overall mean changes. The overall tariff mean for EU-12 increased from initially 2.5 Euros/MWh in 2000 (equivalent to t1) to 2.9 Euros/MWh during 2004 (equivalent with t4=2005). To conclude, sigma convergence did not occur and only a low degree of delta convergence (25%) was evident. Gamma convergence could be found in several cases. France and Germany even showed both forms.

Incentive regulation

In the beginning of the reform, incentive regulation was not in place in 10 of the 12 countries. This situation changed considerably by the end of 2005, when five

member states had introduced incentive regulation. Throughout time, sigma convergence decreased and a movement towards delta convergence is apparent.

As usual, the regulatory practice in UK served as prototype for incentive regulation in Europe. There, price-cap regulation was introduced in 1991 (Waddams Price, 1997) followed by cycles of methodological reformulations and improvements. Taking on the British example, Italy adopted revenue-cap regulation for transmission tariffs with the implementaion of the first Directive (Autorità per l'Energia Elettrica e il Gas, 2005, July 31). Since then, transmission tariffs are regulated via a revenue-cap, "...with the exclusion of the commodity charge subject to a pure price-cap" (Cavaliere, 2007: 15). Ireland was another early mover introducing revenue-cap regulation in 2002 (Commission for Energy Regulation, 2002). One year later, Denmark started to regulate annually the revenues of gas distribution companies (*Energitilsynet*, 2002). In 2003, the Spanish ministry of industry, tourism, and commerce released a decree which introduced revenue-cap regulation. The general rate of return is set for old investments, whereas the rates of return for investments are regulated on a case by case basis. The Netherlands imposed a mixture of revenue-cap and price-cap regulation in 2005 (Ministry of Economic Affairs, 2005a). After strong opposition from industry the revenue cap was lifted in 2007 (Ministry of Economic Affairs, 2007, March 29). Italy, the UK, and Ireland suggest positive gamma convergence, a trend supplemented by Denmark Spain, and Netherlands. The latter fell back in the end of 2005, indicating negative gamma convergence. In contrast, Austria, Belgium, France, Germany, Luxembourg, and Sweden had no incentive regulation in place throughout the entire period of examination. France is in the process of examining advantages and disadvantages of incentive regulation for the French gas market (*Commission de Régulation de l'Energie*, 2005: 55). Germany just recently voted for a revenue cap system (Gas Matters Today, 2007, September 21). Austria and Belgium have plans to introduce incentive regulation in 2008. It is noteworthy that the labels describing the incentive regulation employed mostly refer to the dominant mode of incentive regulation. The applied incentive regulation often differentiates between different levels or parts of the gas value chain such as transmission tariffs, distribution tariff, or for instance an interconnector. Moreover, the regulators across Europe distinguish between old and new investments when applying a regulatory instrument. The most detailed overview concerning the scope and type of incentive regulation member states applied is provided by the 2005 GTE report (Gas Transmission Europe (GTE), 2005, June). To conclude, incentive regulation is not prescribed by the European provisions, as an effect we see expectation 2 to be partially proven by observing a moderate degree of delta convergence.

Minimum booking service

In the first place, incumbents were reluctant to make the transport market more flexible. Initially the common minimum booking period for firm services was one year, not leaving much room for flexible transport services and trade opportunities. The UK was the exception to the rule, offering a minimum booking period of one-to-three days. Apart from Italy (for which no information on minimum booking periods was available) all other 10 member states applied the one-year rule. Within the member states one can observe a clear hesitation to lower the minimum booking period to one-to-three days. Belgium and Italy employed a one-month period in 2002, followed by the Netherlands in 2003. In 2004, Austria offered monthly booking periods and Belgium decreased its minimum booking period to one week. In contrast, Ireland and Luxembourg retained the minimum contract duration of one year. Further developments in the Italian and Swedish gas markets are a little puzzling. First, Italy gradually lowered its minimum booking period down to one-to-three days in 2004, but then in 2005 fell behind by offering a minimum booking period of one year. The same holds true for Sweden, signifying negative sigma convergence in both cases. As a consequence, the indicator minimum booking period exhibits a relatively wide variance, instead of sigma convergence. Austria, Denmark, Germany, the Netherlands, Spain and the United Kingdom are the most flexible, offering one-to-three days of minimum booking service. Belgium allows weekly and France monthly minimum booking periods. In contrast, Ireland, Italy, Luxembourg, and Sweden allow only transport contracts with a minimum booking period of a year for firm services.

Comparing the situations in 2001 and 2005, there is no decrease of variance to indicate sigma convergence. Although the variance might not decrease, the minimum booking services become more flexible over time in old Europe. In other words, the best practice of one-to-three days is not reached by the majority of countries, but the distance to this goal is decreasing, pointing to moderate delta convergence (50%). Contributing to this development are Austria (2005), Denmark, Germany, Netherlands, Spain, and the UK (positive gamma convergence); Italy and Sweden abandoned the one-to-three day contract duration rule (positive and negative gamma convergence). Expectation 2 can only be partially confirmed by the observations of this indicator component.

Use it or lose it

Anti-hoarding mechanisms were not popular in European gas markets before the introduction of the gas reform. Only three countries (Netherlands, Spain, and the UK) offered a use it or lose it provision in the early days. For Sweden this measure has not been applicable, because the Swedish network is under-utilised

and therefore there are no incentives for hoarding capacity in the first place. Other European markets were characterised by a lack or scarcity of transport capacity. To meet contractual congestion in European gas networks the reform targeted those countries which did not offer use it or lose it arrangements in 2001, including Austria, Belgium, Denmark, France, Germany, Ireland, Italy and Luxembourg. The implementation of UIOLI arrangements took place in three waves. First, Denmark, Ireland and Italy went ahead in 2002, implying sigma convergence. Second, Austria and Belgium followed in 2004 with the last movers in France and Germany in 2005. In 2005, all old member states had formally implemented anti-hoarding mechanisms, where it was applicable. Regulators in Ireland, Luxembourg, Sweden, and the UK claimed for different reasons that imposing anti-hoarding measures was not necessary, due to either a lack of capacity congestion or effective secondary trading. A view held by the relevant national regulators was not officially questioned by the EC in their reports. Consequently, a high degree of delta convergence is reached for UIOLI provisions and our expectation (2) cannot be confirmed. All three types of convergence can be ascertained for the UIOLI indicator.

8.3.3 *Balancing period*

In 2001, balancing periods ranged from hourly to non-transparent arrangements. Most of the countries were distributed in two groups, each consisting of five member states. In the first group, hourly balancing was required (Austria, Belgium, Denmark, Germany and the Netherlands). The second group (France, Ireland, Luxembourg, Spain and UK) voted for a daily balancing period. The Commission did not receive any information concerning the balancing period Sweden applied at that time. Italy offered a mixture of daily and monthly balancing arrangements in the first year, but then decided to allow only daily balancing periods thereafter (positive gamma convergence). Other countries proceeded the other way round. The Netherlands moved in 2002 from a single time frame balancing period to a dual arrangement, and since then proffers hourly and daily balancing periods. Germany followed the same scheme in the beginning of 2005; by the end of 2005 the EC received the notice that only hourly balancing periods are required in Germany. Between 2001 and 2005, we observe more countries switching from hourly to daily arrangements, namely in 2003/2004 Denmark and in 2004/2005 Belgium and Sweden were revising its balancing arrangement. At the end of 2005, nine countries preferred daily balancing periods and followed the Anglo-Saxon practice. There is a clear decrease of variance, pointing to sigma convergence. In 2005, only three countries deviate. The Netherlands also deviate by offering partly hourly and partly daily arrangements. Opposed to the Anglo-Saxon daily balancing practice, Austria and Germany required hourly balancing.

Keeping in mind that the European Union did not specify preference with regard to hourly or daily balancing periods, the delta convergence shows in a less strict interpretation even stronger, cumulating to 100% by the end of the examination period. Consequently, expectation 2 cannot be confirmed.

8.3.4 *Third party access to storage*

In the beginning, third party access was formally granted in Austria, Denmark, Italy, Netherlands, Spain, United Kingdom, whereas Belgium, France, Germany, Ireland, Luxembourg, and Sweden did not foresee negotiated or regulated TPA to storage facilities. In 2002, Germany made the first move and in 2004 Belgium and France caught up by introducing TPA for storage. Sweden decided to implement open access to its storage facilities by 2005. Exceptions are Ireland and Luxembourg. Ireland provides extra natural gas storage and additionally may use the Interconnector to the UK market to balance its moderate seasonal fluctuations (International Energy Agency, 2003a: 69-70). Nonetheless, no formal third party access to gas storage was granted. An exceptional case is Luxembourg where no natural gas storage is available. Instead, the de facto monopolist *Société de Transport de Gaz* (SOTEG) is able to fulfil the balancing function that gas storage usually offers through the flexibility measures arranged in the long-term contract with the neighbouring supplier *Distrigaz*. This arrangement does secure the public need of security of gas supply and allows the transmission system operator to fulfil its balancing mandate. It does not however, offer any other market participant access to storage or its related balancing opportunities. For this reason, Luxembourg receives a low score. (International Energy Agency, 2004a: 60).

The analysis clearly indicates a decrease of variance with regard to third party access to natural gas storage. Thus, 10 countries provided the formal conditions of granting third party access to storage by 2005. Consequently, not only sigma convergence occurred, but also a high degree of delta convergence (83%) was reached. Moreover, positive gamma convergence can be found due to progressive choices made in Austria, Belgium, Denmark, France, Germany, Italy, the Netherlands, Spain, and the UK. The second Directive prescribed third party access to storage by 1 July 2004. Accordingly, we expect to see a high degree of delta convergence (expectation 4) from 2004 onwards. This expectation was confirmed in the case of Belgium, France, and Sweden, which contributed in 2005 to the high delta convergence.

8.3.5 *Gas release programme*

Although the European Continental market lacked liquidity, gas release programmes enjoyed only meagre application at first. The UK, and at some

distance Spain, were clearly the forerunners that showed other countries how gas release programmes in practice induce market liquidity and competition. In 2001, the Italian ENI started its so-called "innovative sales" by releasing capacity for the Italian market. These "innovative sales" were not conducted under regulated terms and were replaced by an official gas release programme by the end of 2004. Other countries such as Austria (2003) and Germany (2004) hesitantly implemented gas release programmes. By 2005 seven countries including Denmark, France, and Italy were running a gas release programme, auctioning imported gas from incumbents. The indicator clearly shows different speeds of implementation: Whereas Belgium, Ireland, the Netherlands, Luxembourg, and Sweden are not officially planning to implement a gas release programme, the UK and Spain have already completed the programme. Summing up, 2/3 of the sample countries met best-practice by implementing a gas release programme. Although the necessary condition to fulfil moderate delta convergence is thereby met, an overall decrease of variance cannot be reported. Instead, the range of values increased between 2001 and 2005. Last but not least, the UK, Spain, Germany, Austria, Italy, Denmark, and France are examples of positive gamma convergence. Although the adoption of gas release programmes was not prescribed by the legal provisions a moderate degree of delta convergence occurred, partially confirming our expectation (2).

8.3.6 Trading facilities

Although the overall measures of the European gas market regulation aim to stimulate trade and thereby achieve effective gas-to-gas competition, no common European virtual trading point has been created so far. The following discussion reveals how far the EU is still from that aim. On the national level, the governments and regulators were at best setting a framework, but did not prescribe the creation of trading mechanisms. This was pretty much left up to the companies and proves to be an evolutionary process with different speeds and scope.

In its review of European spot gas markets *Heren* refers to NBP as virtual spot market and names Bacton and Fergus in the UK, *Zeebrugge* in Belgium, and *Bunde* in Germany where spot prices are generated (*Heren Energy*, 2005, 27 May). Additionally, Austria has created a gas hub at *Baumgarten*. In general, natural gas markets show huge differences in terms of traded volumes, number of short-term or forward trades, variety of contracts offered and number of players involved (Wright, 2006). Referring to different modes of trading, we can divide the countries into three groups: mature natural gas markets, developing natural gas markets, and infant natural gas markets (see section 5.10.6). Until now, the UK is the only European country offering a mature spot market and full-fledged

trading facilities since the introduction of the European Gas Reform. In 1996 the National Balancing Point (NBP) was created. Since then, the NBP has functioned as a virtual trading point for the UK market. Two years later, the *Interconnector Bacton-Zeebrugge* began operation and thereby marked the beginning of UK-Continental gas trading. Wright offers an excellent reconstruction and analysis of the maturing UK gas market by tracing the evolution of gas prices and gas trading in the UK (Wright, 2006).

As indicated earlier, Belgium, the Netherlands, Germany, and Austria belong to the group of developing natural gas markets. There, the second rank holds Belgium and the Netherlands. From the start, Belgium benefited from the Interconnector, the pioneer gas hub on Continental Europe. Within the recent years, Belgium's hub became an active and liquid trading point in north-west Europe. Initially, the Netherlands and Germany shared a hub at the border points *Bunde/Oude*, where several pipelines from Germany, Norway, and Russia link with the Dutch pipeline network. Some trading evolved only from 2002 but the hub has been abandoned (Lohmann, 2006). A year later, the Dutch Gasunie set up the Title Transfer Facility (TTF). Since then the TTF has functioned as a virtual trading point, allowing natural gas trades within the Dutch network (Gas Transport Services (GTS), 2007). Over the years the idea evolved to integrate trading facilities in the British, Belgian, and Dutch gas markets, establishing a common north-western market area.

> In June 2004, APX (Amsterdam Power Exchange – owner of OCM operator EnMO) in partnership with Endex (Dutch-based Energy Derivatives Exchange) signed an agreement with Huberator to open a full-fledged, screen-based Gas Exchange (online market and clearing services) at Zeebrugge in January 2005. (Wright, 2006: 65)

Since 3 February 2005, the exchanges APX Gas NL and APX Gas ZEE have been integrated with the established UK Gas Exchange, APX Gas UK, which enables online transactions to be fully cleared and conducted anonymously. Although there are clear attempts to integrate trading facilities, Neumann et al. have demonstrated that trading activities have so far not resulted in price convergence between British and Continental markets (Neumann, Siliverstovs, and von Hirschhausen, 2006). Just recently, the APX group announced the full integration of UK Gas and continental gas onto a single trading platform by June 2007. Moreover, APX declared "APX Gas UK (NBP), APX Gas NL (TTF), and APX Gas Zee (Zeebrugge) will be consolidated onto the trading system EuroLight, which will also include a common clearing." (Gas Matters Today, 2007, May 9: 3).

The fusion of three trading platforms is a market induced development; it still goes with and complements the European regional initiative promoted by CEER/ERGEG.

The Dutch-German gas hub (Oude/Bunde/Emden) was established in 2002 by creating first the EuroHub BV in February and later in October the north-west European Hub service company (HubCo). Both hub operators merged in 2003 into EuroHub GmbH (Lohmann, 2006: 160-162), but the shareholder of EuroHub GmbH suspended its activities already in 2006. German gas trading is developing at a very slow pace. Before the creation of gas hubs or trading points, trading occurred in the regional markets (BEB, EON-Ruhrgas etc). Only by October 2006, the new German energy law foresaw the establishment of virtual trading points. The lack of liquidity and the fragmented structure of the German gas market with 19 initial market areas were the main obstacles for establishment of an active OTC market. The recently established regulator announced that they are planning to reduce the number of market areas to 10 to increase the attractiveness of trading (Gas Matters Today, 2007, April 12). The establishment of the European Energy Exchange is supposed to accelerate German gas trade. The opening was scheduled for 1 July 2007, but was postponed until autumn 2008. In anticipation of the European Energy Exchange, BEB, Erdgas Münster Transport, Exxon Mobil Gastransport Germany and EWE Netz plan to merge their L-gas market areas in Germany into one joint market area by October 2008 (Gas Matters Today, 2007, 11 September).

The group of infant natural gas trading markets consists of the other seven countries: Denmark, France, Ireland, Italy, Luxembourg, Spain, and Sweden. Although we cannot fully map their trading facilities, we would like to give reasons why they were subordinated into this category. Some of the countries established virtual title transfer points in the second half of the Gas reform. Nevertheless, the absence of gas hubs and/or significant volume of trading does not allow to speak of anything other than infant trading facilities. This is the case in Denmark, where in 2004 the GTF was introduced and more trading is planned. France did introduce virtual title transfer points for five zones of the transmission network, but the European Commission does not observe NBP type trading in 2005. In Italy, a virtual balancing point (*Punto di Scambio Virtuale* (PSV) was established; where according to the EC in 2005 limited trading took place (European Commission, 2005a: 33; Harris and Jackson, 2005; Héritier, 2005). Ireland has an interconnector pipe starting at the Scottish town of Moffat, ending near Dublin on the east coast of Ireland. Until now, the direction of gas flow is only in one direction from UK to Ireland. At this interconnector no significant trade is taking place other than the old-fashioned bilateral long-term supply contracts. In a comment to the Regulator, the Irish Bord Gais does not

see the need to put up sophisticated trading facilities (Commission for Energy Regulation, 2007; International Energy Agency, 2003a). In fact, Luxembourg might be too small as it would justify the establishment of a trading platform of its own. Nevertheless, Luxembourg has not made any effort to enable trading trough cooperation with Belgium or Netherlands for instance, or at least such a proactive attitude has not been reported. Spain does not have a gas hub or any other significant trading facilities. Instead, the Spanish government is in the stage of taking some legal measures such as fixing lower tariffs and introducing transparent conditions for TPA to promote trade by making trading activities more profitable. The EC detected limited activities in Spain of NBP type trading in 2005. Sweden's gas market as such is in its infancy, not only trading wise. (International Energy Agency, 2004a, 2004b, 2005; Rasines García, 2006).

To sum up, in 2001 it was only the UK market which had a mature gas trading market and Belgium which started to develop its trading opportunities, whereas all the other 10 European markets were in their infancy. Some dynamics evolved in the Netherlands and Germany in 2002. In 2003 Austria developed some trading facilities. Comparing the variance with regard to trading facilities in 2001 and in 2005, there is a slight positive shift towards increasing trading facilities in the European Union. Although delta convergence occurs, no significant decrease of variance suggesting sigma convergence could be observed. The UK, the Netherlands, and Belgium show evidence for positive gamma convergence, whereas Austria and Germany are less clear cases. For trading facilities, our expectation (2) holds: a low degree of delta convergence (8,3%) corresponds with objective based legal provisions.

8.3.7 Unbundling on transmission system level

Basic unbundling model TSO

Until July 2004, member states were not obliged to assure legal unbundling, which explains why in 2002 four different modes of unbundling were applied across Europe. The first group consists of France, Germany, Luxembourg and Sweden, separated only by the accounts of the incumbent and its transport arms. The second group is characterised by the application of legal unbundling, established in Austria, Belgium, Denmark, and Italy. Third, the Netherlands and Ireland even voted for management unbundling. Fourthly and most forcefully the UK and Spain went ahead by implementing ownership unbundling. Between 2002 and 2005, UK, Austria, and Belgium remained unchanged, UK maintaining ownership unbundling and two remaining on the level of legal unbundling. Positive moves from legal unbundling to ownership unbundling were taking place in Denmark (2002-2004), Italy (2004-2005), the Netherlands (2004-2005),

and Sweden (2005), indicating positive gamma convergence. Conversely, Spain revised its ownership unbundling by falling back to legal unbundling in 2004. Consequently, Spain appears to be a case of both positive and negative gamma convergence. A similar case is Ireland. The Irish regulator declared that they had applied management unbundling until the beginning of 2005. The fifth benchmarking report states quite the opposite when reporting without giving any further explanation that Ireland has not ensured legal unbundling in its market. One can only wonder whether this change of labelling is due to more insights into the unbundling practice of gas companies operating in the Irish gas market, changing definitions of management unbundling, or in fact reflects a real step backwards (European Commission, 2005a: 81). The same holds true for Luxembourg which started with unbundled accounts, advanced by implementing management unbundling in the fourth benchmarking report, but did not offer legal unbundling by the end of 2005. In the beginning of 2005, the German gas landscape showed initial signs of legal unbundling, but predominantly solely accounts were separated. By the end of 2005, German gas trade and transport companies were considered partly legal unbundled in 2005.

Altogether the variance of the indicator did decrease, which allows us to attest sigma convergence. The trend towards delta convergence certainly holds true towards legal unbundling and confirms our expectation (6). Delta convergences towards ownership unbundling occurred to a much lesser degree, reaching only a moderate level (41.7%). In 2005, five member states met the legal unbundling requirements and another five exceeded the Directives yardstick by implementing ownership unbundling. The European Commission officially stated its preference for ownership unbundling in the new energy package published in January 2007. This preference was reinforced in the context of the Third Energy Package in which the Commission proposes the introduction of ownership unbundling. Seven countries still have to make the step towards ownership unbundling to achieve best-practice across the old member states: Austria, Belgium, France, Germany, Ireland, Luxembourg, and Spain. Yet, this step is a fundamental one. For this reason, most of those countries opposed the Commissions proposal of the third Energy package to prescribe ownership unbundling.

Published accounts on TSO level

The publication of accounts has been mandatory since the first Directive came into force. Therefore we expect full convergence throughout the entire observation period (expectation 6). By 2002, all old member states except France and Ireland published accounts of natural gas companies, distinguishing between trade and transport services in their national markets. Stimulated by the legal rule, the member states entered with a high level of harmonisation at the beginning of

the reform, suggesting an 83.3% positive gamma convergence in the first year of monitoring. Surprisingly, the trend did not develop towards full convergence in later years, but instead more disparity evolved. In Germany published accounts were the rule until 2004. Afterwards the European Commission's reports declare the absence of published accounts. 2005 turns out to be an interesting year, when most changes happened. France and Ireland advanced and published their accounts, whereas in Austria, Italy, and Luxembourg published accounts were not the common practice anymore. As a matter of fact, the two former cases show positive gamma convergence and the latter negative gamma convergence. The reasons for not publishing the accounts are unclear, because the relevant EU documents make no reference to this phenomenon. Supposedly, more comprehensive monitoring revealed the gap between the declaration of published accounts and the quality of those publications. Comparing the situation in the beginning of the reform and 2005, the variance of this indicator increased and shows a reverse trend. Eight countries followed the Directive requirements and four countries deviate from the rule. Accordingly, sigma convergence did not occur and a moderate degree of delta convergence was reached in 2005. Thereby expectation 5 is rejected.

8.3.8 Unbundling on distribution system level

Basic unbundling model on DSO level

The second Gas Directive envisaged legal unbundling of the distribution system operators by July 2007. Notably, the distant implementation deadline together with the 100.000 costumer exemption did not urge the member states and natural gas undertakings to quickly unbundle the natural gas trade and transport on the distribution level (European Commission, 2005c: 81-82; Gomez-Acebo, Abogandos, and Russels, 2005). Therefore, we expect a low degree of delta convergence towards legal unbundling and no delta convergence towards ownership unbundling on the DSO level (expectation 7). In the first assessment in 2002, unbundling on the distribution level pretty much resembled the level of unbundling on the transmission level of that year. The member states voted dominantly and equally distributed in groups of five either for account unbundling or legal unbundling. France, Germany, Luxembourg, the Netherlands, and Sweden decided for the minimalist approach of separating accounts for natural gas trade and transport. Austria, Belgium, Denmark, Italy, and Spain implemented legal unbundling of trade and transport services and thereby exceeded the legal obligations of the first Directive. According to benchmarking reports, Ireland appeared to be more advanced by implementing management unbundling. Only the UK demonstrated best-practice at that time by assuring ownership unbundling.

The mode of unbundling in five countries remained unchanged: the United Kingdom preserved ownership unbundling and Austria, Belgium, Denmark, and Italy favoured legal unbundling throughout the time of examination. The Netherlands legally unbundled its natural gas transport on the distribution level in 2004. Furthermore, the Dutch ministry of economic affairs proposed a legal act that foresees ownership unbundling being implemented by January 2008 (Gomez-Acebo, Abogandos, and Russels, 2005: 5). These countries can be considered progressive; the other countries were more reluctant to ensure legal unbundling of the distribution system operators.

France, Germany, Ireland, Luxembourg, and Spain so far show no signs of fulfilling the legal requirements before its implementation deadline. France and Germany explicitly intend to not implement legal unbundling of the gas distribution system operators before July 2007 (European Commission, 2005c: 82; Gomez-Acebo, Abogandos, and Russels, 2005: 5). Both countries and Austria also made use of the 100,000 customer exemption. In the process of completing the transposition of the unbundling provisions concerning the DSO, Austrian regulation has lowered the threshold of the exemption from 100,000 to 50,000 customers (ibid).

In earlier years, Ireland and Luxembourg claimed to provide over management unbundling. In contrast, the benchmarking reports considered even the conditions for legal unbundling unfulfilled (European Commission, 2005a: 82). So far it is unclear whether these shifts are the product of different definitions of management unbundling or the regulator investigated the unbundling praxis more precisely than earlier. In the EC progress report, Spain does not receive a label, instead referring to the fact that the single DSO is the default supplier (European Commission, 2005c: 82). Gomez-Acebo et al. show in their unbundling analysis that legal unbundling in Spain on DSO level is legally only partially transposed. Due to its market size Sweden is an exceptional case in gas market regulation, especially when it comes to unbundling of the distribution system operator. With only 55,000 customers in the distribution portfolio, the unbundling requirements do not apply. At the same time Sweden is not moving forward under its own volition for regulation-for-competition by applying legal unbundling regardless of its formal exemption. For this reason, the indicators score for Sweden is relatively low. (Gomez-Acebo, Abogandos, and Russels, 2005).

Unbundling the distribution system operators shows quite unsatisfactory results in terms of harmonisation and the willingness to implement more than the minimal requirements set by the unbundling provisions. At the end of 2005, the European Commission considered only four countries, Austria, Belgium, Denmark, Italy and Netherlands as legally unbundled and the United Kingdom as the only country practicing ownership unbundling. The other seven countries

are hesitant to transpose the unbundling obligations earlier than the second Gas Directive requires. Only the United Kingdom showed a positive gamma convergence (8.3%) when applying ownership unbundling for distribution system operators. Consequently our expectation is partially right, as the degree of delta convergence is not zero but marginal. Below the level of best practice we see some improvements in Austria, Belgium, Denmark, Italy, and the Netherlands towards legal unbundling. For this reason, low delta convergence can be detected, which confirms the initial expectation with regard to legal unbundling at DSO level. Yet, the variance of the indicator only marginally declined, suggesting a very weak sigma convergence.

Published accounts on DSO level

The publication of accounts for the distribution level has been mandatory since the first Directive came into force. Therefore, we should detect full convergence throughout the entire observation period (expectation 5). By 2002, eight out of 12 countries claimed to meet this obligation: Austria, Denmark, Germany, Italy, the Netherlands, Spain, Sweden, and the United Kingdom. French, Belgian, Irish, and Luxembourg natural gas companies did not facing the publication and separation of their trading and transport activities. And until 2005, little change took place according to the EU documents. In 2004, Germany's optimistic declaration was worked over, saying the publication of accounts is not assured. Italy and Spain revised their proclamation of published accounts of distribution system operators one year later. The Luxembourg practice of account publication was even changed twice, claiming that publication of accounts took place in 2004, but was revised by the end of 2005. In other words, there is evidence for four cases of negative gamma convergence. Only Ireland adjusted upwards in 2005, indicating positive gamma convergence. Consequently, the group of countries publishing accounts on the DSO level over the whole period of examination includes Denmark, the Netherlands, Sweden, and the United Kingdom. In contrast, France only maintained its non publication policy.

By the end of 2005, only six countries fulfilled the obligation to publish accounts of the distribution system operators; the other six member states did not fulfil the requirement. Consequently, the indicator shows an increase of variance. As a matter of fact, sigma convergence did not occur and only a moderate level of delta convergence (50%) could be reached. As noted earlier with regard to the similar component of indicator seven (publication of accounts on the transmission level), the reasons for countries changing implementation declaration are not explained in the benchmarking reports. Consequently, European legal provisions did not have a strong effect on the implementation policy in the member states as expected.

8.4 Overview: convergence of regulatory functions

The following section begins by summarising converging trends focusing on indicators representing the dimension regulatory function. Sigma, gamma, and delta convergence are analysed by combining an indicator with a country perspective. Thereby we explore patterns of member states implementation and measure the distance of the best practice for each country.

In seven cases we observe no decrease of variance. A lack of harmonisation is evident for the indicator and components 'allocation method', 'tariff', 'incentive regulation', 'minimum booking period firm services', 'trading facilities', and 'publication of accounts on TSO and DSO level'. Sigma convergence is predominantly induced by the other nine indicators. The decrease of variance can also be measured for the dimension regulatory function.

The member states scores for the dimension of regulatory function increase yearly by approximately three-10 points. Beginning in 2001 with 81 points, adding up to 92 points in 2002, 95 points in 2003, the scores reached 104 points in 2004, and closed with 110 points in 2005. At the same time the range decreased from initial 105 points in 2001 to 75 points in 2005.

The shift towards a competition supporting regulatory regime is to a large extent generated by positive gamma convergence. Within the dimension regulatory function, positive gamma convergence occurs predominantly moderately. Table 19 displays these indicators. With regard to 'tariffs', 'balancing period', and unbundling measures on the distribution level a low degree of positive gamma convergence showed. Whereas components such as 'type of capacity booking', 'UIOLI', 'third party access to storage', and 'publication of accounts of TSO' even showed a high degree of delta convergence. On the contrary, regulatory inertia became visible in the case of five indicators where a low degree of negative gamma convergence was found. Those are 'type of capacity booking', 'minimum booking period firm services', 'unbundling on the transmission level', and the 'publication of accounts for TSO and DSO'.

Network access conditions and tariffication were prominent features of the gas reform; the EC in conjunction with national regulators CEER and ERGEG greatly emphasised harmonisation and the promotion of competition-inducing and promoting measures. For this reason, the success of these efforts is given more attention and the indicator network access conditions and tariffication is therefore considered separately. The indicator is comprised of seven components, five alone which confirm a moderate or high degree of delta convergence, meaning a clear trend towards best practice over time. This is remarkable and unexpected, when considering that specific regulatory instruments were not prescribed by the legal provisions. The introduction of auctions as allocation

method and the reduction of tariffs across Europe were less successful. For some countries the component tariff shows even reverse trends towards higher tariffs. Denmark, France, and Ireland's tariffs formerly were in the upper middle range tariff zone and even increased their tariffs over time.

Type of convergence		Sigma	Gamma	Delta
Indicator 1	Legal market opening	X	(+) 50%	58.3%
Indicator 2	Gas network access conditions and tariffication			
Component 2.1	Tariff structure	X	(+) 58.3%	75%
Component 2.2	Type of capacity booking	X	(+) 75% (-) 8.3%	83.3%
Component 2.3	Allocation method		0%	16.6%
Component 2.4	Tariff		(+) 33.3% (-) 75%	25%
Component 2.5	Incentive regulation		(+) 50% (-) 8.3%	41.7%
Component 2.6	Minimum booking period firm service		(+) 58.7% (-) 16.6%	50%
Component 2.7	Use-it-or-lose-it (UIOLI)	X	(+) 75.5%	100%
Indicator 3	Balancing rules	X	(+) 8.3%	100%
Indicator 4	TPA storage	X	(+) 75%	83.3%
Indicator 5	Gas release programme	X	(+) 58.3%	58.3%
Indicator 6	Trading facilities		(+) 41.7%	8.3%
Indicator 7	Network unbundling Transmission System Operator (TSO)			
Component 7.1	Basic unbundling model TSO	X	(+) 50% (-) 8.3%	41.7%
Component 7.2	Publication of accounts TSO		(+) 83.3% (-) 33.3%	66.7%
Indicator 8	Network unbundling Distribution System Operator (DSO)			
Component 8.1	Basic unbundling model DSO	X	(+) 8.3%	8.3%
Component 8.2	Publication of accounts DSO		(+) 66.7% (-) 33.3%	50%

Table 19: Occurrence and degree of convergence (dimension regulatory function)

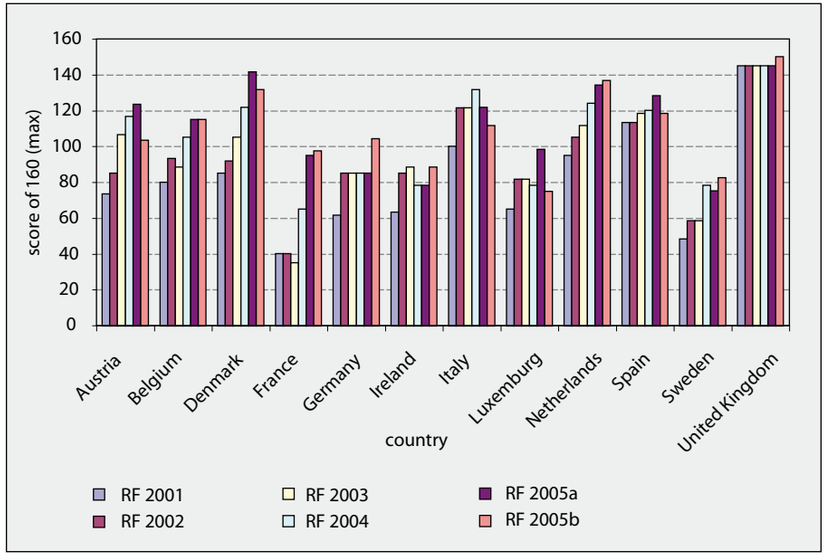


Figure 14: Regulatory function (2000-2005)

Figure 14 shows the countries scoring results for the indicators describing regulatory functions. Accordingly, we observe countries of all four patterns. Four countries develop improvement in a single direction and thereby follow a slope pattern (Belgium, Germany, the Netherlands, and Sweden). The British regulatory regime remained stable over the entire period and resembled a plateau. The scores of most countries form a roof. Austria, Denmark, France, Italy, Luxembourg, and Spain manage to increase their scores during the first year scale down in the second half. The angular point of this pattern differs from 2004 in Italy and 2005 in Austria, Denmark, France, Luxembourg, and Spain. In contrast, no significant pattern could be identified in Ireland. The figure does not show any constant development. The exception to the rule is in fact the UK. Unsurprisingly, the Anglo-Saxon model which served in many ways as a model for best-practice in European gas market regulation did not need to adjust during the gas reform.

In general, the indicators representing the dimension of regulatory function show a moderate degree of harmonisation (54%) and trend towards best practice. A high degree of delta convergence could be achieved for the component 'tariff structure', 'type of capacity booking', 'UIOLI', balancing period' and the indicator 'third party access to storage'. The majority of indicators developed

a moderate degree of delta convergence including 'legal market opening', 'incentive regulation', 'minimum booking period firm service', 'gas release programme', basic unbundling model for the transmission system operator, and publication of accounts on transmission and distribution level. In four cases delta convergence is low: 'tariffs', 'allocation method', 'trading facilities', and unbundling on the DSO level.

We get a mixed picture if we set the indicators' performances in terms of delta convergence in relation to the degree of precision of the European legal provisions. For the indicators 'legal market opening', 'TPA storage' and 'legal unbundling on the TSO level' we observe a high degree of precision concerning the legal provisions corresponding with a high or at least moderate delta convergence. The observations regarding 'trading facilities' and to a lesser extent those of 'incentive regulation', 'minimum booking period firm service', 'gas release programme', ownership 'unbundling for TSO', legal and ownership 'unbundling for DSO' point in the same direction. For those indicators a low precision of legal provisions accompanies a low or moderate degree of delta convergence which suggests a positive correlation. The legal provisions for the unbundling model on the TSO and DSO levels deviated in terms of their ambitions. Therefore, we expected (expectation 8) the degree of convergence to be lower for the unbundling of the DSOs than for the TSOs. As a matter of fact, we observe a marginal delta convergence of 8% for unbundling of the DSO as opposed to a moderate level of delta convergence of 42% for unbundling of the TSO.

The positive correlation is contested by contrary observations. Several indicators reached a high degree of delta convergence although the legal provisions were not prescribing the regulatory instrument. This is the case for the components 'tariff structure', 'type of capacity booking', 'UIOLI', and 'balancing period'. For the publication of accounts of transmission system operators and distribution system operators we expected full convergence, because this instrument has been mandatory since the introduction of the first Directive. These expectations are rejected, indicating little influence of the legal provisions on the member states implementation practice.

To sum up, we see indications for a positive correlation between the degree of precision regarding the European legal provisions and the degree of convergence. Although the majority of indicators support a positive correlation, the number of contradicting observations is too high to speak of a strong correlation that allows formulating conditions.

	RF 2001	RF 2002	RF 2003	RF 2004	RF 2005	RF 2005 (end)
Austria	73.4	85	106.7	116.7	123.4	103.4
Belgium	80.1	93.4	88.4	105.1	115.1	115.1
Denmark	85.1	91.8	105.1	121.7	141.7	131.7
France	40.1	40.1	35.1	65	95	97.5
Germany	61.7	85.1	85.1	85.1	85	104.2
Ireland	63.4	85	88.4	78.4	78.4	88.4
Italy	100	121.6	121.6	131.7	121.7	111.7
Luxemburg	65.1	81.7	81.7	78.4	98.4	75
Netherlands	95.1	105.1	111.7	124.2	134.2	136.7
Spain	113.4	113.4	118.4	120.1	128.4	118.4
Sweden	48.4	58.4	58.4	78.4	75.1	82.5
United Kingdom	145	145	145	145	145	150

Table 20: Countries score of regulatory function

To differentiate the different degrees of progress member states achieved by the end of 2005, we distinguish three groups. The highest degree of delta convergence reached those countries whose score for indicators describing regulatory functions was above 120: Denmark, the Netherlands, and the United Kingdom. The middle group scored between 100 to 130 points. Austria, Belgium, Germany, Italy, and Spain received a middle degree of delta convergence for this set of indicators. The lowest scores were seen in France, Ireland, Luxembourg, and Sweden with less than 100 points in 2005. The detailed scoring results of each country and the countries ranking are summarized in tables 20 and 21 below.

Rank	Countries rank in 2005
1	United Kingdom
2	Netherlands
3	Denmark
4	Belgium
5	Spain
6	Italy
7	Germany
8	Austria
9	France
10	Ireland
11	Sweden
12	Luxembourg

Table 21: Countries ranking describing the dimension regulatory function

8.5 Convergence of regulatory competences

The following section analyses seven indicators in the order of their description in the methodology section.

8.5.1 Type of decision-making by regulatory authority

In 2001, the way countries applied third party access showed some variation, although more than half of the old member states did grant third party access ex ante. Among these progressive countries were Belgium, France, Ireland, Italy, Luxembourg, Spain, and the United Kingdom. At that time, Sweden and Denmark offered only ex post arrangements. Quite the opposite group was formed by Austria, Germany, and the Netherlands who implemented the minimum requirement of the first Gas Directive by applying negotiated third party access. Austria and the Netherlands revised their third party regime assuring ex ante decisions from 2002 onwards. Austria differentiated between ex ante regulation for inner Austrian transport and distribution and negotiated TPA for transit transport. Similar to the Austria, Denmark chose a hybrid mode of regulation which contains elements of ex ante and ex post regulation. Surprisingly, the Dutch regulator (*Directie Toezicht Energie*) stated that in 2004 network access was based on negotiated third party access, while in 2005 ex ante regulation was back in place. Germany was the most reluctant government forcing introduction of

ex ante regulation. Until July 2005, neither a regulator nor an ex ante regulation was ensured. Instead, an association agreement of the gas industry was suppose to guarantee non-discriminatory access to the network. (Lohmann, 2006: 25-82)

By the end of 2005, ex ante regulation had become the dominant mode of decision-making to ensure third party access. Belgium, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Spain, Sweden, and the UK applied ex ante regulation; Austria and Denmark partially did. To sum up, there is a high degree of delta convergence (83%) with regard to ex ante regulation. Moreover, the cases of Austria, Denmark, Germany, and the Netherlands support our expectation (3) because we observe a high degree of delta convergence towards ex ante regulation in the last two measurement points.

8.5.2 *Decision over capacity allocation rules*

In the first year of the reform, transmission system operators were traditionally in charge of allocating the transport capacity within the national natural gas markets. Then, the Transmission system operators allocated the capacity in more than half of the member states. Explicitly this was the case in Austria, Belgium, Denmark, France, Germany, Ireland, and Luxembourg. In the Netherlands and the United Kingdom these responsibilities were shared between the transmission system operator and the regulator. Only in Italy, Spain, and Sweden was the decision power to allocate capacity entirely transferred to the regulator. As we will show, some initial positions of the member states changed over time, but did not result in a decrease of variance with regard to the distribution of decision power.

Denmark, Germany, and Luxembourg left control over the capacity allocation entirely with the transmission system operators. Equally stable, but at the other end of the continuum were the UK and Spain. Positive changes occurred in Austria and Ireland between 2001/2002, followed by France the following year and Belgium in 2004, when transferring decision power from the transmission system operator partly to the regulator. There were also countries who switched back and forth. The Netherlands is such a case. According to Directie Toezicht Energie's answer to the questionnaire, capacity allocation was jointly decided by the regulator and the transmission system operator throughout 2001-2003 and 2005. Nevertheless, this information deviates from the fourth benchmarking report which states that the TSO was in charge of capacity allocation during 2004. Ireland is a comparable case. There, the regulator claimed to share the responsibilities of capacity allocation with the TSO in 2004, whereas the year before and after it was declared to be the regulators responsibility only. The picture at the end of 2005 can be described as follows: In three cases (Denmark, Germany, Luxembourg) the transmission system operator allocates capacity.

Austria, Belgium, France, the Netherlands, and the UK preferred to share responsibilities between regulator and TSO. Ireland, Italy, Spain, and Sweden entirely transferred the allocation of capacity to the regulator. Compared to the initial distribution of decision-making power in terms of capacity allocation, there is no decrease of variance. Consequently, no sigma convergence occurred. Ireland and the Netherlands are interpreted as cases of positive and negative gamma convergence. In general, we observe member states transferring the responsibility for capacity allocation away from transmission system operators to either shared control between TSO and Regulator or solely to Regulators. Expectation 9 is confirmed, detecting a low degree of delta convergence regarding the distribution of decision power of capacity allocation.

8.5.3 *Approval of balancing conditions*

When the monitoring of the balancing regime began in 2002, the member states fell mainly into two categories. Balancing conditions either were approved by the transmission system operator or the regulator. Belgium, France, Germany, and Luxembourg left the approval with the TSO, whereas in Austria, Denmark, Ireland, Italy, the Netherlands, and Spain balancing conditions were approved by the regulator. Initially, Sweden's practice was unknown to the Commission. In contrast, gas market balancing conditions were set by the market in the UK, a practice only considered best practice if applied in mature markets with a comprehensive sector regulation in place. Therefore, the UK receives a high score.

The year 2004 turned out to be eventful year; seven countries changed the authority in charge. Both originally having the TSO responsible for fixing the balancing conditions, Belgium voted for shared competences and France transferred this task to the government (ministry). Ireland, Italy, Luxembourg, the Netherlands, and Spain made the reverse step. Initially, the regulator centrally held the responsibility to approve balancing conditions in these countries, but then more authorities became involved in the facilitation of balancing conditions. As a result, a moderate degree of negative gamma convergence (50%) occurred. The most interesting cases are Italy and the Netherlands. In both the distribution of decision power changed three-times from regulator to shared competences to the ministry and back to shared competences. This is a strong indicator for a regulatory game in which the potential authorities are struggling to gain control or at least to share it. Less spectacular but still noteworthy is the Austrian case in which the regulator received first the regulatory control and then transferred it to the market in 2005. The interpretation of this decision and its effect is less obvious, because the Austrian natural gas market cannot be compared with the regulatory comprehensiveness that the UK gas market

regime and its mature liberal gas market offers. On the contrary, we vote for a conservative interpretation giving Austria a low score for its instrument choice.

From a regulatory perspective, the distribution of power in 2005 reveals an insightful development. At this point, only the regulators in France, Italy, and the Netherlands were still determining the balancing conditions. In most of the other countries balancing conditions were jointly approved by more than one authority, be it the TSO in cooperation with the ministry or the regulator. Only in Belgium did the TSO remain in charge during the entire period.

The state of the play appears to be too ambivalent to suggest more than low delta convergence towards the best practice. The approval of balancing conditions holds: objective based European legal provisions translated into low convergence (10). The range of the indicator only marginally decreased between 2001 and 2005, but still allows identifying a weak form of sigma convergence. During the time of examination, we observe seven cases of positive gamma convergence, though only in France was the approval of the balancing conditions shifted directly from the TSO to the regulator. Furthermore, we observe several cases of negative gamma convergence opposed to six cases of positive gamma convergence.

8.5.4 *Dispute settlement*

Originally, disputes were settled by the regulator in six countries: Belgium, Denmark, Italy, the Netherlands, Sweden, and the UK. In most of the other countries, the member states preferred a clear allocation of rights and duties by either the ministry or the competition authority (responsible for dispute settlement). The ministry was considered the most appropriate authority to settle disputes in Austria, Ireland, and Luxembourg, while in Germany the competition authority settled disputes. Due to the autonomy of the regions in Spain, disputes were partly settled by regional government and the regulator in the first year and then in the second year conveyed to the regulator. By 2001, only France hadn't appointed an authority to ensure dispute settlements, but was then catching up by transferring the dispute settlement to the competence portfolio of the regulator (positive gamma convergence). In 2002, Austria, Ireland, and Luxembourg had already passed on dispute settlement from the ministry to the regulator. For 2004 and 2005, the Belgium regulator declared that the responsibilities of dispute settlement were hybrid, whereas in former years the regulator was suppose to be the only authority settling disputes. According to our data, the Netherlands had the most unstable regulatory framework with regard to dispute settlement. In the first year the regulator held the responsibility, then transferring it for three years to the competition authority, and afterwards shared it with regulator and regional government in 2004, before

finally staying with the competition authority in 2005. For the sake of regulatory stability, one can only hope these shifts in competences are related to the fact that the Dutch regulator, *Directie Toezicht Energie* (DTe), is situated under the roof of the Dutch competition authority (*Nederlandse Mededingingsautoriteit*) and that this might have caused some labelling irritations on the regulatory side. In contrast, Denmark, Italy, Sweden, and the UK provided a stable regulatory framework, by using the regulator as the only mediator of disputes during the entire reform period. German authorities performed less progressive but equally stable, appointing the competition authority to be solely in charge of dispute settlement. By 2005, we observe a converging trend towards the regulator being responsible for dispute settlement in nine countries. In other words, there is a decrease of variance towards what we assume to be best practice. Here sigma convergence goes along with a high degree of delta convergence. The group of best practice is Austria, Denmark, France, Ireland, Italy, Luxembourg, Spain, Sweden, and the UK. Belgium appears to be off beat, because the competences are shared between the regulator and the competition authority. In Germany and Netherlands disputes are still settled by the competition authority instead of the regulator. To conclude, our expectation implying a low degree of delta convergence due to objective based legal provisions is disapproved for dispute settlement.

8.5.5 *Type of regulator*

Even before the introduction of the first Directive, some initial movers created independent regulators to supervise the gas sector. Early birds were the UK (1986/1999), Italy (1995), the Netherlands (1998), and Sweden (1998). These countries were followed by Spain (1999), Belgium (1999), France (2000), Denmark (2000), and Luxembourg (2001). Slight latecomers turned out to be Ireland and Austria. Ireland's regulator, Commission for Energy Regulation (CER), was established in 1999 to regulate the electricity market and in 2002 was extended to the gas market. Likewise, the Austrian regulator e-control was established in 2001, but started its regulation of the gas sector in 2002. Creating sector regulation only after the second Directive, Germany (2005) clearly is at the bottom of the league.

The remit of the regulator was already quite homogenous in 2001 with ten energy specific regulators in place. The two exceptions were Luxembourg and Germany. A small country with a small gas market, Luxembourg located its regulatory staff (two-three staff) under the roof of a multi-utility regulator. On the contrary, Germany is one of the largest European gas markets. Lohmann's analysis of the German gas market shows how well organized gas business interests in conjunction with a lack of political will in the government, namely

the ministry of economic affairs, deferred the establishment of a regulator. This finally occurred only in 2005, when a regulatory authority for natural gas was set up within the Federal Network Agency. The Agency started off with telecommunication and incrementally expanded its sectors to become a multi-utility regulator.

Comparing the regulatory landscape in 2001 with 2005, we balance only a minor decrease of variance induced by the Germans setting up a multi-utility regulator at the very end of our period of examination. To sum up, there are ten energy-specific and two multi-utility regulators in 2005. Consequently, we observe very little sigma convergence, but a high degree of positive gamma and delta convergence. The distance to the best-practice remained unchanged at the same high degree of delta convergence as in the beginning. At first glance the result is puzzling; hardly any effect was observable regarding the type of regulators set up and at the same time we see a high degree of delta convergence throughout the examination period. Expectation 9 cannot be confirmed because here vague legal provisions correspond with a high degree of delta convergence.

8.5.6 *Ratio of consumption of national gas market and staff number of national regulator*

Before turning to the results, the quality of data needs some more explanation to allow an appropriate interpretation. While gathering accessible data on staff working on natural gas market regulation for the regulator, we learned that staff numbers do not necessarily differentiate between professional staff and support staff, or indicate whether this staff is working on gas or electricity regulation. Furthermore, regulators may frequently rely on outsourced expertise which is not reflected in the staff number. The ratio does not take account for input through consultants to the national regulators For this reason, the results of the ratio are somewhat tentative or could even be considered to be problematic.

Our sample countries show a relatively high degree of variation in terms of staff number, annual budget, and market size. In 2001, staff numbers ranged from 1 in Luxembourg to 340 in the United Kingdom.[69] There is the same disparity with regard to market size. Citizens of Luxembourg consumed only 0.6 billion cubic metres (bcm) of natural gas in 2000, whereas UK consumption in the same year was more than 160 times higher, reaching 97 bcm. Having said this, there is no doubt that the ratio setting the market size in relation to staff number of the regulator can at best be a proxy to describe the institutional endowment. At first glance the indicator seems abstract. Therefore, we illustrate the meaning of the ratio by referring to the UK example. In 2001, the UK had a ratio of 0,27. This can be read as one staff member from the Office of Gas and

Electricity Markets (Ofgem) was responsible for a market share equivalent of 300 million cubic metres. One could argue that the higher the ratio, the weaker the institutional endowment of the regulator. In line with this reasoning we divide the countries into high, middle, and low scores groups.

The indicator changes over time are displayed in Figure 15. Initially, the figure suggests a relatively high degree of stability for most of the countries, which needs to be specified by a closer look at the individual cases.

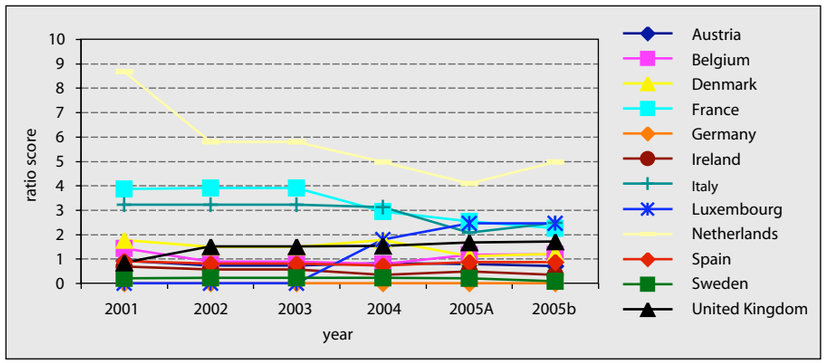


Figure 15: Ratio natural gas consumption/regulators staff (2000-2005)

Initially, there is a considerable number of countries in the first group with a ratio below 0.2 in 2001: Austria, Denmark, Ireland, Spain, and Sweden. The second groups' ratio ranges between 0.2 and 0.49, and consists of Belgium and the UK. The third group with the highest scores above (0.5) incorporates France, Italy, Luxembourg, and the Netherlands.

The ratio of consumption of market and staff of the regulator did not show significant changes in three countries. Sweden stayed at a plateau of 0.2 - 0.1. The UK and Spain ratios appear equally stable. Both increased slightly between 2001 and 2005, English Ofgem from 0.26 to 0.29 and the Spanish *Comisión Nacional de Energía* from 0.8 to 0.11. The case perspective also reveals a gradual downward trend in the market-staff ratio indicating an increase of institutional endowment of the regulators. The Netherlands and Luxembourg had the sharpest and most abrupt declines between 2001 and 2002, indicating negative gamma convergence. The Netherlands is a particularly interesting case. With a ratio of 1.05 in 2001, it cuts back down to 0.63 the year after and closes with 0.53 in 2005. Although it is still a comparably high ratio, the change is significant. Similarly, Luxembourg, employing less staff, lets the ratio drop from 0.54 down to 0.27 in 2002. Though,

as such a tiny natural gas market the drop could be solely explained by a single new employee.

Austria, Belgium, and Ireland represent the group of countries whose regulators provide a high number of staff in relation to their market size and who increase even more the regulatory density in the course of the reform. The Irish Commission for Energy Regulation started with a ratio of 0.13 in 2001 and shrank to 0.7 in 2005. Austria followed the example by reducing its ratio from 0.18 to 0.10 during the same period. The staff endowment of the Belgian *Commission de Régulation de l'Electricité et du Gaz* developed in the form of a wave, starting with 0.33 in 2001, decreasing to a low of 0.14 in 2004 and mounting up again to 0.21 in 2005.

Contrary to the group of fast movers, France, Italy, and Germany appeared to be rather reluctant to provide a strong institutional endowment. France entered in 2001 with a ratio of 0.54 and reduced it gradually to 0.29. Italy started off with a higher ratio of 0.92 in 2001 and reached 0.57 by 2005. Germany brings up the rear, by not institutionalising any regulator until 2005. When put in place, the number of staff generate only a conservative ratio of 0.66. As a result, in the group of late movers it is only with France could we speak of negative gamma convergence.

Bergmann et al. (1998) showed that usually the scope and intensity of regulation sharply increases in the beginning of a reform. A number of European and national laws and regulations had to be implemented and their compliance monitored during the EU gas market reform. To meet the growing work load of the regulator, one would therefore expect an increase of staff which translates into a lower ratio. In the case of the European gas reform, this observation can be confirmed. The range of the indicator ratio market/staff decreased from 1.03 in 2001 to 0.65 in 2005. Earlier we described a downward trend of the ratio on a case by case basis. This trend is also reflected by the overall mean change from 0.38 in 2001 to 0.26 in 2005. In general, the decreasing range and mean of the indicator confirm the occurrence of sigma convergence. To conclude, a moderate delta convergence does not fully support our expectation (9).

8.5.7 *Ratio of consumption of national gas market and budget of national regulator*

Studies on utility reforms observe a rise of regulatory costs due to the increased regulatory activities after the legal introduction of the reform (Bauer, 2006; Bergman et al., 1998). The following section covers the other dimension of institutional endowment, indicated by the annual budget the national regulators have at their disposal. Just as the staff numbers of the regulators show a wide range, so does the height of annual regulators budgets across the old member

states. For instance, the lowest budget has Luxembourg with 0.22 million Euros; this is contrasted by the sum of 103 million Euros Ofgem generated through the licensing system in 2001.

Before describing the indicators performance, we would like to give some illustration of its interpretation, using France and the Netherlands as examples. Both countries market size is comparable, consuming approximately 39 bcm in 2000. Setting the consumption level in relation to the budget the regulator can use to oversee the market, the two countries differ considerably with respect to their ratio. Whereas the French regulator provides over one Euro to regulate a market share of 2.5 bcm, the Dutch regulator only has one Euro to regulate a market share of 5.5 bcm. As a result, the regulatory density in France appears to be much higher than in the Netherlands, considering the regulators' budgets.

The figure below displays the scoring of the 12 member states between 2001 and 2005. Austria, Ireland, Spain, and Sweden receive high scores. As a result of its budget cuts, the British Ofgem achieved high scores in 2001, but only middle scores in subsequent years. Belgium and Denmark form the group whose score levelled in the middle. The group attributed by two lows consists of France, Germany, Italy, Luxembourg, and the Netherlands. No member state with low scores caught up to the middle or even higher score group. Accordingly, no positive gamma convergence occurred. Instead, the case of UK shows negative gamma convergence. Although the UK falls back, Ofgem still has the highest annual budget in total numbers.

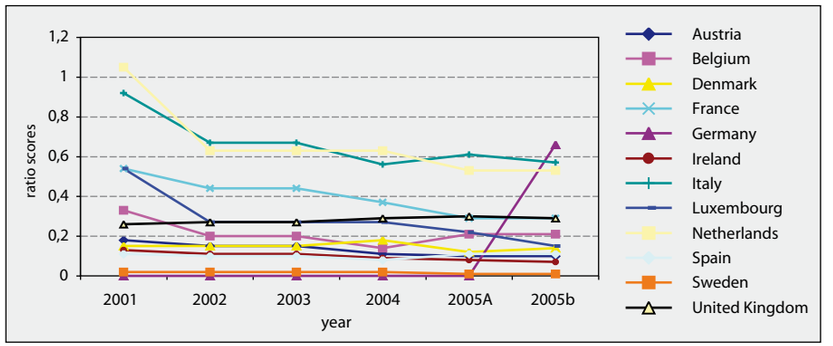


Figure 16: Ratio natural gas consumption/regulators budget (2000-2005)

Looking at the member states, no homogenous trend can be identified. On the one hand there is Sweden, steadying between 0.23 and 0.20 during 2001-2005. Then in 2005 the regulator increased the budget from initially 3.53 million Euros to 7.61 million Euros and thereby improved the ratio to 0.9. On the other hand, Ofgem cut its budget between 2001 and 2002 from initially 103 million Euros to 58 million Euros. Hence, the budget constraints of the early reform years are reflected in a change of the ratio from 0.85 in 2001 to 1.71 in 2005. The German case is an exception in two ways. Germany had no regulator until 2005, but when the Federal Network Agency came into existence, it only published the budget for regulating multi-utilities. In other words, even for 2005 no appropriate data is available.

The group of positive movers whose ratio is steadily declining consists of Ireland, Austria, Italy, and France. Within this group, Ireland holds the first rank with a ratio of 0.69 in 2001 diminishing even further down to 0.35. Austria closely follows with a ratio of 0.93 in 2001, decreasing to 0.70 in 2005. Italy's initially ratio is less favourable, starting with a height of 3.22 in 2001 dropping to 2.48 by 2005. Similarly, France starts with a high score of 3.86 in 2001 and gradually improves the annual budget, closing with a ratio of 2.26 in 2005.

Moreover, we observed sharp declines in Belgium and the Netherlands between 2001 and 2002. At that time, Belgium improved its ratio from 1.42 down to 0.9, but reversed the trend a year later. By 2005, Belgium's ratio was at 1.19. The Netherlands considerably strengthened its budget which translated into a decrease of its ratio from 8.68 (2001) to 5.79 (2002). In the course of the reform, the Dutch ratio lowered even further to 4.96 in 2005. The Netherlands certainly made an effort to strengthen its institutional endowment. Nonetheless, it remains behind compared with ratios of the majority of the other old member states.

As in Belgium, the Spanish regulator shows contradicting trends with regard to the development of its regulators annual budget, though the loops are rather flat. Starting with a very robust ratio of 0.91 the Spanish National Energy Commission (CNE) even raises the budget, thereby lowering the ratio to 0.71 in 2004. Surprisingly, CNE cuts the budget again in 2005, thereby reaching nearly the old level with one Euro corresponding to a market share of 0.97 bcm.

The range of the indicator ratio of budget and market nearly halves between 2000-2005, shrinking from 8.68 to 4.87.[70] In general, this decrease of variance indicates sigma variance. Altogether eight regulators could raise their budgets and thereby improve the ratio expressing the market size in relationship to the annual budget. Opposed to our initial expectation (9), a moderate degree of delta convergence occurred. This also shows in the mean change of the ratio. Formerly, the ratio's mean was 2,05 in 2001 and then decreased to 1.66 in 2005.

Despite the fact that the annual budgets did not develop homogenously, we could identify a general trend that the institutional endowment is improving towards better practice.

8.5.8 Overview: convergence of regulatory competences

This section portrays and summarises the occurrence and degree of the three convergence types for the dimension regulatory competences (see table below). First, we explain the results for sigma convergence. Thereafter, we assess gamma convergence from an indicator perspective and with the outcome of this we show patterns of regulatory choices from a country perspective. We then present the distance towards best-practice is by measuring delta convergence for the indicators of the dimension of regulatory competences.

In comparison to the indicators of the first dimension, those of the regulatory competences show a similar trend towards convergence, though the degree appears at first glance even stronger. Sigma convergence occurred in six out of seven indicators. The mean of scores mean for regulatory competences are very stable and only increase slightly from 42 points in 2001 to 51.5 points in 2005. The range diminishes from 63 points to 43 points. This decrease of variance is mainly induced by Germany. The German scores marked the bottom line with a minimum of 7.5 points in the first two years and a score of 23 points in 2005. In other words, the sigma convergence found in the dimension regulatory competences is partly generated by the strengthening of the German regulatory competences.

The process of harmonisation and directional convergence towards best practice was accelerated by countries which moved forward and applied more favourable instruments. Both forms of gamma convergence are visible in every country, but the degree to which they occur for each indicator varies substantially. For instance indicators such as 'type of decision-making by regulatory authority', 'type of regulator', and dispute settlement show a high degree of positive gamma convergence, whereas the other four indicators only reached either a moderate or low degree of positive gamma convergence. The degree of negative gamma convergence does not vary to the same extent, ranging from 8% to 17% for six indicators. Only the indicator 'balancing conditions approved by' shows a moderate level of negative gamma convergence which in conjunction with a moderate degree of gamma convergence results in an overall low delta convergence. Whereas positive gamma convergence is found quite often simultaneously with negative gamma convergence or just on its own, negative gamma convergence usually comes together with positive gamma convergence. This is not the case for the indicator type of regulator, for which negative gamma convergence is absent.

Type of convergence		Sigma	Gamma	Delta
Indicator 9	Type of decision-making by regulatory authority (Exante/expost)	X	(+) 75% (-) 8.3%	83.3%
Indicator 10	Capacity allocation rule decided by		(+) 33.3% (-) 16.6%	33.3%
Indicator 11	Balancing conditions approved by	X	(+) 58.3% (-) 50%	33.3%
Indicator 12	Dispute settlement	X	(+) 91.7% (-) 16.6%	75%
Indicator 13	Type of Regulator	X	(+) 83.3%	83.3%
Indicator 14	Ratio of consumption of national gas market and staff number of national regulator	X	(+) 50% (-) 16.6%	50%
Indicator 15	Ratio of consumption of national gas market and budget of national regulator	X	(-) 16.6% (+) 8.3%	41.7%

Table 22: Occurrence and degree of convergence (dimension regulatory competences)

The low degree of positive gamma convergence for the 'Ratio of consumption of national gas market and budget of national regulator' indicates a reluctance to improve the institutional endowment of the regulators. The figures for the indicator describing the ratio market size/staff point in the same direction, observing here a moderate level of positive and a low degree of negative gamma convergence. Equally we observe a general reluctance to empower the regulator deciding the capacity allocation rules, signified by the absence of or a low degree of all three types of convergence.

Section 8.2 introduced four different patterns describing the performance of indicators with regard to their distance to best practice. Accordingly, we analyse the indicators performance of the second polity dimension in the same manner. Here, Denmark, France, Germany, Luxembourg, and Sweden gradually minimise their distance to the best-practice model in the form of a steady slope. Even though the incline of the slope differs in total scores, the direction of change is the same. In the case of Spain the slope follows the reverse trend, first providing high scores which in the course of the reform decline by 5 points. This change reflects the shift of governance in terms of the approval of balancing conditions. During the initial years, the regulator was responsible, whereas after 2004 the ministry and the transmission operator shared this competence. Although Sweden shows an overall upward trend, we observe an outlier in the beginning of 2005. Due to changing responsibilities in terms of the approval of balancing

conditions and capacity allocation rules, Sweden's score shows a small dip. The UK and Italy display only marginal changes with regard to their regulatory competences and therefore its scores resemble a plateau. In contrast, scores of Austria, Belgium, and Ireland show an upward and downward trend like a roof. Especially in Austria the changes are significant. The Netherlands appear to be not only a country with relatively little low centralization of decision power at the regulator but also exceptional regulatory instability. The Dutch regulatory competences show mixed performance without indicating any clear direction. In this context the dip at the beginning of 2005 is remarkable. As we see in Figure 17, the scores of the Netherlands see-saw from 35 in 2004 down to 23 in beginning of 2005 and up again to 40 at the end of 2005. The dip is a result of less favourable instrument choices related to dispute settlement and capacity allocation that took effect by 2005.

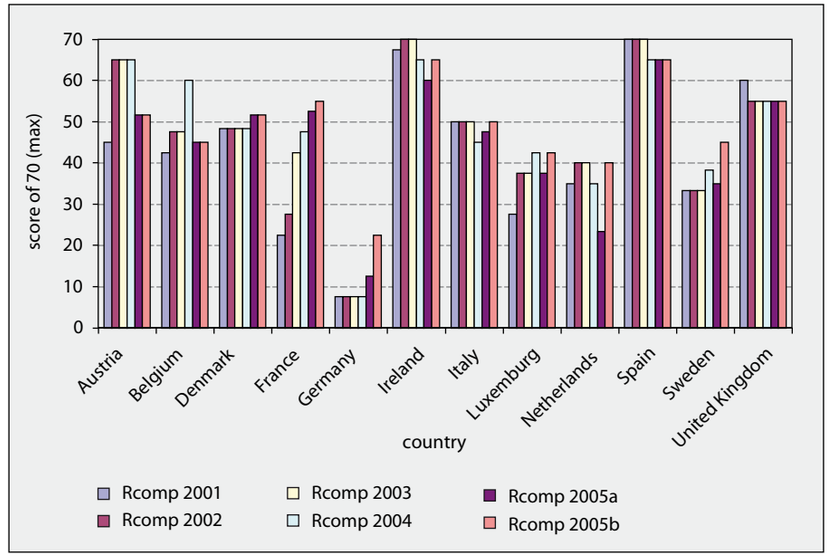


Figure 17: Regulatory competences (2000-2005)

The figure accentuates two peaks to which more attention is given. The first occurs in Belgium in 2004. Then, Belgium revised three measures at once. First, the capacity was no longer allocated by the TSO alone, but jointly with the regulator. Second, the approval of balancing conditions was shared by TSO and regulator. Third, the regulator temporarily employed more staff. The next year

regulatory staff number and budget decreased and the regulators competence for settling disputes was decentralised. The second peak happens in Germany, when the regulator was finally introduced in 2005. Reaching only a maximum score of 23 Germany has by far the lowest score with regard to its regulatory competences.

Previously, we demonstrated that the European legal provisions have not determined which authority has to be in charge of overseeing the different regulatory functions. Therefore we anticipated it as unlikely that the legal provisions induce a high degree of delta convergence for the indicators belonging to the polity dimension during our examination. This expectation (9) corresponds with a moderate delta convergence of 52% for the dimension regulatory competences. Nevertheless, this does not hold true for all indicators. For instance, ex-ante regulation (Indicator 9), dispute settlement (Indicator 12), and type of regulator (Indicator 13) showed a high degree of delta convergence. The expectation is strongly confirmed by the two Indicators 'capacity allocation rule decided by' and 'balancing conditions approved by' and to a lesser extent by the two ratios describing the institutional endowment of the regulator (Indicator 14 & 15).

Taking a country perspective, the table below shows the detailed scoring results describing delta convergence between 2000 and 2005.

	Rcap 2001	Rcap 2002	Rcap 2003	Rcap 2004	Rcap 2005	Rcap 2005 (end)
Austria	45	65	65	65	51.7	51.7
Belgium	42.5	47.5	47.5	60	45	45
Denmark	48.3	48.3	48.3	48.3	51.7	51.7
France	22.5	27.5	42.5	47.5	52.5	55
Germany	7.5	7.5	7.5	7.5	12.5	22.5
Ireland	67.5	70	70	65	60	65
Italy	50	50	50	45	47.5	50
Luxemburg	27.5	37.5	37.5	42.5	37.5	42.5
Netherlands	35	40	40	35	23.3	40
Spain	70	70	70	65	65	65
Sweden	33.3	33.3	33.3	38.3	35	45
United Kingdom	60	55	55	55	55	55

Table 23: Countries score for the dimension regulatory competences

The countries' scoring results at the end of 2005 were divided into three different groups. Accordingly, a high degree of delta convergence is reached if the country accumulated a score between 60-70 points. Ireland and Spain received the highest score with 65 points. A middle degree of delta convergence could be found in the United Kingdom (55), France (55), Austria (52), Denmark (52), and Italy (50), ranging between 50-59 points. The lowest degree of delta convergence appeared in Belgium (45), Sweden (45), Luxembourg (43), the Netherlands (40), and Germany (22.5). The table below displays the countries ranking describing the dimension regulatory competences.

Rank	Countries rank in 2005
1	Ireland, Spain
2	France, UK
3	Austria, Denmark
4	Italy
5	Belgium
6	Luxembourg
7	Netherlands

Table 24: Countries ranking describing the dimension regulatory competences

Strong independent regulators are one of the preconditions to enhance regulatory effectiveness. The results do not suggest that this precondition is met. The indicators describing the development of regulatory competences indicate only a moderate degree of delta convergence (average 57%). Moreover, we explained that the results have to be treated with caution due to the quality of data (staff and budget numbers). Finally, the effectiveness of regulators or regulation is not assessed here. This would be a valuable contribution of future research.

9. The effect of new market designs on economic performance in European Union's natural gas markets

9.1 Introduction

Ten years after the introduction of European gas market reform, consumers, politicians and industry are asking to be shown the benefits of the reform. In the course of the ongoing evaluation and enforcement phase, impact assessments are evolving to analyse the economic outcomes (exemplary ECORYS Nederland BV 2006; European Commission, 2007b; European Commission, 2007e).[71] *Yet it is clear that the progress of the European gas reform, as well as its effects, have fallen behind expectations. In 2005, the European Commission had already reported severe malfunctions such as market concentration, lack of liquidity in the gas market and insufficient market integration and harmonisation (2005: 271). Although research on utility reforms in general and natural gas in particular is flourishing, cross-national comprehensive studies empirically analysing the correlation between regulation-for-competition and economic performance in gas markets are lacking. Nevertheless, opponents of the reform attribute malfunctions in the sector to the introduction of competition, whereas proponents claim the unfavourable economic performance occurred because the reform has not been far reaching enough. The author take a steps back from this heated political debate and offers a scientific perspective on the matter. In this chapter our second research question is addressed by analysing to what extent the effects of regulation-for-competition on economic performance (in the form of natural gas prices, network tariffs, efficiency gains, and investments) can be empirically studied in a European wide comparative analysis. The conclusion is straightforward: A verification of whether the European Union's gas reform reached its reform goals - affordable prices, efficiency gains and security of gas supply*[72] *- while keeping up positivist academic standards appears to be an insurmountable obstacle.*

The chapter outlines the conceptual and practical obstacles of analysing the correlation between regulation-for-competition and economic performance in European gas markets.

9.2 Regulation and economic performance – a literature review

"In economic theory, ownership and the degree of competition are both important factors in determining output levels, costs of production and prices. More formally, the capital market and the product market determine the level of allocative and productive efficiency. Therefore, privatization, competition and more effective state regulation of monopoly activities should lead to improved economic performance" (Zhang, 2002: 3). In theory, the structure-conduct-performance paradigm (SCP paradigm) is straight forward, but in practice this piece of economic wisdom is heavily contested. After a world wide wave of privatization, liberalization and sector reforms the scientific analysis of the variable triangle consisting of competition, privatization (ownership) and regulation and its effect on economic performance received a lot of attention and resulted in numerous empirical studies. A positivist strand of literature searches for correlation between these variables by conducting econometric analyses which are single or multi-equation models conducting cross-country analysis. Steiner elaborates on the advantage of this type of analysis by criticising the state of literature examining the effects of electricity liberalisation: "It is difficult to draw general policy conclusions from existing empirical work that focuses rather on far-reaching reforms in a single market or other country-specific anecdotal discussion of regulatory change because neither type of study separates the effect of regulatory reform from country-specific features" (2001: 145). Instead, she proposes a comparable cross-country study on the basis of panel data. A regression analysis enables the exploitation of cross-national and time series dimensions, whereby country specific features can be controlled for. The following paragraph surveys the main results that econometric research has recently brought about to test the structure-conduct-performance paradigm.

The empirical studies analyse network based industries such as aviation, telecom, gas, electricity, railways, postal services and water. In the group of utility industry studies, sector studies examining the telecommunication and electricity sector are prevalent. The literature covers member countries of the Organisation of Economic Co-operation and Development, developing countries and regions like Latin America or Eastern Europe. To the best of our knowledge, the literature search did not reveal any study on natural gas markets, which systematically explore the causal relationship between ownership, market concentration, regulation and their effect on economic performance in the form of a cross-national comparative econometric analysis. Despite the knowledge that

the European electricity and gas markets differ in many ways, the sectors are the most comparable among the utility industries and the two share significant common features. Both markets are in the energy field, network based, characterised by high sunk costs and have been liberalised shortly one after the other. Major distinctions stem from different supply structures, and applied technologies. In contrast to electricity, gas can on the one hand be stored more economically, but on the other hand different gas qualities demand complex technological solutions to allow gas transport across Europe. Due to the lack of research on natural gas in this field and some common features of electricity and natural gas sectors, we choose to refer mainly to electricity markets in our analysis.

Zhang et al. demonstrate in their literature review that the surveyed empirical results show no clear evidence as to whether privately owned, competitive markets are more efficient than publicly owned monopolized markets (2002). Vickers and Yarrow attribute contradicting effects of privatisation on performance in earlier research days to the focus on ownership (1988). Therefore, recent research advocates to incorporate several factors summarised under the variables privatisation, competition and regulation to explain the effect on economic performance. In practice, the bulk of studies do not include all three variables but often concentrate on one or two independent variables, be it privatization and competition or privatization and regulation. A number of empirical works associated competition with lower costs, lower prices, and higher productive efficiency (Kwoka, 1996; Kleit and Terrell, 2001; Martin and Vansteenkiste 2001). Zhang et al. reached the same conclusion when assessing the effects of privatization, competition, and regulation on the performance of the electricity generation industry in 51 developing countries through the period 1985-2000 (2002). Competition positively effects service penetration, capacity expansion, labour efficiency and prices to industrial users. According to Zhang, privatization and regulation on their own do not lead to obvious gains in economic performance. Consequently the introduction of competition is key to achieving positive effects such as higher efficiency and productivity (ibid). Another two articles apply a complex research design analysing the impact of regulation, industry structure and privatization performance in the electricity supply industry of OECD countries (Steiner, 2001; Hattori and Tsutsui, 2004). Although the two studies are very similar in terms of scope and methodology, the results concerning the impact of regulatory reforms in electricity supply industry on end-user gas prices are partially contradictory.[73] Steiner and Hattori/Tsutsui use the identical sample of OECD countries for the period 1987-1999, applying the same basic framework for model specification and estimation. The main difference is that Hattori and Tsutsui offer results

for random and fixed effects, whereas Steiner only takes into account random effect models (Nagayama, 2007). Steiner's time frame covers only the years from 1986 to 1996 and Hattori and Tsutsui attribute some of the differences in results to the 3 year time difference. Both extracted the price data from Energy Prices and Taxes published by the International Energy Agency. However, the way variables are operatonalised differ. For instance Hattory and Tsutui consider that the unbundling of transmission system operators are only fulfilled when legal unbundling is in place, whereas Steiner regards account unbundling as sufficient (2004: 825). Hattori and Tsutsui findings suggest that the existence of wholesale pool markets do positively correlate with lower prices, whereas Steiner observes the contrary. Both observe a negative correlation between the introduction of third party access and lower electricity retail prices, but differ with regard to the statistical significance of this observation. In Hattori and Tsutsui's analysis third-party access is statistically significantly, whereas Steiner concludes it is statistically insignificant. The comparison illustrates how crucial the exact operationalization is with regard to its effects on statistical significance. Furthermore, the brief review suggests more research is needed beyond 2000 to draw more solid conclusions on the correlation between specific regulatory instruments and its empirical effect on electricity prices. In section 5.2 we elaborate in detail on the way regulation is perceived. Therefore, the following section will continue our literature review by portraying the operationalization of the variable economic performance in econometric studies and refer to results. Moreover, we will display how those variables have been operationalised to analyse the effects of the gas sector reform on economic performance.

9.3 Economic performance

Performance indicators such as natural gas price and investment are usually in the centre of public attention. Efficiency gains are less prominent in politically-driven evaluations; they are to a larger extent the subject of academic interest. The obvious reason for divergent popularity of performance indicators is related to the nature of those indicators. For example, changes of gas prices are clearly visible on the energy bill of voting consumers. Underinvestment sooner or later translates into dysfunctions of the system in the form of 'blackouts' (negative externalities). Efficiency appears less tangible in the public perception.

The European Union set ambitious targets in terms of economic performance to be accomplished by the European gas reform. Natural gas prices and network tariffs were expected to be lowered and become cost-reflective. European companies involved in the transport of natural gas were supposed to increase their efficiency due to a reduction in their operating costs. Furthermore, the

European Commission aims to fulfil its public service obligation to secure the natural gas supply of the European Union by stimulating investments. According to the public regulation approach (Cox, 1999; Genoud and Finger, 2004), markets are organised by a combination of two objectives: first order economic regulation predominantly addressing the structure, conduct and economic performance (e.g. price development) and second order political and social regulation, predominantly addressing the politically defined performance (e.g. security of gas supply). Thereafter, investments can be perceived as general economic performance indicators or more specifically as a public service obligation performance indicator.

9.3.1 *Efficiency*

The field of economics contains efficiency as a central idea as a means by which it can ultimately strive to improve social welfare. In the literature there is a difference distinguished between productive and allocative efficiency. Productive efficiency is achieved when goods are produced in the least costly manner. Allocative efficiency is realised in the case where resources are allocated so as to maximise the welfare of a society. Efficiency can be conceptualised in various ways. Labour productivity is a prominent indicator for efficiency in the research on privatisation (Megginson and Netter, 2001). Efficiency can also be perceived as whether incentive regulation in the form of price cap regulation is in place or not. Price cap regulation employs an efficiency factor to stimulate the reduction the operating costs of the distribution or transmission operators by regulating the prices of their network tariffs. Turvey sets out conceptual clarifications on how to perceive efficiency in the electricity sector and outlines methodological improvements to conduct short-run and long-run network efficiency comparisons for electricity distribution (2006). Steiner elaborated on the conceptualisation of efficiency for the electricity supply industry discussing possible proxies such as labour productivity (output per unit input), capital or total factor productivity (2001). Moreover, she adds utilisation rate and distance of actual reserve margins of capacities from "optimal" reserve margins to account for efficiency.[74] Some indicators were for several reasons not feasible and had to be rejected upfront. The ones she included, utilization rate and optimal reserve margin, are proxies imperfectly representing efficiency. On the basis of her data, Steiner observes a positive correlation between unbundling and the utilisation rate. However, the impact of regulation on the reserve margins remains indefinite, because the operationalization of the indicator did not account for the starting position of individual countries and its relative increase overtime. (Steiner, 2001: 167, 173)

The supply industry and production of natural gas are not subject to European liberalisation policy. Therefore, indicators related to the performance of the

supply industry are not of core interest when verifying the effect of regulation-for-competition on the efficiency of the regulated transport companies. In this context, the utilization rate (which is understood as used transport capacity) qualifies as a potential indicator for efficiency. In the literature, one study measures efficiency in the natural gas market by analysing company's productivity. Lee et al. compare the performance of 28 natural gas transport utilities in eight developed countries between 1987 and 1995. The article presents a method that enables the comparison of profits, price differentials and productivity of transmission utilities and integrated utilities. The authors point out that productivity is determined by various factors such as utility size, customer density, regulatory environment etc. They observe that utility size and pipeline utilization are statistically significant. Productivity differences are largely attributed to the so-called utility dummy which functions as an umbrella variable for various utility-specific and country-specific factors (Lee et al., 1999). In short, productivity in natural gas transport utilities[75] can be measured, but whether for instance the company organisation is more responsible for efficiency increases than is regulation, has not been controlled for. Consequently, a differential analysis would be necessary to verify the effect of regulation-for-competition on productive efficiency in form of pipeline utilisation in the gas transport sector.

Another example of research on the efficiency of the natural gas sector has been de Joode's attempt to estimate the impact of two new infrastructure projects with different institutional arrangements on efficiency performance of the capacity market. In its research design, regulation is initially perceived as an intervening variable, but occurs within the interpretation of results on the performance side as well. In the context of the UK-Dutch case, de Joode points to the application of price cap regulation by the UK regulator Ofgem which imposed an overall efficiency factor of 2% on the natural gas transport companies. In his conclusion, he implies a direct benefit for the consumers stemming from the application of the incentive regulation without any further specification or measurement. Although his reasoning is logical, in doing so, de Joode runs the risk of making a circular argument. (De Joode, 2007)

9.3.2 *Natural gas prices*

Assessing the impact of regulation on natural gas prices has two main obstacles: one being that it is conceptual in nature and the other that it is not reinforced by a sufficient number of cases and has the corresponding problems of data availability. A conceptual problem arises due to the fact that natural gas prices are not based on gas to gas competition. Instead, natural gas prices are still linked to the oil price. Moreover, a general clarification concerning natural gas prices

should be stated upfront. In the media it is often referred to >the< gas price, which certainly is a simplification of the complexity of natural gas prices. There are numerous gas prices generated on different markets and market levels. On the national level, Phillip Wright (2006) shows how the UK market is differentiated into separate but connected markets such as the domestic consumer market, over-the-counter and on-the-day commodity trade, which leads to the generation of different gas prices. As a result of contract pluralism, gas prices are most commonly distinguished between export, import and spot market prices or with respect to the consumer group (industrial and consumer prices). Historically, Western European price formulation in the natural gas sector is predominantly based on the concept of 'market value principles'. These principles "may be summarised as suggesting that gas should be priced either: so as to be at or near parity with crude oil, or so as to be competitive with the final consumer's alternative non-gas fuels, or so as to reflect historic costs of gas production" (International Energy Agency cited after Jonathan Stern, 2007: 1). Consequently, gas price formula within European contracts contain an oil indexation as well as several other factors reflecting production and transportation costs or the companies profit margin.[76] To sum up, the composition of these formulas and the weighting of factors do differ substantially across different market levels. Data on natural gas prices for which the influence of the oil price development is subtracted out of the equation are to the knowledge of the author not available. Although we do not have so-called 'oil price-adjusted' gas prices at our disposal for conducting an econometric analysis, the energy sector investigations by Directorate-General for Competition (DG COMP) demonstrate the evidence of the link to oil product prices (European Commission, 2007e: 101-105). "From an analysis of more than 500 contracts covering more than 400 bcm of gas supplies to the EU countries for the calendar year 2004, DG COMP found that two products – light fuel oil and gasoil, and heavy fuel oil – accounted for nearly 75 percent of price indexation." (Stern, 2007: 6). Apart from end-user gas prices and spot market prices, European gas prices are still not entirely transparent.

Robinson analysed the question of whether European gas prices have converged by testing for beta convergence[77] on the basis of end-user gas prices without taxes for industry in six countries between 1978 and 2004. His sample is based upon Finland, France, Ireland, the Netherlands, Spain, and the UK. The other nine old member states could not be included due to a lack of data: "complete data on gas prices for the period under investigation was unavailable for Luxembourg, Belgium, Austria, Denmark, Germany, Italy, Portugal ,and Sweden" (Robinson, 2007: 2348). It remains unclear why Greece has not been included. He vividly summarizes the results for the six countries under examination: "Eyeballing the data series suggests that national prices were

quite widely spread during the early 1980s, began to fall and converge after 1985 but started to rise and diverge after 1999"[78] (Robinson, 2007: 2348). Robinson partially attributes the contradictory observations to the three different methodologies applied. Regardless of methodological considerations, all approaches reject the expectation that end-user prices fall with the introduction of EU gas liberalisation. Given the limited scope and quality of this article, the result has to be treated with caution.

Accompanying the 3rd Energy Package, the European Commission conducted an impact assessment, analysing the impact that certain regulatory instruments in the electricity and gas markets have on performance indicators. In this context, the European Commission attempts to empirically prove the impact of ownership unbundling on natural gas prices. The report concedes that electricity and gas prices "may not automatically decrease because of ownership unbundling" (European Commission 2007b: 37), and are instead determined by several factors. Nevertheless, the analysis fails in providing a convincing reasoning as to what extent regulation accounts for gas price changes. With regard to electricity prices, the European Commission identifies a correlation between ownership unbundling and decreasing industrial and household prices. The Commission applies a methodology which does not compare actual price levels but cumulative and aggregated price changes. Changes in the electricity price were reduced by 3% for industrial costumers in member states with ownership unbundling, whereas the Commission observed a move up to 6 % in countries with integrated transmission system operators (TSO). Percent changes of equivalent household prices appear even more divergent. Ownership unbundling at the distribution level is supposed to result in a 6% increase, while in member states with integrated transmission systems the operators account for approximately a 30% increase. According to the report written under the lead of Directorate-General for Energy and Transport (DG TREN) "it is not possible to carry out the same comparison for gas prices" (European Commission, 2007b: 38). The Commission's conclusion builds mainly on the argument, that for most of the examination time an insufficient number of cases with ownership unbundling were available. We agree with this appraisal, but consider the conceptual reservation even more relevant. In fact, controlling for the influence of one decisive factor within a complex formula has not been solved.

A recent attempt to empirically substantiate the effect of ownership unbundling on end-user prices for households has been conducted in an econometric analysis by Growitsch and Stronzik (2008). The analysis of 29 OECD countries covers a time period 1989 and 2006.[79] Albeit they are able to detect a correlation between the oil price and the end-user gas prices for households, the authors do not find any significant effect in terms of ownerships unbundling.

Due to the very recent application of ownership unbundling in the majority of countries under investigation, they suggest a re-evaluation in a few years time (ibid).

Our next example as well advocates a long examination period, before a correlation between liberalisation and price development can be judged. Waddams analyses the effect of liberalising UK retail energy markets on consumers. She points out that retail energy prices were falling during the period from 1990 to 2002. Back then, the British government in place attributed this success to their introduction of supplier choice and the removal of price controls. Waddams expresses her doubt that this trend would still hold, when basic conditions in the market or market structure are changed. Rising oil prices and market concentration on the retail level exercised in the form of the "'joint formation' among these suppliers" might induce reversed effects (Waddams Price, 2005: 142). More generally, Waddams concludes in 2005, that whether or not a regulated monopoly is less favourable than introducing competition in retail markets "depends crucially on the competitiveness of the market which emerges from the process, relative to the effectiveness of regulation of the monopoly supplier" (2005: 132). Recent experience in the UK gas market shows that rising oil and gas wholesale prices feed through and increase consumer prices. In this context, the British consumer organization Energywatch released some figures during their campaign critiquing rising energy prices: "Since 2003, British Gas customers have seen their bills go up by 76.7% for gas (from £ 370 to £ 653) and by 74.3% for electricity (from £ 237 to £ 413). Customers taking both fuels from Britain's biggest energy supplier have seen their bills go from £ 567 to £ 1049 over the same period" (Energywatch, 2008, 18 January).[80]

9.3.3 Tariffs

In general, tariffs could serve as indicators to analyse the impact of regulation-for-competition on economic performance. Edwards and Waverman for instance choose to measure performance by analysing interconnect rates in the telecommunication sector (2006). Due to regulators both defining ex ante the tariff methodology and determining the level of tariffs by applying incentive regulation in a liberalised European market, the tariffs seem to be a part of the regulation and do not qualify as pure economic performance indicators. The conceptual demarcation between tariff and tariff regulation seems to be problematic; the variables are not fully independent from each other.[81]

After the introduction of liberalisation the availability and quality of comparable tariffs across Europe has improved. For the last couple of years it has been possible to survey the tariff development by company or nation-wide average tariffs. Earlier research showed that data on tariffs for the EU-12 is often

only available from 2002 onwards (Haase, 2008). Caution should be used when comparing national average tariffs due to the lack of standardized definitions.[82] Some countries are very transparent and have documented their tariff development well (e.g. ECORYS Nederland BV, 2006). The most comprehensive and publicly available collection of comparable tariff data are at present the benchmarking reports of the European Commission and tariff surveys of studies conducted by Arthur D. Little (e.g. 2005). To conclude, due to conceptual objections combined with insufficient data before and after the liberalisation, tariffs do not qualify to be included in an empirical test.

9.3.4 So far so good?

So far, the review of economic literature has shown that gas market regulation and its empirical effect on performance indicators like efficiency, natural gas prices and tariffs, has been hardly subjected to research. On the basis of the existing literature a correlation between the two variables cannot be verified. Moreover, we have demonstrated the obstacles to conducting such an econometric analysis. A historical comparison of gas transport utilities' productivity in the EU-15 fails in the attempt to investigate the productivity of transport services within integrated utilities. The introduction of incentive regulations which employ efficiency factors certainly has a cost-reducing effect on the performance of natural gas transport. Nonetheless, the regulatory instrument determines by definition the performance in terms of efficiency. Consequently, the efficiency factor as a dependent variable is dependent on the performance variable. Data on natural gas prices is not available for an EU-15 cross national comparison. Natural gas prices are influenced by the oil indexation of supply contracts and to a great extent influenced by oil prices. The influence of regulation can not be clearly extracted from other factors driving the gas prices. And finally, tariffs data is insufficiently available to allow a meaningful comparison.

9.4 Impact of the regulation-for-competition on investments in the EU

Concerns about the security of gas supplies have moved up the political agenda due to the huge cumulative need for investments in gas in the EU-15 countries, coupled with the fear of energy blackouts. According to the World Energy Investment Outlook, the total gas sector investment needed in OECD Europe, projected over the period 2001-2030, amounts to $465 billion, or almost $16 billion per year (2003: 266). In considering alternative and reference scenarios, the estimated cumulative gas investments in EU-15 countries between 2001-2030 amounted to: distribution $85-95 billion, transmission $50-75 billion, storage $10-

15 billion, liquefied natural gas (LNG) re-gasification $15-20 billion (International Energy Agency, 2003: 271). The Californian crisis has shown that "sustained periods of shortages caused by under investment or adverse hydrological conditions may mean that market clearing prices can remain at high levels for lengthy periods and can produce politically unsustainable final prices to voting consumers" (Newbery, 2001: 91). Both opponents and proponents of European gas market liberalisation are questioning whether the current regulatory regimes in European energy markets will ensure sufficient investment.

Proponents argue in line with the structure-conduct-performance paradigm, and claim that liberalised markets reduce monopoly rents and that consumer demand will ensure the necessary infrastructure is in place in a timely manner. For them, the measures are not sufficiently far-reaching: insufficient regulatory competences and practice, combined with market power, runs the risk of not delivering the benefits of liberalisation. In contrast, opponents argue that liberalised markets do not provide enough incentives to ensure a sufficient level of investments. As a result, this line of argument suggests, underinvestment might result in a failure to meet the security of supply obligations that the regulatory authorities are supposed to ensure. According to this view, the current regulatory regimes have too few incentives to encourage investment. Instead, some advocate using the power of the market in times of worldwide demand-side competition (General Energy Council of the Netherlands, 2005; Helm, 2005: 11).[83] "The argument that long-term contracting supported by massively capitalised, vertically integrated national champions is the only way forward to ensure security of supply is difficult to refute in the absence of convincing alternative models" (Newbery, 2001: 92). Both viewpoints hold some truth and generate relevant questions which need to be addressed. Nevertheless, the politicisation of discussions on the security of gas supply is not always helpful in finding solutions. Hence, there is a need for academic consideration and evaluation of the matter in hand since this promises a more balanced and systematic insight.

9.4.1 Literature on investment in energy markets

Historically, over-investment and excess capacity in energy markets was considered to be a serious concern before the privatisation and liberalisation of energy markets. In the 1980s and 1990s, the New Public Management movement criticised public ownership for not being appropriate for delivering adequate efficiency and the capital liquidity needed to finance large-scale investments. Nowadays, theories relating to underinvestment in liberalised markets are fashionable, and question whether competition-based approaches are appropriate for network-based industries with high sunk costs. In this context, economists

have argued whether over- or under- investment is the more harmful for social welfare. Helm and Thompson (1991) suggested that, in general, the social costs of underinvestment are higher than those of overinvestment. In the more recent literature this view seems to be widely accepted (von Hirschhausen, Bechers et al., 2004). Accordingly, overinvestment should be the preferable strategy. Risk aversion on both the consumer and the company side is a common argument for a less-liberal market design. The central justification for this proposition stems from the apparent consumers' willingness to pay for security of supply.[84]

Addressing the impact of regulation-for-competition on investment, the recent academic debate on liberalising energy and other utilities can be divided into at least two camps. One applies econometric modelling, trying to analyse correlations between regulatory variables and investment by conducting 'large-n' empirical analysis. The other set of economic studies concentrates mainly on the electricity sector and tends to be theory-driven. Unlike the first set of studies, the latter refers to empirical developments in the form of case studies or illustrations that provide limited evidence, but are not designed as empirical tests.

In the econometric studies, the impact of regulation variables on investment is indirectly researched by using, for instance, the generation capacity installed in electricity markets as a proxy for investment decisions. A cross-national study analysing 38 countries, including countries with developing and OECD backgrounds, concluded that "well defined and credible political institutions are positively and significantly correlated with global electricity generation capacity" (Bergara, Henisz et al., 1997: 11). Cubbin and Stern (2006) reached the same conclusion after analysing 28 developing countries using data covering the period between 1980 and 2001.

The predominantly qualitative studies consider the likely impact of specific regulatory instruments, such as incentive regulations, on investment in the energy sector (Burns and Riechmann, 2004; von Hirschhausen, Bechers et al., 2004; Cowan, 2006). The strength of these studies lies in the micro-level explanatory power of firm behaviour. These analyses implicitly presuppose rational choice, from whence macro-economic phenomena become complex aggregates of individual decisions.[85] Drawing on spot- market pricing theory, Neuhoff and de Vries (2004) stress the importance of long-term contracts between electricity generators and retail companies in changing the incentives for investing in electricity generation capacity. Keller and Wilde (2004) emphasise the need of locational tariff price signals and multilateral coordination mechanisms to provide incentives and the necessary conditions.[86] Both these articles conclude that, under the current regime for electricity regulation, incentives are insufficient to ensure long-term investments in the electricity sector. Burns and Riechmann (2004) adopt a more integrative stance when advocating that

the success of incentive-based regulation depends on how the parameters of the specific regulatory regime are defined. Across Europe, incentive-based regulation of gas markets has only been introduced in a few countries. Incentive regulation is still in its infancy outside the UK and the United States. The analysis of specific forms of incentive regulation, such as price caps, rate of return and yardstick regulation, and their possible impacts on business behaviour in terms of investment should provide useful insights, and lead to improvements and the fine-tuning of the regulatory incentive schemes beyond the electricity sector (Jamasb and Politt, 2007). The bottom line is that scholars are far from convinced that the current liberal market design in the electricity sector is able to balance the uncertainty which market liberalisation induces. Although the qualitative reasoning put forward is reasonable, the literature requires empirical tests to allow generalisations to be made. With the current state of the literature, no definite answer is provided.

9.4.2 *Is there empirical evidence of a hold-up problem in the European gas markets?*

In electricity and natural gas research, the occurrence or danger of underinvestment in a liberalised energy market is predominantly interpreted as a hold-up problem (von Hirschhausen, Bechers et al., 2004). An insufficient level of regulatory stability may result in the holding back of investments, meaning that investments are delayed or even never made. Investment distortions may arise due to the lack of certainty stemming from vertical disintegration and decreasing contract periods. According to Williamson (1985), industries with long asset lives and a high proportion of sunk costs need to reduce risk through either vertical integration or by concluding long term (supply) contracts along the value chain. In reality, once an investment is sunk, the company is tied to the market and reliant on it for returns on their investment. Uncertainty can arise from the regulator's decision, after the investment has been made, to renegotiate prices or expropriate parts of the vertically integrated company. Industry sees the possible compulsion to unbundle ownership, enforced by European provisions, as an act of expropriation.[87] In interpreting the hold-up problem, regulators structurally face a lack of policy credibility. Spanjer (2006: 5) concisely summarised the situation "the essence is that a typical regulator is not able to credibly commit ex post to a regulatory rule, making the rule incredible ex ante". Experience suggests that regulatory rules are erratically or periodically subjected to change. An example of erratic change is the introduction of ownership unbundling, even if long forewarned and well prepared. On the other hand, pricing regulations are reviewed and determined every 3-5 years and this is a typical example of a periodic change that influences the pricing structure and

profitability of the company since, on the supply side, it is contractually bound by longer-term arrangements. Therefore, price regulation has the potential to negatively affect the returns on investments and hence the asset value of the company, raising fear of a "stranded asset" (Helm and Jenkinson, 2001). To sum up, the lack of political credibility translates into uncertainty over the returns on an investment, and this increases the likelihood of declining investments, delaying investments or altering the timing of an investment decision through opportunistic behaviour. In the context of investing in gas transmission and distribution networks, opportunistic behaviour could result in an incumbent operator being inclined not to invest, or postponing such a decision, in case this led to competitors being given market access through the increased transport capacity.[88] Moreover, natural gas companies seek to reduce uncertainty by opposing ownership unbundling and applying for Third Party Exemptions for new investment projects. These exemptions prevent competitors profiting from their investment and, at the same time, allow long-term booking of capacity.

The author has not been able to find any published study which analyses whether the European Union faces hold-up problems in practice. Ideally, such a study would compare the optimum investment level with the actual investments in the natural gas sector to empirically substantiate the occurrence or not of hold-up problems. Adopting a different line, Spanjer (2006) proposed a purely theoretical approach for evaluating whether a hold-up problem is likely in gas markets under the current European provisions. In a first step, he deduced seven criteria, relevant to the occurrence of a hold-up problem, which effect policy credibility. These criteria cover the presence of sunk investments, rapid demand growth, rate of capital depreciation, degree of technological development, private ownership of the company, investors profits and the regulator's discount factors. The last of these reflect the extent do to which the regulator values future benefits over present-day gains. He concludes that the majority of these seven, theoretically-deduced, criteria would induce a low policy credibility, suggesting the likelihood of a hold-up problem. The evaluation of the criteria and their effect on policy credibility is purely argumentative, there are no empirical references to the actual situation in European gas markets. This procedure seems to have three significant shortcomings. Firstly, Spanjer puts forward a schematic argument when comparing the number of criteria which seem to be in favour of encouraging a hold-up problem with the number against. The reasoning used assumes all criteria have equal impacts on policy credibility. On the contrary, we would argue, for example, that a low rate of technological development in the natural gas sector would be far less important than a huge demand increase which would create interdependency between regulator and industry. Secondly, he does not take the exemption regime of the European Union

into account. Thirdly, the argument lacks empirical substance. Rather than concentrating on the theoretical impact of policy credibility, we would suggest examining how contract durations develop, including mirroring the actual regulatory practice with regard to exemptions from third party access (TPA) for investments, and assessing the investments in the European gas markets before and after liberalisation. These three features might be responsible to foreclose an empirical test of the hold-up thesis in the context of European reform.

9.4.3 *Contract duration*

Although the duration of contracts plays a crucial role in shaping the industry's investment incentives, little light has been shone on the details of natural gas supply contracts. Both the industry and governments classify such information as sensitive, whether this be for commercial reasons or for security-of-supply concerns. It could be argued that full transparency with respect to the current and future demand and supply situations, and accompanying trading terms, would create an information asymmetry between producing and consuming countries. Neumann and von Hirschhausen shed some light on the contract landscape by reviewing 317 worldwide long-term natural gas contracts, of which 132 were signed in Europe between 1963 and 2005. Especially in the European context, the two authors faced considerable obstacles in obtaining data[89]: "there seems to be no better secret kept in European trade than which company is supplying natural gas under which conditions" (Neumann and von Hirschhausen, 2005: 10). According to Neumann and von Hirschausen, contract durations decreased significantly as natural gas markets became more competitive. Experiences of US gas market liberalisation suggest that the average contract duration shortens after the ending of a monopoly, to a period ranging from 8 to 15 years. Furthermore, long durations seem to promote the willingness to accept higher volumes in contracts. In the same publication, Neumann and von Hirschhausen observed that asset-specific investments make the difference: "Contracts that have been signed in combination with exploration of new resources or building of new infrastructure are on average seven years longer in duration in Europe and [more generally by] almost three years for all contracts [than those in America]" (Neumann and von Hirschhausen, 2005). At least in the European context, this finding might be related to the practice of TPA exemptions in the EU. As we will show in the next section, virtually all major new investments can avoid granting TPA. Accordingly, for all supply contracts related to new LNG or pipeline projects a quasi-monopolistic situation has been created. In this environment, it is only natural that European contracts are, on average, longer.

9.4.4 *European TPA exemption practice and the impact of unbundling on investment*

A conceptual problem arises when trying to analyse the effect of European regulation-for-competition on investment due to the introduction of exemptions in Article 22 of the second Gas Directive: how to measure the impact of competition on investments when the related competition measures do not apply to new investment projects? In this section we will first summarise the exemption provisions and then demonstrate the significance of exemptions by analysing EU exemption practice. Following this, we will reflect on the European Commission's claim that ownership unbundling, as part of the regulatory regime, has an empirically verifiable positive effect on investments and consider whether this assertion is justified.

Since 2004, any undertaking which is planning new major infrastructure or the substantial upgrading of existing infrastructure can apply for TPA exemptions. Article 22 of the second Gas Directive allows third parties to be excluded from access to transmission and distribution systems, interconnectors, LNG facilities, storage and upstream pipeline networks. The Directive distinguishes between full and partial exemptions (European Commission, 2003). In the case of a full exemption, the owner of the infrastructure has full rights over its full capacity. Consequently, there is no need for public tariffs or dispute settlement procedures. The regulatory authorities cannot intervene either ex ante or ex post. When infrastructure projects are partially exempted, the owner is obliged to offer a certain capacity to other market players. The available capacity is most commonly allocated using an open season procedure or an auction mechanism, and the regulator has to approve the method of allocation. As with a full exemption, the regulator acquires no far-reaching regulatory powers (European Commission, 2004). Exemptions are subject to a two-stage decision-making process during which the designated national regulatory authority assesses the company's request and formulates conditions on which a reasoned decision is based. In the second step, the Commission reviews the decision of the national authority and decides whether to give the exemption final approval.[90] Decisions are made on the basis of criteria formulated within the Directive and supplemented by an explanatory note.

Box 1: Criteria for granting an exemption based on Art. 22, Directive 2003/55/EC[91]

(a) the investment must enhance competition in gas supply and enhance security of supply;
(b) the level of risk attached to the investment is such that the investment would not take place unless an exemption is granted;
(c) the infrastructure must be owned by a natural or legal person which is separate, at least in terms of its legal form, from the system operators in whose systems that interconnector will be built;
(d) charges are levied on users of that infrastructure;
(f) the exemption is not to the detriment of competition or the effective functioning of the internal gas market, or the efficient functioning of the regulated system to which the infrastructure is connected.

In general, the granting of exemptions is an indication that the policy objective of security of gas supply has been prioritised over a purist application of regulation-for-competition. Nevertheless, such a norm-based interpretation has limited supporting evidence, unless it can be substantiated by analysing exemption practice in the EU between 2004 and 2007. For this purpose, we compiled a list of all infrastructural projects that were granted exemptions (see Table 25).

Receipt of notification	Project name	Country and national authority	Activity exempted	Investment volume	Duration
8.11.2007	Nabucco Gas Pipeline	Austria, E-control (the Austrian regulator)	Inter-connector	Approx. € 5 billion	(unknown)
23.07.2007	Eemshaven LNG terminal	The Netherlands, Ministry of Economics Affairs	LNG Terminal	€ 800 million	(unknown)
18.7.2007	LionGas Terminal	The Netherlands, Ministry of Economics Affairs	LNG Terminal	€ 650 million*	(unknown)
04.05.2007	Grain LNG Terminal (phase 1+2)	United Kingdom, The Gas and Electricity Market Authority (Ofgem)	LNG Terminal	€ 485 million	20/25/20 years for the three phases
23.2.2007	Poseidon Pipeline	Greece, Ministry of Economic Affairs	Inter-connector	€ 350 million	25 years
23.11.2006	Gate Terminal Rotterdam	The Netherlands, Ministry of Economics Affairs	LNG Terminal	€ 800 million	20 years (25 years requested, but amended by Dutch regulator)
15.4.2005	Brindisi LNG Terminal	Italy, Ministry of Productive Activities	LNG Terminal	€ 390 million	20 years**, partially for 80% of new capacity
12.4.2005	Bacton-Balgzand Pipeline (BBL)	United Kingdom and Netherlands, Ofgem and the Dutch Ministry of Economics Affairs	Inter-connector	€ 500 million	10 or 15 years, depending on the proportion of the capacity considered
3.2.2005	Milford Haven Dragon	United Kingdom, Ofgem	LNG Terminal	£ 250 million (€ 336 million)***	25 years
1.12.2004	South Hook LNG, Milford Haven	United Kingdom, Ofgem	LNG Terminal	€ 1067 million	25 years
1.12.2004	Isle of Grain LNG Terminal (phase 1)	United Kingdom, Ofgem	LNG Terminal (phase 1)	Included in above	as above
3.12.2004	North Adriatic LNG Terminal	Italy, Ministry of Productive Activities	TPA	€ 835 million	80% TPA exemption for 25 years (20% TPA)

(*) Author's estimation. Official investment figure not published.
(**) Based on the length of the contracts
(***) Based on January 2008 exchange rate

Table 25: Exemptions granted under Article 22 of Gas Directive 2003/55/EC[92]

In 2007, the European Regulators Group for Electricity and Gas (ERGEG) presented an overview of projects which had applied for an exemption under Article 22. ERGEG listed ten LNG projects of which eight have been approved and two are pending (Extension to the Isle of Grain phase 3 and OLT Offshore Livorno). Out of four interconnector projects, three have been granted exemptions from third party access. At the beginning of 2008, three decisions concerning onshore extensions belonging to the North European Gas Pipeline were pending. In other words, between 2004 and 2007, 11 new infrastructure projects have received exemptions based on Article 22. These add up to a total investment of approximately € 11.2 billion Euros. Except for the BBL interconnector, exemptions were granted for 20-25 years. Depending on the capacity allocation mechanism, the impact on the potential market competition and liquidity is considerable. When a TPA exemption is granted, the facility owners might negotiate and share out the primary capacity rights. With secondary capacity rights, the use-it-or-lose-it principle applies. Some of these projects allocate their primary capacity using an open season procedure, a special form of auction.[93] Capacity allocation practice varies among the investment projects.[94] The Italian projects have tended

to allocate their capacity through negotiations; whereas the British projects, such as South Hook LNG, Dragon LNG and the BBL interconnector, use either an auction for long term reservations or an open season mechanism (European Regulators' Group for Electricity and Gas, 2007, September). What we observe is that recent infrastructure projects to bring new tradable gas to the European markets exclude third party access and so potentially enable vertical foreclosure to thrive. Vertical foreclosure is here understood to be obstacles to competition that arise from the vertical integration of companies active in the supply and network business. Nevertheless, the European Commission was able to draw positive conclusions from its energy sector inquiry:

> Traditionally LNG has been imported by national incumbents who also own LNG terminals, which has not permitted the potential [of] imports to increase downstream competition to be realised. Recent trends, however, point to more capacity going to new entrants and to producers themselves. This is likely to have a positive impact on fostering downstream competition unless such effects are frustrated by access, LNG storage or emission rules with negative effects on competition, or by anti-competitive behaviour. (European Commission 2007a, January 10: 282)

The unfavourable rules, which might result in suboptimal competition, are not specified, and solutions to prevent a negative impact are not addressed in this context. Creating conditions in which new entrants come into play is necessary but certainly not sufficient to ensure downstream competition in the market. To reach a judgement as to whether competition will develop, it would be useful to make public the allocation of capacity in these new investment companies across Europe. It seems that the European Commission advocates competition along the complete value chain, rather than competition within and across all parts of the value chain.

To sum up, all the formal requests for exemption so far evaluated have received approval. The European Commission does not keep records of companies that make informal enquiries about exemptions but then fail to formally apply (whether due to negative feedback or any other reason). Therefore, it is not possible to compare the number of informal and formal requests with the number of approved requests. Measuring the impact of regulation-for-competition on investment is thus problematic in terms of the dependent variable because, in practice, third party access is not granted to new investment projects. In other words, the policy objective of achieving security-of-supply is prioritised over a purist application of regulation-for-competition.

9.5 Conclusion

Econometric research has brought about numerous comparative studies on utility reforms across the world and has explored the explanatory power of the structure-conduct-performance paradigm. The literature review revealed that the effect of regulation-for-competition on economic performance is not straight forward and it is hard to control for single factors in complex multi-factor equations. However, a misinterpretation of causes and effects might lead to the wrong policy recommendations and as a result decrease policy credibility and social welfare. After all, the following is a common conclusion of these econometric models: to achieve favourable economic performance within a liberal market organization, competition has to be put in place in conjunction with privatisation and credible regulation. Whereas the assessment of regulatory regimes in European gas markets has been carried out, their correlation to economic performance indicators appears to be more challenging. The effect of single regulatory instruments like third party access or unbundling has not been subject to substantial research and even then the results are contradictory. More research in this regard is necessary, before a conclusion can be reached. Discussion on the factors determining natural gas prices has directed the attention back to the basic conditions of the structure-conduct-performance paradigm. The oil price indexation of natural gas prices demonstrates the importance of basic conditions in shaping economic performance in natural gas markets. In the energy sector, some basic conditions such as a country's resource base, oil price development, access capacity and the degree of worldwide demand side competition do profoundly influence gas prices and security of supply. Changes of those basic conditions therefore need to be given systematic attention and control in econometric research equations and qualitative analyses alike.

The literature review additionally revealed that systematic analyses of the effect of regulation-for-competition on investment do not exist. In our attempt to empirically substantiate the claimed hold-up problem in European gas markets, three findings emerged. Firstly, as Neumann and von Hirschhausen show, the duration of supply contracts has decreased less in the European liberalised gas market than elsewhere. Moreover, investment uncertainty related to contract duration depends on the relevant exemption practice and can therefore only be judged on a case-by-case basis. Secondly, the European Commission and its national regulatory dependants approved all 11 formal exemption requests received between 2004 and 2007 for new investment projects. These reflect a total investment of approximately € 11.2 billion in infrastructure for which there is no obligation to grant third party access. Our attempt to empirically quantify the extent to which the EU is suffering from a hold-up problem did not succeed

because the optimal investment level, with which we could compare the current situation, remains undefined. Nevertheless, the industry's strong opposition to ownership unbundling coupled with the popularity of exemptions allowing long-term contracts does indicate that the general argument in favour of a hold-up problem has empirical support. Thirdly, due to the way the European market was organised prior to liberalisation, investment levels in the natural gas sector in general, and in transmission systems in particular, are not sufficiently clear to allow a systematic comparison. Investment figures tend to be misleading in the sense that they reflect ongoing developments. Consequently, the effect of regulatory regimes on investment in the gas sector as a whole cannot be scientifically verified on the basis of an EU-wide comparison.

Our second hypothesis proposed: The more misaligned transaction characteristics are from modes of governance, meaning the closer a regulatory regime is towards a competitive market (the best-practice of regulation-for-competition), the poorer the performance with regard to natural gas prices, network tariffs, productive efficiency, and investment in natural gas infrastructures and the more likely is a re-alignment of regulatory choices. Ultimately, we have demonstrated that for now a verification of whether or not regulation-for-competition positively correlates with favourable economic performance is not possible due to conceptual and data constraints. The liberalisation of European gas markets and related regulation has certainly had an impact on economic performance in the form of gas prices, efficiency and security of supply. We argue the current evaluations and econometric models do not convincingly measure the impact of regulation to allow a verification of the underlying theoretical assumptions of the gas reform. This might be considered bad news for those who believe a positive impact is a matter of fact.

10. The revision of Dutch incentive regulation

10.1 Introduction

In comparison to other European countries, the Netherlands has been one of the most adaptive countries in terms of applying regulation-for-competition. In our quantitative analysis, we generally observed a growing reluctance towards the end of the period examined among the old member states to apply best-practice in terms of regulation-for-competition (section 12.4). Most of the progressive countries, such as the Netherlands, remained in the emerging model group and did not move into the best-practice group. In some countries, the reluctance to apply best-practice became visible in the implementation pattern which resembled a roof (i.e. peaking and then tailing off). Most commonly in 2005, these countries revised certain regulatory instruments in a less favourable way (in the sense of achieving best-practice) and induced a reversing downward trend. Despite the fact that the Netherlands did not belong to the group of countries with this implementation pattern, which would indicate a downward trend on the regime level, an important regulatory change was made in 2007 with regard to incentive regulation. Since 2005, the Dutch regulatory authorities had applied a hybrid form of incentive regulation which combined a revenue-cap regulation with the method of price capping that involved reducing transmission tariffs by a factor X (X to be determined by the regulatory authority).[95] *While the X-factor reduction was retained, the dominant mode of incentive regulation was revised in March 2007 to become a rate-of-return regulation. Accordingly, the time frame of our analysis is determined by the implementation date of the revenue-cap regulation, in combination with the X-factor usage, in January 2005 and the announcement by the Minister of Economic Affairs to revise the applied incentive regulation in March 2007. This case study does not aim to display the evolution of the*

entire Dutch regulatory regime since European gas market liberalisation, nor is it attempting to provide an exhaustive analysis covering all aspects of tariff regulation and the related negotiations that led to all the distinct regulatory choices made since 2000. Rather, we have depicted one tariff-related regulatory choice, the revision of the incentive regulation in 2007, and analysed with the help of our research design which factors led to this regulatory change.

We will show in the case study how the applied incentive regulation affected investment considerations by the Dutch transmission system operator and ultimately resulted in the revision of the regulatory choice with regard to the employed incentive regulation. The interrelatedness of incentive regulation and investment incentives requires the consideration of two otherwise distinct transactions: the tariff regulation on the one hand, and the infrastructure-related transactions which set the framework for investment on the other. By considering how these two transactions are related to each other in the Dutch context allows us to highlight the conflict between short-term efficiency considerations, as a driver of incentive regulation, and long-term security in gas supply. In so doing, the case study reflects two regulatory objectives, regulation-for-competition and security of gas supply, and shows how these policy objectives may in reality compete. The case study analysis seeks to contribute to answering our first research question seeking the determinants of regulatory regimes and economic performance in European gas markets. Further, we will consider the relevance of our empirical study to the following hypotheses:

Hypothesis 2: The greater the misalignment between the mode of governance and the transaction characteristics, here interpreted as a regulatory regime reflecting a competitive market (the best-practice of regulation-for-competition), the poorer the performance will be in terms of natural gas prices, network tariffs, productive efficiency and investment in natural gas infrastructures, and the more likely the regulatory choices will be realigned.

Hypothesis 3: If regulatory authorities (Principal 2 and Principal 3) in a multi-authority structure differ in their prioritisation of policy objectives, then it is likely that a refinement or change of regulatory choices (including modes of coordination) will occur.

Hypothesis 4: A country whose natural gas supply situation is deteriorating is likely to change its natural gas objectives towards giving greater emphasis to security of supply concerns and will favour those regulatory choices which emphasise achieving security of supply as opposed to competition.

Hypothesis 5: The more that European provisions (Level 2) specify the subjects (indicators) of gas market reform, the more likely it is that best practice will be applied, resulting at the regime level (Level 3) in greater delta convergence.

The chapter starts with a brief introduction outlining the main characteristics of the Dutch gas market while at the same time identifying the main economic agents in the principal agent matrix. Then, the institutional set-up is outlined, concentrating on the distribution of competences between the Dutch Ministry of Economic Affairs and the independent regulator. In doing so, the main principal agent relationships between regulatory authorities and the transmission system operator are outlined. The section then moves on to sketch out the interrelatedness of incentive regulation and investment in the Dutch context. We show how the performance of the transmission tariff and an ambitious investment strategy aiming to transform the Netherlands into a gas roundabout in north-western Europe triggered a realignment of the applied incentive regulation. In the last section, we assess whether our postulated hypotheses are supported by our observations.

10.2 The Dutch natural gas market in a nutshell

This section provides some basic information on the Dutch gas market. Firstly, the demand and supply characteristics of the Netherlands are indicated by analysing the country's resource endowment. Secondly, this section identifies the most relevant economic agents by considering the ownership of the most important companies involved in the Dutch gas business.

In 2007, the Dutch market demanded 37.2 billion cubic metres (bcm) and as such was the fifth largest gas market in European Union. Natural gas contributed 45% of the energy mix, followed by oil with 38% (European Commission, 2007f). Production of 64.5 bcm in 2007 well exceeded demand, and the Netherlands was the EU's second largest gas producer. As the largest gas exporter within the EU-15, gas remains an important source of income for the Netherlands. However, there are significant changes underway, which are becoming visible when reviewing the reserve endowment of the country. At the end 2007, the Netherlands was still claiming over 1.25 trillion cubic meters of natural gas reserves. Nevertheless, one of our variable reserve endowment indicators shows a considerable decrease in the reserve-production ratio over recent years, from 25.1 years in 2001 to 19.4 years in 2007 (British Petroleum, 2004; 2008). Both figures are at the upper end of the values seen in OECD and EU-15 countries, and the fall is largely a result of downgrading in 2003 and 2005. This depletion of Dutch gas resources has been reflected in concerns

raised by the Dutch Energy Council (Algemene Energieraad 2005, Januari) and public media reports (e.g. Van Uffelen, 2005). Nevertheless, the Dutch demand is far from exceeding production (indicator 2), and is not expected to do so in the midterm (before 2010). The same holds true for the other indicator of whether sufficient gas storage and swing production is available during the examination period and in the midterm. The Netherlands provides access to approximately 5 bcm of storage capacity.[96] This amounts to 11% of annual consumption and as such is in the middle of the European range (UK (4%) and Germany (20%)) (Groenendijk 2007, May). An additional gas storage project in Zuidwending, and another near Amsterdam, are in the development phase. To sum up, during our observation period, the Netherlands had more than sufficient gas storage capacity and ample swing producing capacity due to ongoing onshore and offshore gas production. Nevertheless, the Dutch resource endowment points towards a steady decrease in gas resources which is why we would expect, in line with our fourth hypothesis, the Dutch regulatory authorities to change their natural gas objectives to give greater weight to security of supply concerns and to favour those regulatory choices which emphasise achieving security of supply as opposed to competition. In fact, by referring to our elaborations on the incentive structures of regulatory authorities, we can further specify our expectations (see section 3.5). Due to a ministry's inclination to consider the effect of a regulatory choice on the government's re-election chances, the likelihood increases of security of supply considerations being given preference over a strict application of regulation-for-competition.

Historically, the discovery of natural gas in the Groningen area of the Netherlands formed the nucleus of the development of the Western European gas market.[97] During the 1960s, the Dutch government and the companies involved developed a complex governance arrangement, the so-called 'Gasgebouw', which distributed costs and benefits amongst public and private actors (Correljé, Van der Linde, and Westerwoudt, 2003). From the start, the Dutch State has retained a strong position in the governance of the gas market, be it as the stimulator of the small field policy[98] or be it as a shareholder represented by the Dutch State Mines (Asche, Osmundsen et al., 2006), which later became Energie Beheer Nederland B.V. (EBN). In practice, "Most of the gas production concessions constitute of a 50/50 public/private partnership, involving Energie Beheer Nederland (EBN) and consortia of private firms" (Correljé, 2008). During 2003, the joint venture Nederlandse Aardolie Maatschappij (NAM) produced around 30 bcm, followed by EBN who produced 27 bcm in that year. There are several other economic agents active in Dutch gas exploration and production but their annual production volumes fall far behind. Companies such as Total, Wintershall, Gaz de France, British

Petroleum, Burlingthon, Talisman, ENI and Unocal only produce between 0.1 and 3.6 bcm yearly (Lecarpentier, 2004).

Prior to the European gas reform, Gasunie held a *de facto* monopoly. The company was jointly owned by a consortium made up of the Dutch State (50%), Shell (25%), and Exxon (25%). Gasunie was not only the single trader and exporter, but also owner of the national transmission system. In 2003, Gasunie exported 41 bcm to neighbouring countries: Germany (50%), Italy (18%), France (17%), Belgium (14%), and the United Kingdom (1%) (Lecarpentier, 2004). Due to its unique and dominant position in the Dutch gas market, Gasunie was an anticipated target of the EC Directorate on competition and potentially faced high penalties (Correljé, van der Linde, and Westerwoudt, 2003: 201). Gasunie was first legally unbundled but remained sheltered under the roof of its trading arm Gasunie Trade and Supply B.V., and its transport arm N.V. Nederlandse Gasunie. The two parts being separated by 'Chinese walls' and having distinct accounting systems. Despite not being legally obliged to unbundle its trade and infrastructure business, by applying ownership unbundling[99], Gasunie took further steps and reorganised its governance shortly after its legal unbundling. First, Gas Transport Services (GTS) was created on 14 July 2004 as a subsidiary of Gasunie. Although the transmission grid remained a Gasunie asset, ownership unbundling became effective once Gas Transport Services became the single transmission system operator in the Netherlands. The newly created TSO has its own internal governance with its own Commissioners and was legally independent of Gasunie. Being the only TSO, GTS plays a central role in our case study analysis.[100] Gasunie itself was transformed into an infrastructure company offering technical services and consultancy. The second step, the splitting of the trading arm from Gasunie, reached its final expression when Gasunie Trade and Supply was renamed Gasterra in September 2006. The shareholders of the trading company remained Shell (25%), Exxon (25%), the Dutch State (10%), and Energie Beheer Nederland B.V. (40%).[101] Gasterra benefited from the fact that Gasunie had established the Dutch trading hub, the Title Transfer Facility (TTF), in 2003 (see section 8.3.6). Since then, the TTF has functioned as a virtual trading point, allowing natural gas trading within the Dutch network and becoming the largest trading platform in Continental Europe. When the liberalisation process started, Gasunie Trade and Supply was the only trading company but, by the end of 2008, the number of traders who were physically trading at the TTF had grown to 60 (Gas Transport Services (GTS), 2007). In general, the number of economic agents active in the Dutch gas business has increased considerably with the liberalisation of the market. The most important economic agents for our analysis are Gasunie, GTS, Gasterra, Shell, Exxon and EBN. Reviewing the shareholders of some of these companies reveals that the Dutch State still holds

significant shares in the Dutch gas business. The Dutch gas users are separately organised into organisations representing large consumers, medium-sized consumers, and households. The Association for Energy, Environment and Water ('Vereniging voor Energie, Milieu en Water') accommodates the large consumers, while the medium-sized users express their concerns regarding gas market regulation through the Horticultural Production Association ('Productschap Tuinbouw') and 'LTO-Nederland' (Correljé, 2005). Householders do not have a specific gas or energy watchdog organisation. Their concerns are taken care of by the general 'Consumenten Bond' (ibid).

10.3 Institutional set up

The legal foundation of the recent Dutch gas market governance is constituted in a number of European and national norms, regulatory decisions and companies' own guidelines or codes of conduct. Our following list is not exhaustive and concentrates on the two main European Gas Directives of 1998 and 2003, which were implemented here in the form of the 'Gaswet' (Gas Act) of 2000 and the 'Interventie-en-implementatiewet' (I&I wet or Intervention and Implementation Act) of 2004.[102] Unlike the first and second Gas Directive, Regulation 1775 was automatically adopted by the Dutch government when it came into force in July 2006 (see section 7.1). Gas market regulation, especially tariff and access regulation, were further specified by binding measures introduced by the regulatory side and through operating rules developed by Gasunie.[103] A central feature of gas market governance, the Gas Tariff Code, was adopted in August 2005 and came into force in January 2006. The Netherlands Competition Authority published its decision to adopt price capping as a method to promote efficient operations by TSOs on 5 September 2005 (Directie Toezicht Energiesector (DTe) 2007). All these legal norms and codes of conduct created a complex principal agent matrix distributing competences and duties related to the gas market governance which we will outline in the following paragraphs.

On the governmental side, various ministries are involved with gas in some way. The Ministry of Housing, Spatial Planning and Environment (VROM) is involved through environmental and spatial planning procedures which are required when gas transport or production facilities (e.g. transmission or distribution pipelines) need to be constructed. Due to the growing internationalisation of energy-related themes such as climate policies in general, or gas transport and trade in particular, the Ministry of Foreign Affairs has a stake in for example facilitating consumer-producer relations or in communicating the Dutch position and strategies vis-à-vis European Institutions. When it comes to the overall policy and regulatory strategy formulation, the Ministry for Economic

Affairs takes the lead and is the decision-maker of last resort. The general energy strategy is set every four years and published in the Energierapport (Correljé and De Vries, forthcoming). Both the Ministry for Economic Affairs and the Ministry of Finance hold dual roles as firstly the executive political force, and secondly as representatives of the Dutch State as a shareholder along the gas value chain in Energie Beheer Nederland B. V. (production), Gasterra (trade), and Gasunie (transport). More specifically, "the Ministry (*of Economic Affairs*) is in charge to collect the revenues from gas production: the 'gasbaten' (gas profits)" (Correljé, 2008). After the ownership unbundling of Gasunie in July 2005, the Ministry of Economic Affairs represents the Dutch state as a shareholder of Gasterra, and the Ministry of Finance represents the Dutch state as owner of Gasunie.

An independent regulator was established in 1998 to regulate the transport sector. With effect from July 2005, the Dutch regulator (Directie Toezicht Energie, hereafter the DTe) was placed under the roof of the general competition authority (Nederlandse Mededingingsauthoriteit, hereafter the NMa)[104], but institutionally the Ministry of Economic Affairs functioned as the DTe's principal. In our context, the main regulatory authorities are the Ministry of Economic Affairs and the independent regulatory authority.

The distribution of competences among the Ministry of Economic Affairs, the DTe and the designated transmission system operator with regard to tariff specification are mainly defined by the Gas Act and supplemented by a Ministerial Decree (Ministry of Economic Affairs, 2005a). The Decree aimed to set out the cornerstones of a regulatory framework. The content of the Ministerial Decree may be challenged if one-fifth of the members of one of the parliamentary chambers vote to set the regulatory framework by legal norms. As such, the Dutch parliament may under certain circumstances function as a veto of last resort. In the principal agent matrix of Dutch gas market regulation, the Ministry of Economic Affairs functions as the second principal (P2) and has the competences to formulate the basic conditions for investment-related transactions to upgrade or build new transmission system capacity. The distribution of competences between the regulator and the Ministry of Economic Affairs reflects the government's desire to leave features which are closely related to security of supply under ministerial control (see section 3.5). The independent regulator, the DTe, is in charge of the so-called hands-on regulation. In the principal agent matrix, the regulator holds the position of third principal (P3). The duties of the regulator are generally more concerned with monitoring the gas market, with actual tariff regulation and, since 2005, also with settling disputes between customers and network operators. Nevertheless, the regulator is able to make some substantial decisions, for instance with regard to the tariff structure. In the Guidelines for gas transport, the DTe decided to maintain an entry-exit

approach as the mode for capacity booking in 2005 (Directie Toezicht Energie, 2005). The general duties of the DTe are (Nederlandse Mededingingsauthoriteit (NMa), 2008)[105]:

- To issue supply permits for the supply of electricity or gas to captive consumers and to small-scale users;
- To determine guidelines for tariffs and conditions with regard to access to gas transmission pipelines and gas storage installations and, if necessary, to issue binding instructions;
- To determine transmission and supply tariffs for gas, including the discount (price-cap) aimed at promoting efficient operation by the gas network operators;
- To assess every other year whether operators sufficiently and efficiently meet the total demanded supply for transmission capacity, as calculated on the basis of estimates submitted by the network operators;
- To assess every other year whether license-holders sufficiently and efficiently meet demands, calculated on the basis of estimates of the total supply demand of captive consumers, submitted by the relevant license-holders;
- To supervise compliance with the Electricity Act 1998 and the Gas Act;
- To closely monitor developments in the markets for gas and electricity, with a view to transparency, non-discrimination, competition and effective market operations;
- To advise the Minister of Economic Affairs on applications for approval with regard to instructions issued by an electricity/gas network operator.

According to Article 12 of the Gas Act, the procedure determining the actual tariffs is initiated by the transmission system operator making proposals consisting of the tariff methodology on which the tariff calculation is to be based. The DTe takes the second step by reviewing the proposal and decides, based on Article 82 of the Gas Act, whether the applied methodology is in line with the regulatory objectives outlined in the legal provisions. The approval of the calculation of firm-specific efficiency factors requires a separate decision (Netherlands Competition Authority, 2005). After reviewing the methodology proposal, the DTe is supposed to make a decision: it might decide that the proposal is not applicable or suggest revisions. On the basis of the ex ante approval of the method, the TSO can go forward and calculate and publish the actual regulated tariffs. The DTe is then supposed to make a final tariff decision.

Nevertheless, a tariff revision might also take place ex post if the approval of the regulated tariffs was based on incomplete or incorrect data.[106] If tariffs are not settled within the prescribed period through negotiation between the TSO and the DTe, and possibly the Court, then the tariffs used in the previous period remain applicable. Ultimately, this rule ensures that the gas transport services can be maintained, even if the parties involved have not reached a final decision on the actual tariffs.

Although they are somewhat subject to regulation, the Gas Act obliges the economic agents, namely Gas Transport Services on the transmission level and regional network operators on the distribution level, to ensure security of supply. As noted in the decision on the security of gas supply in the context of the Gas Act ('Besluit Leveringszekerheid Gaswet'), "GTS have the statutory duties to provide certain degree of security of supply and security of transportation, explicitly referring to the protection of domestic customers in the event of default of suppliers failure of production and transmission capacity" (Correljé, 2008).

On the basis of Articles 10(a), 8, and 54(a) of the Gas Act, the transmission system operator is obliged to ensure security of supply by maintaining the network and providing sufficient transport capacity. Other services prescribed in the Gas Act involve balancing and flexibility as well as a certain degree of quality consistency through the blending of different gas sources. In the same Article, the ministry is allowed to request certain maintenance work on the network and may even request an increase in transmission transport capacity. In other words, the Ministry of Economic Affairs functions as the direct principal of the TSO when it comes to those investment transactions which are considered as perquisites for a secure gas supply. At the same time, the agent GTS has to report every two years to its other principal, the regulator DTe, as to whether they have provided sufficient transmission capacity to meet the demand in the Dutch market. Correljé refers to a similar division of labour in the upstream business: "Production companies are no longer subject to any public service obligations, but the DTe is now primarily responsible for the ex post monitoring of compliance with the conditions of the supply licenses which all energy companies supplying directly to small consumers must obtain in advance." (Correljé, 2008: 9)

Thus, in both parts of the gas value chain, a form of labour division between Principal 2 (the Ministry) and Principal 3 (the DTe) is applied: decisions outlining the cornerstones of the regulation or involving public service obligations are tackled by P2, whereas monitoring tasks and daily hands-on regulation are overseen by the DTe.

10.4 Dutch incentive regulation and its interrelatedness with investments

In the context of the European gas reform, incentive regulation has been applied against the backdrop of European gas markets monopolistic or oligopolistic market structure dominated by vertical integrated companies. It is commonly acknowledged that transmission networks show characteristics of a natural monopoly. Due to the high investment costs of transmission infrastructure it is mostly not economically to lay competing gas pipelines to provide the distribution system operators or direct customers with gas. Prior to the European gas reform, the transport arm of an integrated company held a gatekeeper position and could prevent new market participants to trade gas in a market by not granting those competitors access to its network. As Joode notes, "this would theoretically lead transmission system operators to charge monopoly tariffs. In order to prevent monopoly pricing and induce virtual competition on the tariff networks, network regulation is in place." (2006)

In our methodology chapter (5), we outlined a set of indicators which the European Commission considered as relevant regulatory tools to arrange the tariffication and network access conditions (see section 5.10.20). The formulation of tariffs actually forms a complex sub regulatory regime consisting of several components among others tariff structure, minimum booking period of firm capacity, and incentive regulation. The different forms of incentive regulation emphasise different regulatory actions by which the tariff level is fenced. The literature distinguishes at least between four types of incentive regulation: price-cap regulation, revenue-cap regulation, rate-of-return regulation, and the so called discretionary regulatory regime of tariff determination (see section 5.6 and 5.10.2). In practise, seldom one of those ideal-types of incentive regulation is applied on its own right. Instead hybrid modes of incentive regulation prevail, combining different elements of those types.[107] Despite this fact, it is useful to name the main difference between those variants of incentive regulation relevant for our analysis. "Price cap regulation allows the operator to change its price level according to an index that is typically comprised of an inflation measure, I, and a 'productivity offset', which is more commonly called the X-factor. Typically with price cap regulation, the regulator groups services into price or service baskets and establishes an I - X index, called a price cap index, for each basket. Establishing price baskets allows the operator to change prices within the basket as the operator sees fit as long as the average percentage change in prices for the services in the basket does not exceed the price cap index for the basket. Revenue cap regulation is similar to price cap regulation in that the regulator establishes an I - X index, which in this case is called a revenue cap

index, for service baskets and allows the operator to change prices within the basket so long as the percentage change in revenue does not exceed the revenue cap index" (Jamison, 2007). Whereas the price or revenue-cap takes the reduction of operational (and capital) costs as the main angle for regulating the companies profit, rate of return regulation (also known as rate on investment) focuses on setting a ratio of money gained or lost on an investment relative to the amount of money invested. The strength and weaknesses of price or revenue-cap regulation are in fact complementary to those associated with the rate of return regulation. The so-called Averch-Johnson-effect suggests that over-investment is likely in case the utility is allowed a rate of return in excess of the cost of capital (Averch and Johnson, 1962). Therefore, a rate-of-return regulation may under certain circumstances run the danger of resulting in an over investment. The consumer then profits from higher quality of services and at the same costs are increased. Burns and Riechmann (2004: 212) summarize authors referring to the downsides of a strict cost-reflective incentive regulation approach. "Rovizzi and Thompson (1995), the incentive to reduce costs may lead to a reduction in quality of service investment. Markou and Waddams Price (1999) also argued that investment patterns for British Gas indicate that 'shortterm profit improvement' may motivate the company to lower its investment levels and they found that, in the water sector, 'a decline in renewals and maintenance of the existing distribution network has proved an important source of dividend growth'. The bottom line is that both incentive schemes bear their own risks when the parameters of incentive regulation and surrounding regulatory framework are not carefully chosen. A too narrowly applied price-cap or revenue-cap regulations may lead to under-investment, whereas a rate-of-return regulation may result in an over-investment in transmission capacity (see for further consideration section 9.4.1). Burns and Riechmann suggest applying a comparative efficiency analysis (benchmarking) of revenue-cap regulation to overcome excessive reduction of operating expenditures. Moreover, their general advice is regulators to be more output oriented ensuring a certain level of quality of services, than input oriented which might require regulators to mandate investments (Burns and Riechmann, 2004: 218).

European legal provisions do neither prescribe one of the named incentives schemes nor does the European Commission officially prioritises one of the options. Yet, Article 18 of the Directive 2003 requires that the member states ensure that the method the tariff formulation is based on, has to be approved by a regulatory authority. Moreover, Regulation 1775 announces objectives tariffs and its methodology shall account for. Tariffs shall be transparent, cost-reflective, and non-discriminatory while at the same time ensure the system integrity, future maintenance, and investments (Article 3, Regulation 1775). The

European provisions aim to apply the institutional logic of perceiving natural gas as commodity to tariff regulation (section 3.3.3), while at the same time referring to secondary regulatory goals related to security of gas supply. Whereas Regulation 1775 was directly adopted by Dutch law, the regulatory instruments how to implement the objectives prescribed by the European provisions were not specified. In line with our fifth hypothesis, we would expect the Netherlands' regulatory authorities do not necessarily apply best-practice in form of incentive regulation, because this measure was not mandatory by the European provisions. As we will elaborate below the Dutch regulatory authorities held a different view on this matter and consequently adopted early a hybrid mode of incentive regulation.

The evolution of the Dutch tariff regime was accompanied with heated debates between the regulatory authorities and Gasunie (respectively later GTS), arguing whether a market based or cost plus approach is more appropriate for the governance of the gas network.[108] Whereas GTS pursued a market based approach, DTe could enforce the cost plus approach. The market based approach to determine transmission tariffs foresaw the benchmarking of Dutch transmission tariffs against other transmission tariff of surrounding countries. The benchmarking of the transmission tariffs was aiming to prevent a distortion of national gas flows due to differences in transmission tariffs. Cost plus versus market based approaches to regulate network and their anticipated problems are widely discussed in general literature and in the Dutch context most prominently by Jepma (e.g. Jepma 2001). Before discussions were generating a consensus between the conflicting parties, facts were created.

In 2002, the DTe published the outline of the new tariff regime in a binding instruction (Directie Toezicht Energiesector, 2002). The new Dutch tariff regime grounds on the principle of cost-reflectiveness. Correljé summarised the contours of the then new framework: "DTe forced GTS: a) to reduce its tariffs by 5% annually over the period up to 2005, b) provide information on available entry exit capacities, c) to set up a balancing regime and an entry-exit tariff system, d) to provide indicative tariffs for short term transport contracts based on efficient economic costs, and e) to implement black-haul regime." (Correljé, 2008: 11) The new framework marks at least two landmark decisions in the Dutch tariff regime laying the ground for the implementation of the cost-reflectiveness principle. First the introduction of the entry-exit systems and second the introduction of the revenue-cap.

Despite the fact that the claim that entry-exit based tariffs are fully cost-reflective was contested, the DTe introduced in 2003 an entry-exit system where after the tariff structure and transmission pricing is based on. Back in 2000, the Ministry of Economic Affairs preferred distance based tariffs, but the DTe

succeeded in establishing an entry-exit based tariff system (Klop, 2009: 50). Entry-exit tariffs (like postalised tariffs) allow some shifts in terms of pricing. Though, the degree to which entry-exit systems allow the socialisation of costs is considered to be less compared to a postalised tariff structure. The latter is by definition an average of prices not taking into account the actual transport distance of a capacity booking.[109] Entry-exit tariffs shall reflect demand of specific entry and exit points and thereby show signals to the market where more capacity is necessary. This feature is interpreted to ultimately enhance the transparency. The non-discriminatory criterion is contested. On the one hand objectively those customers which ship gas over long distances are paying for those costumers whose contractual or physical path of trading is shorter. In fact, a cross-subsidizing is inherent to entry-exit systems (Gas Transmission Europe, (GTE) 2003). On the other hand, lifting or removing the distance element in the tariff method and socializing tariffs are expected to encourage new entrants to enter the market. Especially new entrants were supposed to be favoured by entry-exit systems, while the incumbents would already have booked transport capacity. Regardless from which perspective one applies the non-discrimination criterion to entry-exit systems, their application certainly offer a trade-off between favouring new entrants vis-à-vis incumbent gas traders to ultimately promote the competition in the market. The European Commission might have favoured entry-exit tariff structures due to the anticipated competition inducing effect. However, in the literature the pros and cons of entry-exit systems remain contested (e.g. Brattle Group, 2002; Gas Transmission Europe (GTE), 2003).

On 5 September 2005, the Netherlands Competition Authority published its decision to apply a method of price capping to promote efficiency operations of gas network companies in the Netherlands. In its decision the NMa and DTe explicitly links the reasoning to apply incentive regulation with the lack of a competitive market structure: "The aim of the system of regulation contained in the Gas Act is to give companies which find themselves in a monopolistic situation an incentive to act as efficiently as companies on a market characterised by competition." (Netherlands Competition Authority, 2005: 2). Immediately after the method decision was adopted, several market parties brought the DTe's method decision to the Court. In January 2006, GTS jointly with large and medium sized consumer organisations Association for Energy, Environment and Water and the Production Association of Horticulture 'Productschap Tuinbouw' as well as Gasunie Trade and Supply appealed against the applied incentive regulation at the Court ('College van Beroep voor het bedrijfsleven'). GTS was questioning the regulators legal mandate to apply a revenue cap taking the companies turn over as a base and challenged the method on the basis of which an X-factor reduction was supposed to be based on. (College van Beroep voor het bedrijfsleven, 2006, 30 November)

As an immediate effect of the revenue-cap, the GTS' turnover for transmission services dropped from 1.4 billion in 2004 to 1.2 billion in 2005. For the transmission tariffs in 2006 this decision translated into a lowering of tariffs by a nominal 4.2% (GTS, 2005: 15). Moreover, the regulation also had an effect on the financial account of Gasunie. In 2005, Gasunie's financial result before taxes dropped by 58 Million Euros from 687 Million in 2004 to 629 Million Euros in 2005 (Gasunie, 2005: 33).[110] As we will demonstrate below, the effects of organising the tariffication according to the principle of cost-reflectiveness influenced the tariffs in such a way that the impact on the operations of the Dutch unbundled TSO appeared contra-productive in creating investment incentives. Therefore, it is necessary to make the link between tariff regulation and investment incentives more explicit.

Prior to the gas market liberalisation, investment decisions were made by vertical integrated companies. Planning, investment, and operational processes were coordinated in the integrated companies and could be optimised under conditions of information sharing. To phrase it in terms of transaction cost theory, hierarchy (vertical integration) captured potential risks related to information asymmetry, or behavioural uncertainty for instance by trading parties. Complementary long-term contracts as hybrid modes of governance tried to prevent potential hazards along the value chain, linking producing with importing or transporting companies. Pelletier and Wortmann conclude "the vertical separation of the trade and transport sector has resulted in a new operation and planning paradigm" (forthcoming). In addition, the liberalisation process decreased contract durations (see section 9.4.3). In case ownership unbundling is applied, then the TSO operates in a business environment which dramatically differs from the pre-liberalisation governance. In 2005, Gasunie's Gas Transport Services was one of the few gas companies who had fully unbundled its transport arm while other Continental competitors like Eon, RWE or Distrigaz still enjoyed some advantages of vertical integration. Ownership unbundling excludes the option of cross-subsidizing the transport business with the help of revenues stemming from more profitable trading or supply branches. Instead, network tariffs are the only possible source of income for an ownership unbundled transmission system operator to earn back its investment costs. An ownership unbundled TSO is reliant on a proportional tariff regulation on the one hand and a stable investment framework with sufficient returns on investment on the other hand. In case these two conditions are not given, then network companies are set under considerable stress. In this context, Correljé points to the tension which arises from applying incentive regulation to achieve efficiency gains in the short term and long term considerations to ensure sufficient investment.

> As compared to access and tariff regulation, the regulatory framework for the governance of network investments is much less developed. These transactions are being dealt with on an ad hoc basis, under a considerable degree of uncertainty and regulatory reservation. Moreover, it is in these infrastructure-related transactions that the problem of applying short term economic efficiency principles – the basis of the current regulatory approach – emerges to its fullest extent. It is a vacuum of realistic rules and stabile signposts for longer term investment that is jeopardizing the longer development of adequate infrastructural systems for an efficient, sustainable and reliable energy supply. (Correljé, 2008: 13)

Prior to gas market liberalisation, the company's transmission tariffs, revenues or their rate of return on investment were not regulated. Transactions related to the tariff formulation and investment decisions were internally dealt with in the integrated companies. The balancing of potentially conflicting requirements stemming from tariff or investment transactions was solved without the involvement of independent regulators. This situation has changed with the gas market liberalisation in the Netherlands, where after the coordination of the different transactions and possible effects from tariff regulation on investments is based on regulation as mode of governance (see section 3.4). While a revenue cap regulation was already in place in 2005, a clear framework how investment transactions are dealt with by the regulatory authorities was lacking.

Nevertheless, by means of incentive regulation the DTe was indirectly involved in setting investment incentives. The calculation of a revenue-cap and regulated tariffs (minus the X-factor) is based on the regulatory asset base (Ministry of Economic Affairs, 2005a). Investment in assets needs the approval by the DTe by evaluating whether the proposed investment is considered beneficial and necessary ('nut en noodzaak evaluatie') for the Dutch consumers, before it is included in the regulatory asset base (Ministry of Economic Affairs, 2005a). Only in that case, GTS receives the regulator's approval to include an investment in the RAB ensuring that the investment costs can be earned back through the tariffs. This procedure involves that the DTe evaluates whether it considers an investment project efficient with regard to the benefits of the Dutch consumer. During our examination period, the criteria and procedure for such an evaluation were not very elaborated. Long term security of supply considerations are not necessarily taken care of when incentive regulation is applied. Incentive regulation is as such designed to enhance productive efficiency by lowering operational costs and to pass-through economic rents which otherwise may be captured by a transport monopolist. By design it is prone to run the danger of falling short in setting sufficient incentives for investments in the transport network unless a long term investment framework is established (Burns and

Riechmann, 2004: 212). As our case study shows this investment framework was still in the process of being formulated by the Ministry of Economic Affairs and the DTe.

10.5 Dutch tariff performance and the Jepma effect

On the introduction of the gas reform in the Netherlands, the actual level of the tariffs was a matter of concern for the Dutch transmission system operator. At least two opposing camps battled to achieve 'optimal' tariff performance in the Netherlands. Whereas the proponents of market-based tariffs emphasised the role of higher tariff levels to maintain the functioning of the market, their opponents preferred a cost-oriented regulated tariff aiming to ensure a reduction in end-users' gas bills.[111] The related discussion mainly took place in the years prior to the application and revision of the incentive regulation scheme, and is well documented (Jepma, 2001; Jepma, 2004; Correljé, 2005; RBB Economics, 2005; Brattle Group, 2007, December; Klop, 2009). Within the third principal, the DTe, and its agent the GTS, disagreement essentially persisted as to whether low tariffs indicated a desirable economic performance or would cause unintended site effects that would result in the malfunctioning of the market. The latter phenomenon entered the literature as the Jepma effect which Pelletier and Wortmann (forthcoming) concisely summarise:

> Jepma (2001) and Jepma et al. (2004) studied the impact of the differences in tariffs applied on different grids on the distribution of the gas flow, assuming purely commercial and profit maximizing behaviour by the shippers. He has shown that the gas transport tariff differences may induce unnatural gas routing within a network of interconnected national grids. This leads to a shift from the natural route (which is commonly the shortest) to the cheapest one. Thereby it potentially creates congestion on the cheapest part of the grids network. This last phenomenon has also been studied in Boots et al. (2005). Because transport tariffs are fixed, the equalizing arbitrage market mechanisms are blocked, and this phenomenon is amplified locally by specific differences in national transport tariffs. Jepma (2001, appendix1a) also suggested that such rerouting of natural gas flows could, apart from the described congestion, also lead to misguided grids capacity expansion of the cheapest grid and misguided under- investment in the most expensive grid. That is because distorted flows by definition give false incentives for infrastructure investments and will therefore lead to a sub-optimal interconnected grids network. The congestion and misguided investment incentives are referred to in the literature as the Jepma effect.

Historically, Dutch transmission tariffs have been relatively cheap compared to those in neighbouring countries. To support its claim that Dutch tariffs were low, GTS gathered empirical evidence by commissioning comparative studies analysing gas transmission tariffs in north-western European countries. After reviewing tariffs in Belgium, France, Germany, Italy and the United Kingdom, the Arthur D. Little (2005) study concluded that the relative position of the Dutch tariff vis-à-vis its European neighbours was consistently at the lower end of the range. The Dutch tariff ranged from € 20 per cubic metres/hour/year to € 60 per cubic metre/hour/year, whereas the upper tariff range reached € 120 per cubic metre/hour/year. The figure below visualises this empirical observation.[112]

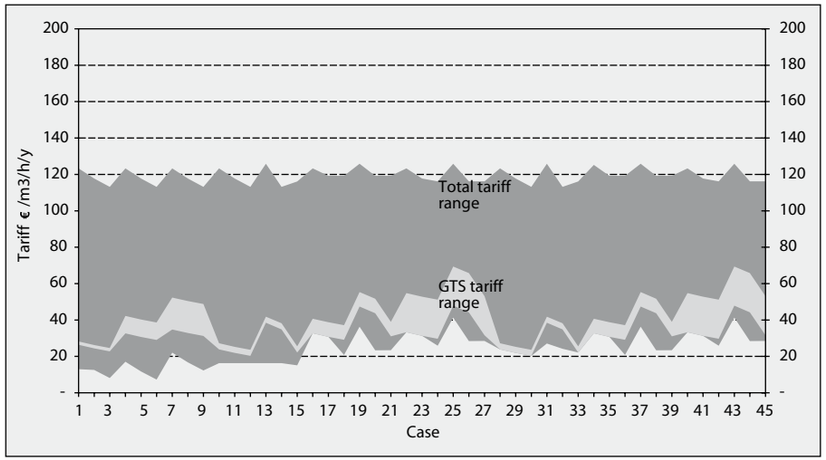


Figure 18: Comparison of the Dutch transportation tariff with the total range of European tariffs (1 January 2005)[113]

In practice, the transmission tariffs were so low that a re-routing of gas flows was likely. Shippers active on the German gas market could, for instance, decide not to book the shortest transport route (through the German network) but to use the Netherlands as a transit route by entering gas in the north of the Netherlands and extracting it in the south. Under certain conditions, this behaviour might lead to over-congestion on the north-south pipeline and, as a result, consumers connected to this trajectory might potentially not be served, as capacity allocation is offered on a first-come first-served basis.

The DTe was mandated to apply the principle of cost-reflectiveness as prescribed in Regulation 1775. The DTe was concerned that it should act in line

with the legal provisions and was driven in this attempt to avoid any court appeal which might have been the result if a market-based tariff approach was seen as having been adopted.[114] At the core of the ongoing debate remained the question whether a market-based or a cost-based approach should prevail, and what was in line with Regulation 1775. The opposing parties were struggling to provide empirical evidence to show or reject the existence or likelihood of the Jepma effect. The DTe also commissioned a consultancy report. In 2006-07, the Brattle Group was asked to inquire into the legal grounds and economic reasoning behind a market-based approach being seen as in line with the regulatory objectives outlined in the European provisions. The consultancy company approached the matter from a competition and a somewhat normative theoretical angle; investigating whether (cross-border) pipe-to-pipe (P2P) competition justified a market-based approach. The consultancy concluded:

> 'We do not believe that the Jepma effect is covered by Article 3 of the Regulation. We understand that benchmarking was included in the text of Regulation 1775 to recognise that some legislators perceived that there was competition between pipelines in Germany, and that benchmarking could therefore act as an alternative to cost-based regulation. Hence the intent of the Regulation seems to be the link between competition and the use of benchmarking. Regulation 1775 does not envisage using benchmarking to address the security of supply concerns raised by the Jepma effect. Therefore, we do not address the Jepma effect further in this report, since it does not seem to be a reason for benchmarking envisaged by 1775. That is not to deny that there is a link between the existence of P2P competition and the use of higher tariffs to avoid the alleged Jepma effect on security of supply. Raising transit tariffs to choke off demand for transit is more likely to have the desired effect if there are competing networks that have/can provide additional capacity. However, this link is not enough to ensure that the Regulation would allow for higher tariffs to choke off demand. The text of the Regulation suggests rather clearly that benchmarking is relevant to ensure that tariffs reflect efficient costs and provide appropriate returns and incentives for investment.'(Brattle Group 2007, December: 8-9)

The Brattle Group's elaborations backed the DTe's position in questioning the legal grounds for a market-based approach while at the same time acknowledging that effectively higher tariffs might reduce the risks associated with the Jepma effect. As we will show later, the regulator (the DTe) and GTS, as prominent actors in opposing camps, remained in a stalemate situation. The impulse to bring new dynamics into the situation was induced by mid- and long-term concerns over security of supply.

10.6 "The Gas roundabout" - a new strategic vision

In 2005, the Dutch reserve base and potential production from the small fields in the North Sea were adjusted downwards and this was reported in the Dutch news coverage. At the same time, the outcomes of debates on the strategic positioning of the Dutch gas market in a changing market environment were delivered. The Netherlands Energy Rapport 2005 stresses the need to strengthen the Dutch position in north-western Europe by continuing its small-field policy and expanding the gas import and transport infrastructure so as to become an important trading platform within Europe (Ministry of Economic Affairs, 2005: 51-52). These propositions by the Ministry for Economic Affairs were in line with the Dutch Energy Council's advice to adopt an import strategy to meet the future challenges triggered by the liberalisation of the European gas market, the internationalisation of the formerly regionally organised gas markets and its own decreasing resource base (Algemene Energieraad, 2005, Mei: 6).[115] In the same year, Gasunie announced its new corporate strategy aiming to become the "gas roundabout" ('gasrotonde') of north-western Europe (Gasunie, 2005). This strategy translated into proposals for several new investment projects ranging from gas storage to LNG facilities, and the expansion of the transmission pipeline system. Driven by the wish to increase the flexibility in the gas market, Gasunie invested in a gas storage project in Zuidwending, in the north of the Netherlands. New pipeline connections and the Gate LNG Terminal were envisaged in order to attract natural gas from outside the Netherlands (see section 9.4.4).[116] On the transmission level, infrastructure was proposed to expand two trajectories: one optimising gas flows from the north-east to the south-west of the Netherlands, and the other serving the same purpose for the north-east – north-west trajectory[117]. The latter, the so-called, Grijpskerk-Wieringermeer (GWWL) line was designed to increase transport capacity and to integrate the Balzgand-Bacton Pipeline with the Dutch transmission system, which now connects the UK with the Netherlands. Ultimately, the Dutch-German border point at Oude Statenzijl could be connected to the UK gas market. The north-east – south-west pipeline was designed to expand the gas transmission network in the Netherlands and also to enhance transit capacity (Gasunie, 2007). The required capacity was determined by conducting an open-season procedure starting in 2005. This brief summary of the infrastructure projects shows that the implementation of the envisaged roundabout strategy implied massive investments, for which an appropriate regulatory framework was still to be elaborated.

Thus, in the first half of 2005, a new strategic vision for the Dutch gas market was formulated by the Ministry of Economic Affairs, as well as by Gasunie and its transport subsidiary GTS. This revision can be interpreted as a reaction to

the decreasing resource endowment of indigenous natural gas. With regard to strategy formulation, we can see support for our fourth hypothesis: that a country whose natural gas supply situation is deteriorating is likely to change its natural gas objectives to give greater emphasis to security of supply and will thus favour those regulatory choices which emphasise achieving security of supply as opposed to competition. Therefore, we would expect the Dutch regulatory authorities to rebalance their regulatory choices with regard to their strict application of cost-reflectiveness as the dominant feature shaping the incentive scheme.

10.7 The revision of revenue-cap regulation

In 2005, GTS conducted an open-season procedure to investigate how much transport capacity shippers would want to book on the north-south trajectory from 2010 onwards. Phase 1 of this project foresees 310 kilometres of pipeline, 2 compressor stations and some modifications at border points, requiring an investment of some € 1.1 billion (Gasunie, 2007). Open-season procedures have two phases (European Regulators Group for Electricity and Gas, 2007). In the first, the market needs are assessed and then, in the second, the capacity is allocated by binding agreements. The first phase proper starts after a preparatory phase with the transmission system operator notifying the potential shippers. Then, non-binding bids on the basis of the open-season notifications are made and reviewed by the TSO. The capacity demand thus estimated usually requires adjustments to the previous market screening results, enabling one to formulate a business case on which to base the investment decision. In the second phase, capacity is allocated and binding agreements are reached between the TSO and the shippers. A factor in making the final investment decision is whether the proposed investment will be included in the regulatory asset base.

During 2006 and early 2007, GTS was facing considerable regulatory uncertainty[118] (section 3.4.2) in at least two ways. First, major elements of the applied incentive regulation, such as the reduction of tariffs by Factor-X and the approval of regulated tariffs, were not yet finalised. Second, the parameters of the investment framework and its related regulatory decision-making procedure were still to be settled.

In general, GTS and the shippers were interested in long-term contracts when booking transmission capacity (Ministry of Economic Affairs, 2007, March 29) and tariffs were similarly long term. Theoretically, shippers can align long-term gas supply contracts with long-term transport contracts and thereby reduce the risk of importing gas without having sufficient transport capacity to serve the customers. Similarly, the TSO profits from long-term capacity contracts because it

can reduce the risk of underutilising the pipeline, which would ultimately reduce the profitability of an investment. Following our interpretation of transaction cost economics, we observe shippers and the TSO jointly adopting a strategy that seeks to reduce potential hazard through the application of hybrid modes of governance. This strategy was hampered by the applied incentive regulation. While GTS was offering long-term contracts to its transport customers, the tariffs (minus the efficiency factor) of the TSO were to be approved on an annual basis. The incentive scheme is by law valid for 3 - 5 years and tariffs are annually approved (Netherlands Competition Authority, 2005). The high frequency in reviewing and determining effective tariff regulation contrasts with the ten to fifteen years that long-term contracts usually span.[119] Due to this frequency of tariff regulation, the TSO was not able to implement a long-term tariff structure in its long-term capacity booking contracts with the shippers. Given this, both GTS and the shippers were facing regulatory uncertainty.

During the first half of 2006, the DTe and GTS regularly exchanged views on the investment projects related to the open-season procedure and were trying to agree on a way forward.[120] Several meetings were held in this period in which first the evaluation criteria and then the process was developed and communicated. Then, in March, GTS started discussing its investment plans with the DTe and thereby officially informed the regulator of its intention to invest in the transmission system and submitted an investment plan proposal. In doing so, GTS was seeking to receive a green light at an early stage and clarify whether the investment plan would be considered necessary and beneficial for the Dutch consumers. The DTe's positive judgement was a precondition for GTS being able to recoup their investments through their transmission tariffs. In this context, it is worth mentioning that the first method decision foresaw the option of creating additional financial allowance when an investment was judged by the DTe to be "considerable and exceptional" (aanmerkelijk en uitzonderlijk) (Directie Toezicht Energie, 2006, 22 September). GTS presented their open-season related investment project in such a way as to meet these two characteristics.

Based on future transport scenarios that considered the demand and supply of gas and network use between 2005 and 2015 in the Netherlands, GTS developed three reference investment proposals. The first option represented a minimal variant, basically covering the unavoidable investments of € 470 million that GTS needed to make to meet its legal duty to supply its customers. The second and the third options both foresaw the expansion of the transit transmission capacity aiming to support the Dutch ambition of becoming Gas roundabout in north-west Europe. Extra capacity was planned along the north-south trajectory to serve domestic end-users and, additionally, more entry capacity in the northeast and exit capacity in the south of the Netherlands was considered.

The difference between the second and the third reference investment proposals lies mainly in the amount of transit capacity and related investment costs. GTS advocated the second investment plan, which incorporated a moderate extension of transmission capacity designated for domestic and transit gas transportation. The required investment amounted to € 1.27 million. This preferred proposal was based on the open-season procedure that GTS had initiated in 2005. The investment scheme was aligned with the market screening and backed by shippers' willingness to commit to proposed capacity expansions.

On 22 September 2006, the DTe reacted with a letter to GTS in which they gave their informal view on the request (Directie Toezicht Energiesector, 2006, 22 September). On the basis of the Gas Act, and the subsequent method decision made by the regulator (ibid), DTe did not see any legal grounds for making an ex ante decision as to whether such investments would be approved as efficient and therefore able to be added to the regulatory asset base. Articles 41b and 81 of the Gas Act give the regulator the duty of ensuring that tariffs are cost-oriented. Tariffs should equally pass through costs as well as benefits to network users. Since network users only benefit from additional transport capacity once the investment is activated (i.e. implemented), the DTe only approves an investment in the year in which it is activated.[121] Alongside its general objection to deciding in advance on the inclusion of an investment in the regulatory asset base, the DTe also articulated its view on the actual level of the network investment. The regulator expressed doubts over the certainty of the estimated costs in GTS's favoured investment scenario. The likelihood of exceeding the costs of € 1.2 billion, as estimated in the second investment scenario, was considered to be too high.[122] In addition, the DTe questioned to what extent the additional transit capacity would be used in practice. The regulator cited Gasmonitor, published in 2005, which claimed that half or even two-thirds of total H-gas[123] import capacity was not utilised. Mainly for these reasons, the DTe considered an investment of € 740 million to be more appropriate and a safer investment. This amount, according to the DTe, was covered by long-term contracts when assuming an utilisation rate of 40% of this additional capacity after the contracts ended in 2022. It is not our goal, in this thesis, to provide a further evaluation which seeks to determine whether the DTe or GTS and its shippers are more realistic in their anticipation of future capacity needs. Nevertheless, the DTe's approach has clear difficulties in accommodating transmission capacity expansion for transit purposes. Any substitution or expansion of the transmission network will ultimately result in an increase in the tariff level once the investment has entered the regulatory asset base. Additional transit capacity induces supplementary costs due to higher entry-exit tariffs on the transmission level. If the DTe were to agree to this, then the Dutch consumers might face the costs without being able

to quantify immediate financial benefits in the short term. At the same time, slightly higher tariffs might protect the Dutch consumer against a congestion of the transmission system which could result from relatively low tariffs (the Jepma effect). The new Dutch import strategy seeks to gradually substitute imports for indigenous gas supplies while at the same time functioning as a supply corridor for Norwegian and Russian gas to other north-western European countries. What might be conceived of as a transit capacity for the first five to ten years of its existence might later increasingly function as capacity to serve Dutch consumers. Another interpretation of the DTe's view on GTS's proposed investment plan of € 1.2 billion would be that the Dutch gas regulation does not have an appropriate response on how to socialise transport investment with national as well as at transit purposes. Short-term efficiency considerations prevailed in the DTe's informal response to GTS's investment proposal. The national focus of tariff regulation, in combination with a strictly applied cost-reflectiveness, led to regulatory uncertainty and limited incentives to invest.

Shortly after the DTe had given its view, the Ministry of Economic Affairs published a policy statement acknowledging that the NMa/DTe had difficulties accommodating transit and national transport functions within the cost-reflective paradigm (Ministry of Economic Affairs, 2006, 6 October). The Ministry criticised the regulator for not sufficiently taking into account the double function of the gas transport network in the Netherlands. The Ministry saw slightly higher tariffs as desirable to prevent congestion in the Dutch transmission network due to a redirection of gas flows induced by comparably low tariffs. Alongside preventing a possible Jepma effect, the Ministry explicitly referred to its ambition to become a gas roundabout, implying a need to encourage an increase in transit transmission capacity across the Netherlands. The ministerial regulatory authority called for the revision of the regulatory framework with regard to the setting of tariffs and investment decision procedures. In a letter to Parliament, the Minister of Economic Affairs outlined tentative contours of a revised regulatory framework. In October 2006, the Minister acknowledged: (1) the cost benefit analysis of an investment in transit capacity is primarily an issue for the investor; (2) the Dutch regulatory authorities should minimise the risks to Dutch customers related to investments which are primarily for increasing transit capacity; (3) the cost benefit analysis of those investments which primarily serve the purpose of increasing internal gas flows in the Netherlands should be done by the regulatory authorities; (4) determining the level of the transport tariff should take into account the tariffs on alternative routes (ibid).

On 30th November 2006, the Court reached a decision on the pending appeal against the applied revenue-cap regulation and the method decision necessary for the X-factor reduction, and annulled both regulatory decisions. The Court

shared GTS's interpretation of Article 82: that regulation of the company's revenues is beyond the legal scope (judgement declaration point 5.7). Although the appealing companies were given rights, regulatory certainty was still not achieved. Around this time, the contracts made with the shippers required GTS to make a final investment decision before 1st April 2007 (Ministry of Economic Affairs, 2007, March 29).

In a letter to Parliament, the Minister of Economic Affairs defined the cornerstones of the revised incentive regulation. The legal provisions, the Gas Act and related regulations such as 'Regeling tariefstructuren en voorwaarden gas' were announced, and to be adapted by January 2010 (Ministry of Economic Affairs, 2007, March 29: 7). The proposed revision reflects a shift from revenue-cap regulation to rate-of-return regulation. However, the latter is a hybrid rather than a pure model because it is complemented by price capping through applying an X-factor to lower operational costs. The rate-of-return regulation specifies infrastructure-related transactions by determining allowed rate-of-returns on the one hand and, on the other, by addressing regulatory procedures and the distribution of competences between the regulatory authorities - according to which a decision on whether an investment will be approved for inclusion in the regulatory asset base will be made. The new regulation distinguishes between existing and expansion assets to reflect the different risk levels associated with these investments. Whereas the market for existing gas transport facilities is considered to be relatively certain, expanding the grid and attracting gas imports and transits bears a higher risk which the higher return should accommodate. Existing assets may use a weighted average cost of capital (WACC) of 5.5% (pre-tax) with a depreciation period of 55 years. The risks associated with new assets justify a WACC of 7% (pre-tax), and a depreciation period of 20 years (ibid: 5). The relatively short depreciation period sets the basis for recouping investment costs while existing medium and long-term contracts support the economics of the project. On the upside, GTS could reduce its financial risks in the medium term, and promise higher incomes both during and after the depreciation period.[124] On the downside, the TSO runs the risk of opportunistic behaviour by the regulator in the longer term. For example, once the depreciation period is complete, the regulator could change the regulatory contract with the TSO by unilaterally imposing a windfall tax on the revenues generated by the depreciated (i.e. written-off) investment. (Klop, 2009)

The procedural rules for investment-related transactions have been revised such that the Ministry of Economic Affairs is the first to be approached by Gasunie/GTS. If the investment plan can be accommodated within the given regulated tariff level, the business case is to quickly pass to the NMa for evaluation purposes. If the existing tariffs would endanger the investment project, the Ministry will

conduct a cost benefit analysis. On the basis of this analysis, and after having considered the advice of the competition authority (the NMa), the Ministry of Economic Affairs will decide whether the investment project serves the public interest (i.e. security of gas supply). If the Ministry concludes that it does, then the NMa is expected to revise the regulated tariffs in such a way that the rate-of-return outlined above is guaranteed (Ministry of Economic Affairs, 2007, March 29: 5). These procedural rules clearly indicate that the second principal, the Ministry of Economic Affairs, shifted priority away from cost-reflective tariffs to tariffs commensurable with ensuring a secure gas supply in the mid- and long-term.

With regard to the overall tariff regime, the Ministry has acknowledged two constraints which the Gas Act and accompanying procedural rules (such as 'Regeling inzake tariefstructuren en voorwaarden gas') have imposed on the TSO through their tariff regulation:

1. the frequency of tariff regulation change creates uncertainty because it makes it impossible to conclude long-term contracts including fixed transport tariffs;
2. the strict application of cost-reflectiveness does not account for strategy-driven investments.

The Ministry has emphasised that the objective of tariffs is cost-oriented. Nevertheless, if the likelihood of capacity congestion is high as a result of increasing transit flows (Jepma effect), tariffs may be increased beyond the pure cost-based tariff level. One could interpret the Ministry's statement as a form of reopening clause[125] for the regulatory contract between GTS and the regulator over transactions related to tariff regulation. If the benchmarking of tariffs shows that they are lower than those in surrounding transmission system operators, and GTS is able to show that shippers' booking behaviour is already or is likely to negatively effect the use of the Dutch transmission network, then tariffs might be adjusted upwards regardless of the actual cost-level underpinning the tariffs. The new tariff regulation also considers revising the Gas Act (Article 82) in such a way that the legal basis for capacity booking can involve long-term contracts with fixed tariffs (ibid: 4). However, it is to be seen if and in which manner these propositions will be included in a revised Gas Act and associated legal provisions. Moreover, how tariff regulation will be applied in practice when a new method decision is adopted remains unclear.

In July 2008, the Ministry of Economic Affairs confirmed the announced revisions and that it expected them to be translated into a Gas Act by January 2010. The revisions were now based on the competition law. Later, the regulatory authorities envisage synchronising the re-evaluation of the key parameters, framing tariff regulation and investment transactions, in 2012. (Ministry of Economic Affairs, 2008, 3 June)

10.8 Conclusion

European law has not directly prescribed the application of one variant of incentive regulation but it has indirectly required any tariff system to be in line with the principle of cost-reflectiveness. Given the weak specifications in the EU law concerning the application of incentive regulations, the Netherlands initially adopted a revenue-cap regulation. Here, a cost-reflecting principle was applied in the form of a price-capping method, and this was later revised to a rate-of-return regulation, both of which are conceived as best-practice by the European Commission. Accordingly, the regulatory outcome neither strongly supports nor contradicts our fifth hypothesis.

We observed that poor, or at least negatively perceived, economic performance triggered actual, or the consideration of, realignment of modes of governance. The comparatively low Dutch gas tariffs distorted investment incentives for GTS, the transmission system operator. The actual tariff performance suggested negative implications (partly captured by the Jepma effect), and evoked the conflict between the short-term efficiency goals promoted by the regulations and the long-term desire to ensure sufficient import and transmission capacity for the Netherlands. Given the procedural and regulatory uncertainty concerning the tariff regulations, and the inclusion of investments in the regulatory asset base, there was a lack of incentives to upgrade and expand the Dutch transmission system. For this reason, we see the case study result as supportive of our second hypothesis.

In the Netherlands, the falling resource endowment led to a new strategy for restructuring the Dutch gas market, and one which gives more priority to the policy objective of security of supply while lowering the relative importance of cost-reflectiveness – previously the dominant regulatory goal. This outcome supports our fourth hypothesis. The revision of the Dutch incentive regulation, from an approach based on revenue capping to a rate-of-return regulation, reflects the growing importance attached to security-of-supply considerations in a European country which had been at the forefront and an early mover in

viewing best-practice in terms of regulation-for-competition.[126] Although we differentiate between revenue-cap and rate-of-return forms of regulation, both approaches are considered to be European best-practice and are in line with the institutional logic of treating natural gas as a commodity. Accordingly, this regulatory refinement is seen as a gradual shift in terms of changing the mode of governance. This change reflects the desire by the Ministry of Economic Affairs to optimise short-term efficiency goals while considering long-term gas supply security. As such, the Dutch revision to its incentive regulation is a shift from a purist application of regulation-for-competition, which prioritised the lowering of costs as the primary regulatory goal, to a more balanced approach giving more prominence to what was once a secondary regulatory goal. To put it another way, when the transaction effects related to the performance of the tariff regulations impinged negatively on the infrastructure-related transaction, then realignment took place. During the phase reconsidering the Dutch incentive regulations, GTS, the economic agent, acted in line with transaction cost reasoning when asking for long-term tariffs to minimise investment risks. This approach reasons that infrastructure-related transactions are characterised by high asset-specificity (especially site-specificity) and high regulatory- and business-environment-related uncertainty and, consequently, align best with hybrid modes of governance such as long-term contracts. Risks and potential hazards, such as stranded assets, led GTS to push for a revision to the tariff regulations and for a regulatory contract which would establish a basis for economically viable investments. A deadlock developed when GTS needed regulatory certainty while the DTe could not see legal grounds to provide this certainty by deciding ex ante whether an investment could be included in the regulatory asset base. Ultimately, the Ministry of Economic Affairs (Principal 2) proactively engaged in the dispute, which had developed primarily between the DTe (Principal 3) and GTS, to resolve the regulatory priorities. However, it is not clear whether the Ministry of Economic Affairs was mainly driven by political or economic incentives (see section 3.4.5). Given the dual role of the Dutch State and its relevant ministries (Economic Affairs and Finance) as both shareholder and regulatory authority it is impossible to give a definite answer. The Ministry of Economic Affairs and the regulator, the DTe, differed in their prioritisation of policy objectives. Whereas the Ministry of Economic Affairs gave more weight to mid- and long-term security of supply considerations, the DTe prioritised regulation-for-competition with its inherent emphasis on cost-reflectiveness as a policy objective. Although we could observe a correlation between the wide dispersion of regulatory goals among regulatory authorities and the likelihood of regulatory change, our qualitative analysis lacked a controlling factor which would enable us to confirm (or reject) our

third hypothesis. Further research is necessary to test whether, in a situation where regulatory authorities (Principal 2 and Principal 3) in a multi-authority structure differ in their prioritisation of policy objectives, it is more likely that a refinement or change to the regulatory choices (including a change in the mode of coordination) will occur.

11. The UK gas storage regime

11.1 Introduction

This eleventh chapter examines the decision of the UK regulatory authorities not to introduce strategic storage or other forms of increased security of gas supply obligations. Through this, we analyse as to whether the distribution of energy policy priorities within a multi-authority structure influences the regulatory outcome (hypothesis 3). After a brief introduction, the basic characteristics of the gas market are outlined and relevant economic agents are identified. Next, the section on the institutional setting describes the regulatory authority structure and the distribution of competences amongst the principal agents involved. In the following sections, we analyse the influence of several variables on the regulatory choice that was made in 2006 and confirmed in 2007. More specifically the effect of the UK's endowment with natural gas, rising natural gas prices, European legal provisions, the given authority structure and the prioritisation of regulatory objectives are amongst the factors considered. In the case study, the following hypotheses will be considered:

Hypothesis 2: The greater the misalignment between the mode of governance and the transaction characteristics, here interpreted as a regulatory regime reflecting a competitive market (the best-practice of regulation-for-competition), the poorer the performance will be in terms of natural gas prices, network tariffs, productive efficiency and investment in natural gas infrastructures, and the more likely the regulatory choices will be realigned.

Hypothesis 3: If regulatory authorities (Principal 2 and Principal 3) in a multi-authority structure differ in their prioritisation of policy objectives, then it is likely that a refinement or change of regulatory choices (including modes of coordination) will occur. In turn, in case regulatory authorities in a multi-authority structure apply the same prioritisation of policy objectives, then it is unlikely that a refinement or change of regulatory choices (including modes of coordination) will occur.

Hypothesis 4: A country whose natural gas supply situation is deteriorating is likely to change its natural gas objectives towards giving greater emphasis to security of supply concerns and will favour those regulatory choices which emphasise achieving security of supply as opposed to competition.

Hypothesis 5: The more that European provisions (Level 2) specify the subjects (indicators) of gas market reform, the more likely it is that best practice will be applied, resulting at the regime level (Level 3) in greater delta convergence.

11.2 UK gas market in a nutshell

The liberalisation of the UK gas market took place before the European gas reform started in 1998. All the major changes such as the privatisation of British Gas, the establishment of the then regulator, the Office of Gas Supply (Ofgas), which later became the Office of Gas and Electricity Markets (Ofgem), and the introduction of competition were agreed and implemented between 1986 and 1998.

The unbundling of British Gas (BG) was initiated in 1997 and took place in several stages. First, the separation of BG activities resulted in the establishment of BG plc and Centrica. Next, the former transportation arm of BG, which had remained part of the incumbent, was transformed into BG Transco plc in December 1999. One year later, its demerger from BG was finalised and transport services were integrated under the umbrella of Lattice Group plc. In 2002, Lattice Group plc merged with National Grid to form National Grid Transco plc - the UK's largest utility. National Grid owns and operates the gas transmission system throughout in UK and is also active in the gas distribution business. Several authors have described the process of liberalisation of the UK gas market during this time period in great detail (e.g. Waddams Price, 1997; Thomas, 2003; Helm, 2004). Whereas prior to liberalisation natural gas was treated as a public utility, the dominant institutional logic changed towards conceiving of natural gas as a commodity (see section 3.3.3). Full competition was legally established throughout the UK by 1998. During the 1990s, the UK gas prices for small,

medium and large consumers in final and access markets showed a downward trend, which gave support to the proponents of market liberalisation (see Figure 1 in Waddams Price, 1998: 118). In the current decade, the picture has changed. Since 2002, the UK gas market has experienced drastic increases in wholesale gas prices which have fed through to consumer prices. Especially during the winter months, natural gas prices have increased and skyrocketed in the winter of 2005-06. The market appeared to be insufficiently liquid to meet demand, and overall supply flexibility seemed lacking. The increase in gas prices led the UK government to review its gas market regulation and to consider measures to improve the security of gas supply.

Currently, the UK remains the largest market as well as the largest producer of natural gas in the European Union. In 2000, natural gas contributed slightly more than 40% to the UK energy mix, followed by oil with 32% in 2004 (Wright, 2006: 1). Annual natural gas demand was fairly level, ranging from 91 to 94 billion cubic metres (bcm) during the period 2002 to 2007, but production decreased during the same time by one-third. Whereas production totalled approximately 103 bcm in 2002 it shrank to 72 bcm in 2007. Thus, during our investigation period, the UK shifted from being a net exporter to a net importer. The decline of UK production is also reflected in the remaining reserve levels. In 2001, the UK had a reserve/production-ratio (R/P ratio) of 6.9 years which was downgraded to 5.7 years for 2007. If we compare this with the average R/P ratios at the end of 2007 for OECD countries and EU-15 states (13.7 years and 14.5 years respectively), we can only conclude that the UK has a relatively poor R/P ratio (our main indicator for the resource endowment variable) (British Petroleum, 2002; British Petroleum, 2008). "National Grid Transco (the TSO) has projected gas import requirements around 24 bcm for 2006-07, 55-80 bcm for 2010-11 and 75-100 bcm for 2012-12" (Stern and Honoré, 2004). As we will show in the sections below, the two other indicators used for a country's resource endowment also reflect a severe worsening of the supply situation by 2005 and can be characterised as natural gas demand exceeding supply and far too little natural gas storage capacity being in place.

Phillip Wright identified eleven major market players in the UK gas market: British Petroleum (BP), Shell, Statoil, TotalFinaElf, Gaz de France, Centrica (British Gas), EdF, E.ON (Powergen), RWE (npower), Scottish Power and SSE (Wright, 2006: 48-49). In the decade following the end of vertical integration as the norm, or the unbundled world, companies still tended to minimize their risks by being active in different parts of the value chain. The portfolios of the major companies are quite diverse. Although all eleven players are active in shipping gas, only a few have a significant share in the UKGS upstream business. The production of the big four players gives an indication of the competition in the upstream activities:

BP produced 13.5 bcm, Shell 10.7 bcm, TotalFinaElf 10.8 bcm and Centrica 10.9 bcm in 2003. The production of four of the other competitors, Gaz de France, Statoil, E.ON (Powergen) and RWE (npower), together only amounted to an annual production of 2.1 bcm. Wright explains, "EdF, RWE, Scottish Power and SSE are more focused on electricity than gas – and they are managing risk with substantial dual fuel generation assets and captive domestic consumers" (2006: 50). Competition has not been realised to the same extent in the gas market as for electricity. In December 2003, Centrica (British Gas) was still supplying 60% of the retail customers in the UK and remained the most important economic agent. Powergen followed with 12%, npower with 9%, Southern and Scottish with 7%, Scottish Power with 6%, EdF Energy with 5% and the remainder holding just 1% (Waddams Price, 2005: 134). Natural gas storage is currently dominated by Centrica who alone provide over 76.2% of storage capacity. Other companies hold marginal shares in terms of natural gas storage.[127] As such, Centrica is an important agent when it comes to gas storage regulation. With the liberalisation of the UK gas market, the number of companies active upstream, in liquefied natural gas (LNG), storage, in wholesale and downstream activities has certainly increase considerably. Yet, we see that Centrica still holds a very important position in the UK gas market. Unlike in many Continental European countries, the UK introduced gas to gas competition which is reflected in the prevailing contract structure. "In Great Britain, more recent long term contracts tend to be indexed to gas prices" (Office of Gas and Electricity Markets (Ofgem), 2004, October), whereas in the rest of the European Union long-term gas contracts are indexed to oil prices (see section 9.3.2).

11.3 The institutional setting

The distribution of competences amongst regulatory authorities and regulatory instruments are prescribed by the Gas Act of 1986 and amended by the Gas Act of 1995.[128] Further, the Competition Act 1998, the Utilities Act 2000, the Enterprise Act 2002 and the Energy Act 2004 form the legal basis for the activities of the regulatory authorities. The governmental bodies involved in the regulation of onshore gas industries are the Department of Trade and Industry (DTI), the Office of Gas and Electricity Markets (Ofgem), the Office of Fair Trade (OFT), the Gas Consumer Council, the Competition Commission, the European Commission, the High Court, the Environment Agency and the Health and Safety Executive. The main regulatory authorities, which we classify in our analysis as principals, are the European Commission (P1), the DTI (P2), and Ofgem (P3). The DTI (now the Department for Business, Enterprise and Regulatory Reform) functions as

the lead office on energy policy in the UK in general, and for UK gas market regulation in particular.[129] The Secretary of State, as head of the DTI, is obliged to fulfil the following duties:

- ensuring that all gas which is reasonably demanded by consumers is supplied;
- ensuring that all licence holders are able to finance their authorised activities;
- securing effective competition in gas supply; and
- subject to the above duties, secondary duties relating to:
  - protecting the interests of gas consumers, particularly those who are disabled, chronically sick or pensioners;
  - promoting efficiency and economy among licence holders;
  - securing effective competition in the conveyance of gas to new pipeline systems and areas, and in activities ancillary to gas supply and shipping;
  - the environment and to safety. (Oxera, 1999: 21)

Moreover, the DTI gives consent for power stations to be built and defines the extent of the regulated industry by deciding on exemptions from the requirements of the licences. The Ministry is responsible for the regulation of oil and gas offshore activities. The DTI appoints members to the governing board of the Gas and Electricity Market Authority which sets Ofgem's strategy, and has the power to veto any proposal by the regulator to modify licences. In short, the DTI has several competences which qualifies it as the principal for Ofgem (A1) (ibid).

A concern which is regularly raised is related to the task division between the DTI and Ofgem, according to which Ofgem has no say in regulating the construction, maintenance and operation of offshore storage, pipelines and production facilities. The DTI holds asymmetric information power, and Ofgem relies on the willingness of the DTI to share information on offshore activities. For this reason, Ofgem has repeatedly announced its aspirations to take over offshore regulation as well.

Ofgem's role is to protect consumer interests by promoting effective competition, wherever appropriate, and regulating effectively the monopoly companies which run the gas pipelines and the electricity grid. Ofgem complements the duties fulfilled by the DTI, with regard to the offshore sector, for the onshore sector. These duties are economically securing the gas supply, fostering and safeguarding competition, and promoting efficient and viable performance of the market players.[130] The authority determines who is a market player by granting licences. Ofgem functions as the principal for the economic

agents. The Gas Act, as amended in 1995, distinguishes between "public gas transporters, in this case Transco; gas shippers, essentially gas wholesalers; and gas suppliers, the companies that retail gas to the final consumers" (Thomas, 2003: 203). At the same time, the gas regulator has an interest in ensuring a sufficient number of licences because it is funded by those energy companies licensed to run the gas and electricity infrastructure. Ofgem formulates and sets the standard licensing conditions (SLC). In accordance with section 23(4) of the Gas Act of 1986, the Secretary of State may veto and modify Ofgem's licensing conditions. If licence-holding agents breach the SLC or other legislation, or fail to meet performance standards, then clauses 57 and 92 of the utilities act allows Ofgem to impose monetary penalties (HMSO, 1986). Furthermore, every five years, Ofgem reviews the prices for the gas transmission and distribution networks. The price control specifies the maximum revenue that a network can recover from its customers for a specific period. The aim is to increase the efficiency of transmission and system operators and to ensure that those companies do not secure monopoly rents against the interest of consumers (Ofgem, 2006).

In preparation for the Utilities Act, OFGAS and OFFER, the gas and electricity regulators, merged in June 1999 to form the Office of Gas and Electricity Market. In 2000, the Utilities Act was adopted and outlined the competences of the newly created regulatory body as described above. "The Bill represents an important change in the powers of government, as there are more formal opportunities for the government to intervene in the regulatory process, for example, through social and environmental guidance or levy schemes for disadvantaged consumers" (Graham, 2000: 103). According to clauses 10 and 14, the Secretary of State may release guidance to Ofgem to steer gas market regulation in such a way that social and environmental policy objectives are supported. The option of political guidance can potentially be applied to accomplish, for instance, security of supply related measures. Graham comes to the conclusion that "it is unlikely that these formal powers will actually be used to any great extent but they provide more possibility for informal influence by the government over the Authority's agenda" (ibid). We share this view, and interpret the introduction of political guidance, or levy schemes, as an indicator of the growing importance attached to secondary regulatory goals. In our theoretical considerations on the comparative incentive schemes of ministries vis-à-vis independent regulators, we demonstrated that ministries are more inclined than independent regulatory agencies to emphasis those policy objectives which assist in the re-election of their party/government (see section 3.4.5). The revision introduced by the Utilities Act could be interpreted as a principal's (P2) attempt to introduce ex ante and ex post control of its agent (A1), in order to prevent the agent deviating from the politically opportunistic interests of the principal.

National competition authorities such as the Office of Fair Trading (OFT) are part of the multi-authority structure (see section 2.1.3). Alongside Ofgem, the OFT (A2) holds a mandate to promote and ensure competition in the gas market. Coen analyses the relationship between Ofgem and OFT in his study of changing business-regulator relationships in the UK energy sectors and reaches the following conclusion: "With respect to the proposition that multi-authority structures make the monitoring of compliance more difficult, we find that, while there was potentially conflict of interest between the OFT and OFGEM, in reality clear demarcations are in place. Ofgem acts on the basis of the Energy Act and is the dominant institution in regulating energy and monitors competition in the sector. The OFT only intervenes in the most overt anti-competition cases. Significantly, institutional processes have been put in place to establish dialogue between the two regulatory bodies to avoid double jeopardy" (2005: 112). Our interview results support this observation.[131]

Furthermore, the Utilities Act established the Gas and Electricity Consumer Council, the so-called Energywatch, to protect and promote the interests of all gas and electricity consumers. Ofgem functions as the principal for Energywatch. According to section 7 of the Utilities Act, Ofgem and the Gas and Electricity Consumer Council are obliged to cooperate in terms of information exchange and to coordinate in order to ensure a "consistent treatment of matters that affect both of them (*Ofgem and Energywatch*)" (The Gas and Electricity Authority and the Gas and Electricity Consumer Council 2004, December). Energywatch primarily provides advice and information to domestic consumers (ibid, point 3.2). The creation of Energywatch can be seen as an attempt to increase the information level and thereby encourage switching of gas suppliers at the retail level and so stimulate what is seen as rational consumer behavior in a competitive market.

Between 1998 and 2000, the rearrangement of regulatory authorities that was on the agenda had the clear aim of fostering "better regulation". The Utilities Act is a result of this process, giving more prominence to secondary regulatory objectives alongside regulation-for-competition. At the same time, the principal has increased, through the introduction of political guidance, the possibility for the Secretary of State to steer the agent Ofgem towards fulfilling public service obligations. Previously, the principal could only appoint members of Ofgem's governing board and thus indirectly influence its strategy. Ultimately, the principal has been institutionally endowed, through the provisions of the Utilities Act, with the potential to boost its re-election chances if perceived as necessary.

11.4 Rising natural gas wholesale prices

In 2004, the impulse for new regulatory action was based on the poor economic performance of the UK gas market. Rising wholesale gas prices had brought the issue of market failure to the top of the political agenda. The discussions centred on a lack of market liquidity in the UK, and failed competition within Continental Europe. In our comparative assessments of the regulatory regimes in the European Union, the United Kingdom obtained, with 200 to 205 points, the highest scores for best-practice in terms of European regulation-for-competition between 2000 and 2005 (see section 8.2). In hypothesis 2, we formulated the expectation that those countries with high scores on this basis would display relatively poor economic performance in terms of natural gas prices which, in turn, would make a realignment of regulatory choices more likely (see section 3.4.4). After reviewing the transaction characteristics of the gas sector, we earlier concluded that European best-practise in terms of regulation-for-competition would not be the most efficient mode of governance. Thus, the rise of natural gas prices in the UK gas market seems at first sight to be in line with the second part of the alignment hypothesis (section 3.4.1) where a mismatch of mode of governance and transaction characteristics is likely to result in poor economic performance. While reviewing the Ofgem's Gas Probe, the case study analysis will explore the applicability of this hypothesis.

The figure below shows the rise in wholesale natural gas prices in the UK between 2002 and 2005 and sets this trend in relation to an averaged Continental wholesale prices.[132] In 2002 and 2003 the UK price was still below 20 pence per therm[133] and lower than those typical in Continental Europe. The comparison of Continental and UK price developments shows different patterns. Whereas in Continental Europe the price has moderately and steadily increased, we observe in the UK regular price peaks during the winter months. Especially since winter 2003-04, the price has taken off and moved beyond 24 pence per therm to skyrocket to above 50 pence per therm during winter 2005-06. Not only have wholesale prices increased dramatically, but also European spot markets. Especially the National Balancing Point (NBP) seemed to push its limit. Between 14 November 2005 and 24 March 2006, the NBP day-ahead price was well over 50 pence per therm and saw considerable volatility. In November 2005, the NBP day-ahead price moved above 150 pence/therm and in mid-March the price nearly reached the 200 pence per therm mark. In comparison, the Dutch Title Transfer Facility day-ahead price generally remained below 50 pence per therm. (Gas Matters 2006, June: 7)

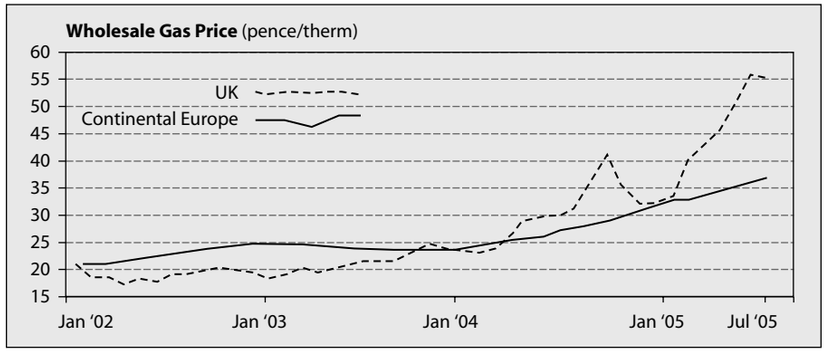


Figure 19: UK Wholesale Gas Prices between 2002 and 2005 (pence per therm)[134]

The UK gas market was facing a lack of liquidity and the demand for gas was exceeding supply. At the time, the regulatory authorities, and market agents, were appalled by the market behaviour of their continental neighbours given the high UK prices and available capacity to transfer gas from the Continent to the UK. "Even given that Interconnector users may not have based their plans on the increased capacity being available a month early at the beginning of November, there were still 35 days over December to March where less than 60% of capacity was unused despite a price differential of over 20 p/th"[135] (Gas Matters 2006, June: 8). Gas traders were scenting good business opportunities promising profits of millions of Euros. However, despite the high prices in the UK, gas trading companies were not able to direct natural gas to the island. The journal Gas Matters which specialises in natural gas market developments around the world questioned what many observers were wondering: "why did gas not follow price?" (Gas Matters 2006, June: 9). The neoclassical wisdom that a commodity will be sold to the highest bidder seemed to be at odds with market reality. Before we consider the causes of the price rises in the following section, some effects of the poor economic performance on UK consumers in the economy will be discussed.

Since 2004, the effects of the rising wholesale prices have been fiercely felt by UK consumers. According to Energywatch, households were facing an increase of 21% in gas bills and 15% in electricity bills during 2005 (Energywatch, 2005: 6). Also industry felt the effects of two winters of rising prices: "UK manufacturers of food and drink have seen their collective energy costs rise by around £ 180 million per year. The UK plastics industry, which employs 200,000 people and provides around £ 4.5 billion of exports every year, has seen its gas bills go up by around 30-35% and its electricity bills by 30-40%" (ibid: 7).[136]

During the winter outlook for 2006-07 organised by the Institution of Gas Engineers and Managers and hosted by the Department of Trade and Industry in London on 19 October 2006, industry representatives reflected on their experiences in operating Combined Cycle Gas Turbine plants during the previous winter. Here, we refer to two examples to illustrate the effects of the skyrocketing gas prices during that winter. Firstly, related to the second largest chlorine plant in Europe, Andrew MacKenzie, Gas Purchasing Manager at INEOS ChlorVinyls[137], illustrated the impact of energy prices on their business. At their Runcorn plant, energy accounts for 80% of the costs in producing their product. As a result of the high wholesale gas prices, the production level at the Runcorn plant had to be reduced by 80%, and an emergency plan for a complete shutdown had to be developed and customer orders cancelled. In such a high price environment, energy-intensive companies were inclined to consider alternative energy supplies. However, switching from gas to oil was not an option due to the asset specificity of the energy plants, as our next example demonstrates. Colin Hood, the Chief Operating Officer of Scottish and Southern Energy, referred to several logistical and technical challenges which prevented such a strategy. In his estimation, meeting the demand of a CCGT plant (≈700 MW) would have necessitated several oil tankers per day. Moreover, technicians would face problems in switching fuels in a smooth and reliable way.[138]

The rising energy costs seen by consumers were in sharp contrast to the increasing revenues of companies involved in the gas business. According to Ofgem's estimates, gas producers enjoyed increased revenues of over £ 5.2 billion as a result of these price spikes during winter 2004-05 (Energywatch, 2005: 6). Therefore, the most relevant consumer associations, representing private and commercial users, forcefully addressed their concerns in the media and approached governmental and regulatory institutions.

11.5 The Gas Probe

The Energy Intensive Users Group (EIUG) functioned politically as a seismograph of rising energy prices. The EIUG reacted as early as May 2002 to the rising prices, by calling for the OFT to investigate gas markets. This move can be interpreted as a reaction to the DTI consultation process on gas prices and possible improvements to market efficiency which was finalised in February 2001 but without resulting in any actions. The EIUG, as an agent, appealed not to the prime principal, the DTI, but to the OFT which itself functions as an agent of the DTI while being the principal for economic agents. The EIUG approach can be interpreted as an attempt to increase the pressure on its principals to monitor and control the behaviour of those agents which can influence UK

gas prices. The EIUG repeatedly criticised the concentration on the wholesale market (Energy Intensive Users Group, 15 May 2002). Earlier, the EIUG had even referred to rumours alluding to irregular behaviour in the spot, forward and future markets (Energy Intensive Users Group, 28 March 2001). Furthermore, the "EIUG also wants to see changes to DTI's dual role as regulator and sponsor of the offshore gas industry by extending the role of Ofgem (the independent market regulator)" (Energy Intensive Users Group, 15 May 2002). As such, the Energy Intensive Users Group supported Ofgem's attempts to increase its regulatory scope to include the offshore market.

The main driving force behind putting the rising wholesale prices on the agenda came from industrial consumers and their associations: both the EIUG and Confederation of British Industry were active. The activities and standpoints of EIUG are well documented whereas the role of the CBI is less transparent.[139] Between the winters of 2004-05 and 2005-06, the EIUG and the CBI organised several opportunities to share their concerns with officials from the DTI and Ofgem and, on the European level, with their European counterparts, DG TREN and DG COMP.[140] Both associations emphasised the impact of high energy prices on their competitiveness but never disputed that the path to low energy prices should be based on market mechanisms. The proactive actions of Energywatch took slightly longer to enfold, reflected in the fact that their 2003-04 annual report did not address the issue of rising wholesale gas prices at all.[141] This may have been because the Council was still in the constitution phase, and Energywatch was still rather concerned with its core issues such as correct billing and selling and fuel poverty.[142] An alternative reason may be that the effects of wholesale price increases take some time to feed through to the retail level. The contract structure for private or commercial users foresees annual or monthly payments based on periodically determined fees. In contrast, industrial consumers buy their gas directly from shippers and are therefore more quickly affected by wholesale price changes. Therefore, it is not altogether surprising that Energywatch joined the chorus of agents from industrial consumer associations somewhat later in calling for a Gas Probe.

In November 2003, Ofgem launched a probe into the causes of the movements in wholesale gas prices inquiring into possible internal and external market failures. The initial findings from this probe were published in May 2004 and the final report was published six months later in October 2004. Ofgem's main concerns circled around two questions: "why UK gas supplies had been lower than expected and why gas supplies imported from Europe had not increased more quickly when GB prices had increased above European levels" (Office of Gas and Electricity Markets, 2004, October). The regulator did not investigate

potential manipulation of the wholesale markets because this would be a task for the Financial Service Authority.

The interim report identified the main factors driving wholesale prices. One was related to the oil price even though, in the UK, long-term gas contracts tend not to be linked to oil prices. Nevertheless, since the UK market is linked to Continental markets, it indirectly imports oil indexation. "Ofgem's analysis suggests that this link may explain up to 30 per cent of the movement in forward gas prices" (Office of Gas and Electricity Markets, 2004, October). Further, Ofgem identified the decline in indigenous gas supplies and rising storage costs as price drivers. However, the reasons for the decline in supply did not seem to be fully understood and Ofgem called for greater transparency in information on the offshore business. Ofgem pointed to the fact that transparency is greater in the electricity market where the regulator has sectoral power (ibid).

Carried out mostly behind the scenes, a struggle between the DTI and Ofgem accompanied the Gas Probe. As Ofgem's principal, and having regulatory oversight of offshore gas activities, the DTI can refuse to pass on information or choose not to monitor the economic agents. Since the DTI seemed unenthusiastic to share information with Ofgem, the latter informally approached a number of companies to gather further information (ibid). The companies' willingness to cooperate was increased when Ofgem imposed penalties of up to £ 1 million on certain economic agents. Between February and July 2004, Transco, Powergen, npower and Scottish Power received notification of penalties for anti-competitive behaviour. Powergen, npower and Scottish Power were accused of hindering domestic customers trying to switch suppliers (Electricnet, 2004, July 20). Ofgem further judged that Transco had failed "to develop its pipeline system in relation to connections in an economical and efficient manner" between March 2001 and December 2003 (Ofgem, 2004, 19 May). As a consequence, the companies provided Ofgem with the necessary information to proceed with their enquiries in the context of the ongoing Gas Probe. The Energy Intensive Users Group claimed that "a wider enquiry is needed covering the structure and regulation of the offshore market" (Energy Intensive Users Group (EIUG), 2004, 28 May) and therefore backed Ofgem in its tussle with the DTI. At the same time, however, the EIUG acknowledged that a successful inquiry would require the combined forces of the DTI, Ofgem and the FSA.

The results of Ofgem's requests for information were twofold. Firstly, the DTI, gas producing companies and Transco voluntary agreed to publish additional information, on offshore gas supplies and maintenance, on Transco's website (Ofgem, 2004, October). Secondly, Ofgem could then learn more about the causes related to changes in the internal market and specify to what extent those

factors were responsible for the price rises. From this it became apparent that, at five sub-terminals, gas supplies were 40 per cent lower than in 2002. "Eighteen percent (*of the wholesale price rise*) was the result of year-on-year decline in the rate at which ageing gas fields can produce gas; and 18 percent was the result of planned and unplanned maintenance. The remaining reduction, representing 4 percent of peak day supplies, was the result of contractual arrangements which may have prevented gas that was physically available from flowing despite high prices" (Ofgem, 2004, October). The latter referred to swing producing capacity that was not used due to contractual arrangements prohibiting it from being sold below a certain price.

The DTI and Ofgem regulatory authorities had thus succeeded in clarifying the main causes for the market distortion and improving the transparency with regard to information on offshore gas activities. In October 2005, Ofgem concluded that the two main drivers for the rise in UK wholesale prices were mainly the result of (a) high oil prices feeding through to British prices, predominantly because of the pipeline link to the rest of Europe, and (b) faster than expected decline in gas supplies from the North Sea (Ofgem, 2005, 24 June). This analysis suggests that poor economic performance in terms of forward gas prices cannot be attributed solely to the gas-to-gas competition. In fact, markets influenced each other, inducing effects from various institutional arrangements and market behaviour.

Although the Gas Probe was officially closed in October 2004, the regulatory authorities had failed to clarify whether European gas companies held back gas supplies or transport capacity on the European pipeline network to prevent gas flowing to the UK (Ofgem, 2004, October). For this reason, Ofgem and the DTI approached the latter's principal, the European Commission (Principal 1), seeking an investigation into possible anti-competitive behaviour in Continental gas markets. One year later, on 25 November 2005, Ofgem sent a letter to the Directorate-General for Competition proposing the launch an energy sector inquiry. In parallel, the UK government, represented by Ofgem and the DTI, entered consultations on the subject with its neighbouring countries. The apparent reason for gas not flowing from north-western Continental countries to the UK was summarised in Gas Matters as "public service obligations require several potential sellers to hold gas in storage and there is simply not a lot of spare gas in north-west Europe during much of the winter" (Gas Matters, 2006, June: 607).

11.6 A liberal regulatory regime challenged

The UK government increased the pressure for regulation-for-competition to be applied across Europe. However, harmonisation towards regulation-for-competition in Continental European gas markets was unlikely to happen quickly enough to solve the UK supply-demand gap problem. At the same time, wholesale prices and thus consumer prices continued to rise for three years putting increasing stress on UK market regulation. Based on findings generated in the context of the Gas Probe, the regulatory authorities were now considering what action should follow. As demand was exceeding supply, the discourse was increasingly under the heading of security of gas supply. The discussions on the gas market were embedded in a more general political concern on how to restructure the energy sector after moving from a net exporter to an importing country. The future roles of other energy carriers such as coal, nuclear and renewable energies were provoking heated discussions amongst the various interest groups and the political establishment. With regard to natural gas, the fundamental question arose as to whether the UK should extend its security of gas supply obligations to include strategic storage. The issue of gas storage was on the table and a central concern: "Arguably the least contested lesson of last winter is that Britain does not have enough storage. Britain currently only covers about 4% of its demand from storage because it relied on North Sea swing for the rest. As the swing declines, swing will have to come from elsewhere, and extra storage makes sense." (Gas Matters, June 2006: 9)

11.6.1 Projected gas storage and supply situation between 2005 and 2010

When a country's natural gas resources are close to depletion, it has three main options: a shift towards other energy sources (energy source substitution), increasing gas imports or reducing natural gas demand (a so-called demand-side response).[143] The UK regulatory authorities in charge of natural gas regulation considered all options and tried to combine these three strategies. However, increasing the UK's energy efficiency in general, and the efficient use of natural gas in particular, largely lies outside gas market regulation. When moving from a gas exporting to a gas importing country, storage becomes increasingly important to guarantee short-term gas market liquidity. Generally speaking, gas-exporting countries are less reliant on gas storage than those that import due to their ability to produce on demand. Historically, this effect shows in the different gas storage capacities seen across Europe. Whereas the UK has little storage capacity, other Continental countries possess extended storage capacities. The UK gas market relies heavily on the Rough storage, which Centrica owns and has operated since 2002.[144] "It is assumed to have around 2.8 billion cubic metres

of storage space, but it has proved possible, depending on injection profiles over the year, to sell an extra 400 million cu m or so of space" (Platts, 2005). In total, the UK gas market commanded a storage capacity of around 4 billion cubic metres in 2005. There are several more projects coming on stream and more being considered which would increase the current storage capacity. Four gas storage projects, Humbly Grove Hampshire, Hole House phase 2, Byley and Aldbrough, are expected to add 920 million cubic metres by 2008-09 (ibid). If all the projects in the public domain are realised, then the total UK storage capacity could exceed 9 billion cubic metres by 2010. However, "what is worth noting is that even on the most optimistic assumption of 9 billion cubic metres by 2010, that would only give the UK enough capacity to store around 26 days of average 2010 demand (estimated at 339 million cubic meters, *UKGR 276/12*). Germany, a country with a similar annual gas demand level to the UK, is believed to already have sufficient storage capacity for some 80 or more days of its average demand" (ibid). Given this backdrop, the projected increase in storage capacities should be seen in relative terms. The indicator used to describe the demand-supply relationship (variable resource endowment, indicator 3, see section 4.3.1) in terms of storage or swing production has different values in the present situation (t1) and in the midterm perspective (t2). As the findings of the Gas Probe confirm, the demands for gas storage and swing production were certainly not met during the winters of 2004-05 and 2005-6. In the projections for storage capacities in the midterm (until 2010), the value of the third indicator improves in the midterm. However, although the UK's total storage volume is predicted to double, its storage capacity will remain low compared to many other European countries. In a study commissioned by the DTI, ILEX Energy Consulting concluded, based on their simulation of a future potential UK demand-supply gap, that a storage capacity of 75 days or 44 million cubic metres is desirable (ILEX Energy Consulting, 2006: iv).

However, to fully understand the impacts that the present and anticipated resource endowments have on regulatory choices other indicators need further consideration. Since 2002, the tightening of the demand-supply balance has contributed to the increase in wholesale gas prices feeding through to consumer prices. Accordingly, Indicator 2 for the variable resource endowment can be specified as that demand currently exceeds supply (t1). The midterm supply-demand scenario for the UK was not certain as of 2005: it is always difficult to know if and when import projects will become operational. Further, environmental uncertainty (see section 3.4.2) arose because of external effects from the global LNG business. In 2005 and 2006, it was unclear, to market participants, to what extent price differentials in Asian, North American and European LNG markets would divert LNG cargoes originally intended for unloading in the UK to other

destinations.[145] More importantly, the contractual situation with some import projects was not fully clear at that time (Stern and Honoré, 2004). Despite the uncertainties, regulatory authorities anticipate a certain future development in the country's resource endowment on the basis of increased import capacities. This anticipation can be best approached by considering the UK's proactive attempts to increase its natural gas import capacity through LNG projects. If all the six projects being considered, Isle of Grain I & II, South Hook I & II, Dragon LNG I and Canvey Island, are implemented in the way they were projected in 2005, then the UK could increase LNG-based natural gas imports from 4 to 45.4 billion cubic metres between 2005 and 2010 (Platts, 2005). In addition to the LNG-based increase in UK imports, several import pipeline projects are projected. The Interconnector between Belgium and the UK, the Dutch-UK link (the Balgzand Bacton Line or BBL) and two import pipelines from Norway (Langeled and Tampere links) are expected to add 69 billion cubic metres of import capacity (ibid).

Mixed results are seen when reviewing the indicators describing the present (2005) and anticipated future resource endowment of the UK, thus requiring a differential analysis. During winter 2004-05 and 2005-6, all the indicators pointed towards the UK being under-supplied with natural gas and lacking sufficient flexibility instruments such as gas storage and swing production. The picture changes when looking at the midterm perspective. The number of intended storage and import projects suggests that the supply situation is about to improve considerably. While gas storage will not reach the levels seen in other European countries, the UK's storage capacity is expected to increase sharply. In the midterm, import capacity will nearly equal the UK's 2007 production capacity, and will have reached more than 70% of that figure by 2007. Overall, the total of LNG and pipeline projects as of 2005 suggest that there will be a sufficient supply (Indicator 2) in the UK in the midterm. Stern and Honoré even indicated, in 2004, that there might be an oversupply, at least in terms of import capacity, towards 2010: "total annual import capacity existing and under construction (not all of which has committed gas reserves) adds up to 70-80 bcm for 2006-07. This could increase to as much as 120-130 bcm/year if LNG plants are built and expanded. These figures are much larger than the projected demand for imports noted above" (Stern and Honoré, 2004: 2). As we noted earlier, Transco similarly projected additional import capacities of 55-80 bcm for 2010-11 and 75-100 bcm for 2012-12. As such, the projections of midterm import capacity might even exceed demand. The present and midterm supply situation has been closely monitored by National Grid Transco who have informed the DTI and Ofgem regulatory authorities of this situation. On this basis, we can assume that both regulatory authorities were making their regulatory choices

with regard to gas storage based on the present and predicted future resource endowment of the UK.

11.6.2 Strategic gas storage in the UK?

The European Union's legal provisions for natural gas storage are less specific than for instance for transmission and distribution networks. Although the general reform principle applies, the first Directive hardly specifies any measures to regulate gas storage. The second Directive introduces third party access to gas storage (see section 7.2.2) and only in 2008 did the European Commission commission a study to review the gas storage situation in Europe. So far, the European provisions do not prescribe how much natural gas each member state should have in store. The original proposal for the Directive on security of gas supply (Directive 2004) foresaw member states imposing minimum storage objectives, but the Commission's attempt to harmonise and supranationalise competences with regard to security of gas supply failed (see section 6.5).

Consequently, the UK authorities had a free regulatory choice over how to improve or specify their provisions with regard to gas storage. Essentially, two options were under consideration: the introduction of strategic storage or a market-based approach implying the retention of the current regime. The latter intended to mainly target improving investment incentives in natural gas storage through optimising planning processes and other related administrative decision processes. In the Energy White Paper of 2003 (Department of Trade and Industry, 2003) the UK government and the regulatory authorities explicitly subscribed to market-based solutions as the dominant mode of regulation when outlining the underlying principles of their energy strategy:

> Liberalised energy markets are a cornerstone of our energy policy. Competitive markets incentivise suppliers to achieve reliability. (…) For the market to work, firms need to be confident that the Government will allow them to work. Energy supply problems in other countries have demonstrated the risks of not doing so. **We will not intervene in the market except in extreme circumstances, such as to avert, as a last resort, a potentially serious risk to safety** (bold in the original). (Department of Trade and Industry, 2003: 77)

Treating natural gas as a commodity thus remains the institutional logic of economic governance in UK gas markets. The introduction of strategic storage obligations would imply a shift to the logic of public utilities since strategic storage involves increasing the level of state intervention: either the state owns gas storage itself, and so fulfils its own security of supply obligations, or the state

obliges gas suppliers to domestic customers to maintain a minimum level of storage throughout the winter.[146]

Both regulatory authorities, the DTI and Ofgem, supported a market-based approach, although the review of current security of supply arrangements did consider interventionist approaches as well. The prioritisation within policy objectives was coherent across the two principals: it prioritised a competitive liberalised gas market. A final rejection of regulated gas storage was announced after the consultation process in 2007, but the Secretary of State had already announced the landmark decision in January 2006, indicating that the UK was not changing its institutional logic. During a Parliamentary debate, the then Secretary of State (Alan Johnson) acknowledged the national need for additional gas storage (and import) capacity, and said that the Government would bring forward legislation when Parliamentary time permitted (House of Commons, 12 January 2006). Mr Johnson was not, however, considering strategic storage or regulating gas storage. A view which the subsequent Secretary of State, Alistair Darling, repeated five months later in his 'Parliamentary Statement of Need for Additional Gas Supply Infrastructure' (House of Commons, 16 May 2006). In the meantime, the Rough storage facilities were be put out of operation for several weeks due to an accident on 16 February 2006. Perhaps surprisingly, the regulatory authorities did not reconsider their preferences with respect to the regulation of gas storage after this accident occurred. This could be related to the fact that the explosion happened towards the end of winter. The likelihood of reconsidering the prioritisation within regulatory objectives might have increased had the accident taken place at the beginning of the winter, because the effect that would have had on wholesale gas prices and spot markets would have been much greater. Instead, the Secretary of State heading the DTI was guided by the institutional logic that conceives of natural gas as a commodity and so emphasised only the need for improvements with regard to the planning processes. During his speech he proposed the subsequent measures:

> - legislation (when parliamentary time permits) to establish an offshore regime to enable innovative projects to go forward: gas storage in offshore salt caverns, and Liquefied Natural Gas (LNG) import projects with offshore unloading;
> - a review of onshore consents regimes, aiming to simplify and streamline procedures, in coordination with the Energy Review and with the Barker Review of Land Use Planning into the planning and land use system; and
> - measures to improve public understanding of the need for additional gas supply infrastructure projects, including onshore projects, and to promote best practice among project sponsors when applying for regulatory consents. (ibid)

These measures were later incorporated in the Planning Act of 2008 which establishes an Infrastructure Planning Commission to consider at the national level planning applications for nationally significant infrastructure projects including onshore gas storage facilities; and the Energy Act of 2008 in respect of subsea gas storage facilities. The government, represented by the DTI, is explicitly trying to enhance the coordination with local planning authorities when considering planning applications for gas storage projects (ibid).

When the Energy Review Report was published in July 2006, it announced a consultation process to review the robustness of the current security of gas supply arrangements. To ensure that the consultation with market participants and consumer groups[147] could contribute to the next White Paper on energy policy (due in 2007), the process started on 16 October 2006 and was closed on 12 January 2007. In parallel, the DTI commissioned two studies conducted by Oxera (2007) and ILEX Energy Consulting (2007) on the effect of different measures to potentially enhance the current security of gas supply arrangements. This procedure can be interpreted as an attempt by the regulatory authorities to reach an informed and consensual decision. Until then, the decision-making had lacked a qualified in-depth consideration of the pros and cons of the old institutional arrangements in a changing market and gas supply environment. The loss of the main storage facility at Rough in February 2006 raised concerns and reinforced the regulatory authorities' need to base the decision on gas storage on sound and profound considerations.

The consultation process considered two measures which could either lead directly to the development of strategic gas storage, or indirectly require more storage capacity to be constructed. One proposal was to expand the existing suppliers' obligations to cover industrial and commercial (I&C) users as well as domestic users; the other put forward the idea of regulating the use of gas storage for security of supply. The former foresaw the development of licence conditions for industrial and commercial users, following the existing model applied for households. The DTI explained: "in order to ensure secure gas supplies to I&C users (as well as domestic users), a licence condition could be developed that would require suppliers to have enough available gas to cover their industrial and commercial customers with firm contracts in the event of a 1 in 20 or a 1 in 50 winter. The mechanism for ensuring compliance with the expanded obligation would be left to the market. However, the most likely way that this obligation would be met, assuming that it was actively enforced, is through additional gas storage, although there would also be scope for contracting demand side response" (DTI, 2007: 29). Extending the licence conditions therefore would indirectly encourage more gas storage. In comparison, the regulation of gas storage measure "has been designed explicitly to prevent storage inventories to

be depleted in the early part of winter and hence making them unavailable in potential cold spells during the second half of winter" (Oxera, 2007: 47).

The government, represented by the DTI, rejected both these measures. The arguments against the introduction of strategic storage or a change in security of supply obligations were threefold. The probability of an extreme winter (1 in 50, or 1 out in 30) or comparable extraordinary events is relatively low, whereas the costs of the proposed measures are relatively high. At the same time, adding further security of supply obligations were considered to reduce the incentives for developing commercial storage or related infrastructures. DTI referred to the cost-benefit analysis carried out by Oxera which suggested:

> (…) if an obligation equivalent to a security of supply level of a 1 in 30 winter was applied across the market, i.e. to industrial, commercial and domestic consumers and the power sector, there would be a cumulative (discounted) net cost to society of £ 177 million over the period 2007-2020. This net cost arises due to the fact that, although there would be a benefit in terms of avoided supply interruptions and demand-side response costs of £ 478 million over that period, the measure would also lead to a decrease in welfare of £ 655 million due to the increase in prices required to remunerate the additional investment. In addition, Oxera did not account for the implementation costs of this measure, which could potentially be significant given the monitoring and enforcement required to ensure its effectiveness, which would further add to the net cost of £ 177 million. (Department of Trade and Industry, 2007: 13)

In general, the positions of the regulatory authorities, namely the DTI and Ofgem, did not differ in their general objection to the imposition of strategic storage. During the consultation process, both reiterated their beliefs in a market-based approach: "We explained in the Review report that we continue to believe that well-functioning markets are the most effective mechanism for ensuring adequate investment in gas infrastructure" (Department of Trade and Industry, 2007).

Centrica and other market participants repeatedly rejected the imposition of any form of strategic storage or an increase in the security of supply obligations for producers (Centrica, 2007). The two main consumer associations also failed to call for a change in the mode of coordination, and were also urging market-based solutions. The EIUG explicitly supported the emphasis on market solutions (EIUG, 26 February 2003). Energywatch is devoted to the idea of liberal markets and advocates instruments that are based on industry self-regulation.[148] Before and during the consultation process, Energywatch did not call for the establishment of strategic storage, but emphasised the need for transparency in

the gas market and strong investment incentives (Energywatch, 2007). As such, there was a general consensus among the majority of consulted associations and companies dismissing any change to the regulatory approach. Only Gaz de France was cited as supporting the regulation of gas storage (Department of Trade and Industry, 2007: 15).

Thus, it is hardly surprising that regulating gas storage by imposing a minimum level of storage during the winter months was rejected. The DTI's official justification was: "given that the majority of responses and the analysis indicated that regulating the use of storage in the manner described in the consultation would significantly impact on the profitability of storage operators and hence the incentives to provide more storage capacity, this measure is unlikely to benefit security of supply. Government therefore does not propose to consider this measure any further" (Department of Trade and Industry, 2007: 15). Instead, the White Paper on Energy restricted itself to harmonising the existing offshore gas development consent regimes and introducing a new offshore licensing system. In addition, the DTI formulated guidance to assist potential investors in gas storage projects and associated infrastructure under the existing planning system (Department of Trade and Industry, 2007, May: 21).

11.7 Conclusion

European legal provisions did not specify how much gas storage a country should have at its disposal, but instead concentrated on the introduction of third party access to gas storage facilities in the second Directive. The European Commission's wish to establish a minimum storage capacity across Europe failed. The UK's regulatory authorities voted against the introduction of strategic storage or extending the security of supply obligations to enhance the protection of industrial and commercial users against supply disruptions. Consequently, a non-specific European legal provision resulted in the absence of best-practice being implemented, which supports our fifth hypothesis.

Increasing wholesale gas prices triggered a review of the current gas storage arrangements. The findings of the Gas Probe suggested that the poor economic performance in terms of forward gas prices could not be attributed solely to the gas to gas competition arrangements which dominated in the UK. The price rise was, to a large extent, seen as a result of importing gas from other countries under contracts which were oil-indexed. As such, the markets influenced one another, inducing effects from different institutional arrangements and market behaviours. A careful consideration of the situation does not confirm our second hypothesis, or at least there is not clear-cut support. A distinct effect of the UK's adoption of best-practice in terms of regulation-for-competition cannot be

verified from this case study. An in-depth empirical consideration of the second hypothesis is however also elaborated in chapter 8.

Analysing the institutional setting in which the multi-authority structure is embedded showed Ofgem as having competitive ambitions vis-à-vis its principal, the DTI, when it came to the responsibility for onshore and offshore gas market regulation. However, Ofgem's aspirations to extend its regulatory scope did not affect the regulatory choices made with regard to the UK gas storage regime. Despite the fact that the Utilities Act offered more possibilities for political intervention by the Secretary of State, the head of the DTI did not formally take advantage of this opportunity in the discussed case. Whether it was informally used by the principle (the DTI) to influence its agent (Ofgem) in reaching its regulatory preference in terms of a gas storage regime is unrecorded. Given the fact that all the involved regulatory authorities prioritised competition over security of supply, there was also no need for the Secretary of State to intervene using the Utilities Act. The circumstances suggest that the Secretary of State and his department did not see their government's re-election put at risk by not imposing a minimum storage obligation. It is noteworthy that with regard to strategic storage the spread of preferences was relatively small. A strong coalition calling for the introduction of strategic storage or extended security of supply obligations for suppliers could not be identified. Our observations support our third hypothesis. Since the regulatory authorities in a multi-authority structure did not differ in their prioritisation of policy objectives; it was unlikely that a refinement or change of regulatory choice (including mode of coordination) would occur.

According to our fourth hypothesis, we would expect a country whose natural gas supply situation is worsening to change its natural gas objectives to give greater weight to security of supply concerns, and to favour those regulatory choices which emphasise security of supply as opposed to competition. During winter 2005-06, while the regulatory authorities were still in the decision-making process, all three indicators describing the resource endowment of the UK gas market were showing demand exceeding supply. The UK was changing from being a net exporter to a net importer of gas, suggesting that security of supply would be of increasing importance as a regulatory priority. By considering the situation in winter 2005 in combination with the anticipated midterm gas supply situation, we were able to reach a more differentiated reasoning. While the production rates move towards depletion, the indicators capturing import capacity and the level of storage or swing production change the picture. According to the projections, gas storage capacity is expected to double by 2010, to provide around 26 days of average 2010 demand. Although the UK remains far behind what is seen as a desirable 75 days (44 million

cubic metres), considerable improvement is in hand. In conjunction with the anticipated growth in import capacities, projected to achieve an oversupply situation in the midterm, the need for new storage seems to reduce over time. Overall, the regulatory authorities were expecting the demand-supply gap, which was to an extent responsible for the price rises, to be reduced if not removed in the near future. Strictly speaking, we cannot claim this gives support to our fourth hypothesis. The British case study teaches us that if the anticipated resource endowment is projected to be considerably increased by adding import capacities, then regulatory authorities are unlikely to change their natural gas objectives to give more weight to security of supply concerns, but will favour those regulatory choices which emphasise achieving security of supply through a market-based approach.

The rejection of strategic storage, announced in January 2006, demonstrated that regulatory authorities were taking cost benefit considerations into account. At the end of the consultation process on the robustness of arrangements for securing gas supply, the DTI referred to the anticipated impact that strategic gas storage measures, or enhanced supplier obligations, might have on social welfare (2007). Based on the Oxera study, various measures to improve security of gas supply were related to anticipated costs and benefits. Extending the supply obligations, Oxera estimated, would lead to an 'increase' in welfare (net present value over 15 years) of minus £ 655 million and a net benefit of minus £ 177 million. A similar assessment for the establishment of strategic storage was not provided,[149] but this was expected to negatively effect investment incentives for commercial storage (2007: 35-36). Transaction cost efficiency has not explicitly been a consideration. Despite the fact that transaction cost economics, when applied to European gas markets, suggests that a hierarchy, in the form of vertical integration, is a well-aligned governance choice, the UK regulatory authorities favour market-based approaches and prioritise competition. They have a preference for the high-powered commercial incentives that market approaches offer, while unbundling the gas industry. In terms of the gas storage case study, the UK applied a regulation-for-competition approach without regulation. Here, we see a clear difference between the European Commission's interpretation of regulation-for-competition and the national regulatory authorities' understanding, which can also be related to the inherent principal agent dynamic. The European Commission's goal, when calling for minimum storage standards, is to enhance security of gas supply. At the same time, however, the Commission was seeking to extend its own competences as principal vis-à-vis the national regulatory authorities when calling for the supranational coordination of strategic gas storage in 2004. The DTI supported the European Commission in its attempt to foster

the application of best-practice in terms of regulation-for-competition in the European Union, but the DTI's and Ofgem's willingness to transfer regulatory power to the European Commission to create strategic gas storage was, at best, very limited.

12. Concluding considerations

12.1 Introduction

The liberalisation of the European gas market was conceived as a massive project to integrate national markets and optimise their performance. This involved the restructuring of multilevel governance structures across the European Union's gas markets. In search of an optimal market design, very contrary expectations were formulated from various theories as well as from answers given by practitioners active in the field. Beyond the strong rhetoric, we found far less certainty and unambiguity than we had expected. In reality, there is insufficient, empirically proven, scientific evidence to determine the optimal design for European gas markets. Partially, this may be a matter of timing rather than principle. In any case, the relatively short reform period to date argues for an evolutionary perspective on the European gas liberalisation which is also reflected in our initial problem statement: Informed by New Institutional Economics in general, and Williamson's four-layer framework in particular, this PhD thesis investigates the extent to which the evolution of regulatory regimes in European gas markets and the impact of those regulatory regimes on economic performance in the gas sector can be empirically analysed. Our assessment of regulatory regimes across the old member states, and our attempt to empirically study the effect of those regulatory regimes on economic performance in European gas markets, contributes in an analytically descriptive manner to a better understanding of the situation achieved during the first six years of the European gas reform. We will start our concluding considerations by first revisiting our theoretical approach, and then discuss our empirical findings.

12.2 Concluding theoretical considerations

The most stunning revelation are the two diametrically opposed propositions for optimal modes of governance for the gas markets of those economic theories which formed the theoretical backbone of the European Union's gas reform on the one hand and applied transaction cost economics on the other hand. Transaction cost economics takes the theoretical standpoint that due to the transaction characteristics of the gas sector the optimal way of dealing with governance in natural gas markets is to perceive it in form of a public utility as organising institutional logic. The EU gas reform challenged this standpoint by claiming natural gas needs to be treated as commodity in order to overcome market failures which have been triggered by forms of market organisations perceiving gas as public utility. The European Union's reform approach interpreted the neoclassical theory and structure-conduct-performance paradigm of industrial organisation theory in such a way that regulation-for-competition is best suited to ultimately reach market based coordination as mode of gas market governance.

In this context it is noteworthy that the European Union attempts to change the dominant institutional logic despite the fact that it remained highly contested amongst economists, whether natural gas fulfils the characteristics of a commodity (Abott, 2001). Before the gas liberalisation natural gas was perceived as public good or common good.[150] The European Union replaced the formerly dominant institutional logic perceiving natural gas as public utility by conceiving natural gas as commodity. The general justification for the introduction of competition is related to the states' public interest to protect its citizens against market failure. Most prominently the Commission made reference to market failure induced by market power and incomplete information.[151] The European gas reform first and foremost envisaged the creation of a harmonised, integrated and liberalised European gas market. Based on the European Union's mandate to safeguard public interest in the gas sector, the two Gas Directives define public interest with regard to first order economic regulation, completion of an internal competitive gas market, and second order political regulation, public service obligations. More specifically, the aim of the reform is to increase efficiency, safeguard competitive gas prices, raise the standard of services, and intensify competition in these markets – in short to improve the overall economic performance.

To increase our understanding with regard to which factors are influencing the evolution of regulation-for-competition in the EU and how these regulatory regimes influence economic performance in European gas markets we draw on Williamson's four-layer model (1998). The model served as a fruitful starting

point to organise our analysis by identifying relevant variables, but necessitated several modifications. From an evolutionary perspective, informal institutions (Level 1) such as member states' beliefs, norms, or European (energy) policies influence formal institutions such as national or European laws (Level 2). Those informal institutions then shape institutional arrangements (Level 3). So-called actual regulation in turn determines the market structure and market performance (Level 4). Williamsons' conceptual framework does consider the particular authority structure as relevant variable. By applying his modified conceptual framework the first research question is answered. The following variables have been identified to determine regulatory choices in a first step and economic performance in a second step: policy objectives, European legal provisions, specific regulatory choices or the bundle of institutional arrangements summarised as regulatory regime, economic performance, and the country's endowment with natural gas. The empirical application of the four-layer framework showed several shortcomings which necessitated improvements and adaptations. The critique is fourfold and reflects the modifications in our applied conceptual framework.

Firstly, the four-layer framework is in its original version is too static. The way the frequency of institutional change within the layers is perceived seems not to be realistic. Although we agree with Williamson that in some layers change occurs less frequent than in other layers, the static assumption where after change is happening in regular time periods such as every year, every 10 years or once in a hundred years is inappropriate. Furthermore, the causal flow is not one directional but feedback processes between and within the layers and their constituting variables occur. Therefore, other scholars started making the framework more dynamic by including feedback processes from the fourth level to the individual subsequent levels (Correljé, 2007; Correljé, forthcoming; International Gas Union, 2006; Groenewegen, 2005). In this context, we propose an additional modification: energy policy and member states' beliefs (Level 1) expressed through attitudes towards liberalisation might change within an examination period and directly or simultaneously affect the institutional arrangements on the third level. Accordingly, inter-variable flows are not only possible but even likely in the course of changing governments (Stern, 1998: 209-210). Moreover, intra-variable effects might occur as well. For instance, the structure of contracts may foreclose certain regulatory options. If the gas demand is fully covered by import contracts signed by incumbents,[152] then gas release programmes might be a favourable instrument to release gas to new market entrants.

Secondly, the four layer model and their variables are not sufficient in explaining regulatory choices. According to Correlje and De Vries (2007:

forthcoming), the starting position of a country and external factors such as the resource endowment of a country do trigger regulatory decisions. By referring to the starting position of a country's earlier policy choices the authors integrate the idea of path dependency in the conceptual framework.

Thirdly, the operationalisation of the four-layer model requires some clarifications. Our application of the four-layer model to the European gas market reform showed that the distinction between formal institutions and institutional arrangement is not as straightforward as the model originally suggested. In the case of European gas market reform, most of the actual regulatory functioning is finally determined on the level of institutional arrangements within the member states. Therefore, we distinguish between European legislation on the formal level and regulation on the level of institutional arrangements. As we elaborated in the theory chapter, our proposition is not a final solution to the demarcation problem.

Fourthly, scholars argued that the four-layer model is unsatisfying in explaining how these layers or variables are related with each other. Groenewegen and Künneke (2005) made the proposition that these layers and their constituting variables are somehow related to institutional logics. Künneke specified these logics by saying the institutional logic structuring the institutions on all four layers was before the EU energy liberalisation characterised by the idea of treating natural gas markets as public utilities. With the liberalisation the institutional logic changed. Since then, the European Union fostered to restructure European gas trade and transport guided by an institutional logic treating natural gas as commodity. The PhD thesis contributes to the understanding of these institutional logics by proposing that the alignment hypothesis of transaction cost economics offers a micro analytical explanation for the evolution of those logics, which are underlying economic governance in general and European gas market governance in particular.

In our attempt to investigate which mode of European gas market governance is best aligned with the characteristics of transactions in gas markets we found a preliminary answer. To the knowledge of the classical transaction cost framework and its contemporary advancement, transactions which are characterised by high asset specificity, high degree of behavioural and environmental uncertainty, and high frequency are best aligned with hierarchical or hybrid modes of governance. Insofar the introduction of market based coordination and competition is as such not the most efficient way in terms of transaction efficiency to safeguard hazards related to transactions involving high investment costs. In other words, transaction cost economics takes the theoretical standpoint that due to the transaction characteristics of the gas sector the optimal way of dealing with governance in natural gas markets is to perceive it in form of a public utility as

organising institutional logic. Until now, a profound, concise and more elaborated theoretical reasoning is missing how the potential hazard related to the asset specificity can be safeguarded otherwise. Prior to liberalisation, investment risks involving site specificity have been safeguarded by vertical integration, long term contracts and a relatively small number of actors involved. In a liberalised market, vertical integration is supposed to be replaced by an unbundled and competitive market with more liquidity due to more short-term trade and contracts. With the introduction of competition, the number of active agents is increasing which alters the likelihood of collective action dilemmas. In case, an investor decides to invest in new pipelines or import facilities the company faces behavioural uncertainty in at least middle and long term. Uncertainty remains with regard to two questions: will shipper book sufficient capacity at prices guaranteeing the calculated return on investment? And will regulatory authorities change the regulatory contract in such a way that the profitability of the investment starts to fail? Therefore, coordination and smart regulation is key (Burns and Riechmann, 2004) to overcome the looming fear of "stranded asset" (Helm and Jenkinson 2001, see 9.4.2) in a liberalised gas market. The question how to improve investment incentives in European gas markets lies beyond the scope of our problem statement. Nevertheless, future research should emphasise how to alter investment incentives in liberalised gas markets, since the attributes of transactions remain the same (Couwenberg and Woerdman, 2006).

Although transaction cost economics can be applied to the public sphere, we advocate that it is not well-equipped to fully account for political processes. For this reason, we complemented transaction cost reasoning with a principal agent approach in our qualitative analysis. Evaluating incentives schemes valid for economic and political agents brought about additional insights. Particularly, the comparison of incentives schemes of political principals as part of the government and independent regulators suggests that the former is more prone towards political opportunism. In times when security of gas supply is very prominent on the political agenda, we assume ministries to prioritise security of gas supply concerns vis-à-vis regulation-for-competition, whereas independent regulatory agencies are more likely to prioritise a strict application of regulation-for-competition.

Yet, the overall understanding of regulation as mode of governance within transaction cost economics is until now not sufficiently elaborated. Regulation is perceived as somehow hybrid form located between privatised markets and public bureau. The application of transaction cost reasoning is not well advanced enough to determine when regulation is chosen as optimal mode of governance. Although the second-generation of transaction costs expands its scope to the public sphere far more elaborations and applications need to follow, before the

transfer of the theoretical approach to the public sphere can be evaluated against the appropriateness of such an undertaking and the explanatory reach it claims. If transaction cost economics teaches us anything with certainty, then it is that the cyclic re-alignment of governance structures is the normality,[153] because a mismatch between the characteristics of transactions and governance structures is likely under conditions of incomplete information and bounded rationality.

12.3 Public regulation approach

In the course of our conceptual and theoretical considerations, we confronted New Institutional Economics with governance concepts found in contemporary regulatory studies. In defining our own understanding of regulation and how it relates to economic performance, we drew on the work of several scholars (including, in a range of publications, Arentsen, Cox, Finger Genoud, Groenewegen and Künneke). These academics have enriched our conceptual understanding, and their contributions have resulted in the formulation of a public regulation approach which is characterised by its conceptual perceptions of regulation, economic performance and their interrelatedness (see chapter 2). From this, regulatory regimes are seen as two-dimensional: one refers to regulatory functions and the other encompasses the distribution of competences. This approach was grounded on the concept of regulatory comprehensiveness which is embedded in the structure-conduct-performance paradigm of industrial organisation and relies on three criteria: coherence, efficiency and effectiveness. The notion of coherence relates to both dimensions of the regulatory regime. With respect to regulatory competences, it indicates that some organisations are more appropriate than others for being given the responsibility for certain regulatory functions. For example, regulators are considered to be more appropriate holders of tariff control than the transport entity of the incumbent gas company. With respect to regulatory functions, the idea of coherence suggests considering a wide range of regulatory functions along the value chain of the gas business. Our operationalisation of regulatory regimes in European gas markets is built upon these conceptual ideas. When it comes to effectiveness, economic performance in a transaction cost perspective includes both neoclassical and political dimensions. Economic performance is not restricted to transaction cost efficiency, allocative and productive efficiencies or prices which are subject to first-order economic regulation. A public regulation approach explicitly takes into account the safeguarding of public service obligations (PSOs). The performance with regard to PSOs, such as a secure gas supply, is conceptually distinguished and is to be achieved by second-order political regulation. On a conceptual level, this distinction is

clear-cut and helps when considering indicators for economic performance according to their primary regulatory goal. In the course of our considerations, we concluded that attributing regulatory instruments to either primary or secondary regulatory goals in the form of liberalisation versus security of supply is not always straightforward. A regulatory instrument may for instance serve both goals, albeit to different degrees (see section 6.8.1). Ultimately, however, the distinction allows one to evaluate efficiency and effectiveness, the two criteria in the concept of regulatory comprehensiveness. In this thesis, we only evaluate using the effectiveness criterion (chapter 8) which assesses the relationship between the reform objective and the performance outcome. Nevertheless, the application of a transaction cost framework also theoretically enables one to estimate the efficiency criterion because the relationship between resources and outcome can be expressed in the form of transaction costs. In chapter 3, we saw that transaction cost economics hardly ever measures transaction cost efficiency in quantifiable terms.

The concepts of policy convergence and regulatory comprehensiveness form the basis of the methodology for assessing regulatory regimes in European gas markets (see chapter 2). In capturing patterns of institutional change, the concept of policy convergence enables one to distinguish between three different approaches for assessing convergence. Sigma convergence only addresses the decrease in variance, whereas gamma convergence indicates both the rate and direction of change. By introducing a distinction between negative and positive gamma convergence, one can differentiate between leading member states falling behind (-) and trailing countries catching up (+) with best practice. Further, delta convergence allows one to measure the quality of change in the form of the distance to a best-practice model. For this purpose, we developed a methodology that deduces what the European Union sees as best-practice in gas market regulation. The definition of a regulatory regime and its operationalisation focuses on the formal institutional factors of regulatory performance. In operationalising regulatory regimes, we referred to the concept of regulatory comprehensiveness which suggested organising the indicators along the two dimensions of regulatory function and regulatory competences. This distinction allows one to explore differences in implementation patterns that are attributed to either the policy or the polity dimensions. To measure a member state's distance from the best-practice model for European natural gas market regulation, we created an index based on 15 indicators consisting of 23 components. The sum of these 23 components, each with a maximum value of 10, results in a total of 230 possible points. Finally, the total scores and the indicator values are attributed to one of three models: a minimum model, an emerging model and a best-practice model (see section 5.12, Table 15).

12.4 Convergence of regulatory regimes towards best practice

To research the impact that European legal provisions and policy objectives have had on regulatory regimes (hypotheses 3 and 5), the regulatory regimes first needed to be assessed. The next section summarises the findings showing the extent to which the old member states applied best-practice in terms of regulation-for-competition between 2000 and 2005. Changes to regulatory regimes in European gas markets appear to have been incremental: member states have redesigned their regulatory regimes but in a stepwise manner. In general, regulatory regimes in European gas markets only achieved a moderate degree of delta convergence towards best-practice (the average 'score' was 54% at the end of 2005). In other words, we are only halfway towards best-practice. The overall increase in countries' scores translated into a decrease in variance in the form of sigma convergence. Numerically, the overall spread decreased from 142 points in 2001 to 88 points in our final 2005 assessment, suggesting a moderate sigma convergence. The mean score of 123 points in 2001 had increased to 159 points (out of a maximum of 230) by the end of 2005. At the end of the research period, the distance of the mean score from best-practice was thus still over 70 points. These observations support our second hypothesis in which we argue that a misalignment between transaction characteristics and the mode of governance, as is inherent when using regulation-for-competition in European natural gas markets, is likely to result in a reluctance to apply what the EU perceives as best-practice. This results in member states holding back from moving towards (delta) convergence in terms of regulation-for-competition best-practices.

The member states' reluctance to move towards best-practice becomes even more apparent when analysing the rate and degree of convergence in individual countries. In doing so, we identified four different implementation patterns. The British approach to gas market regulation functioned as a kind of prototype for European best-practice. As a consequence, the UK was not forced by EU legislation to make any changes, and so levelled out at a plateau of best-practice during the entire period with scores between 200 and 205 points (see Figure 20).

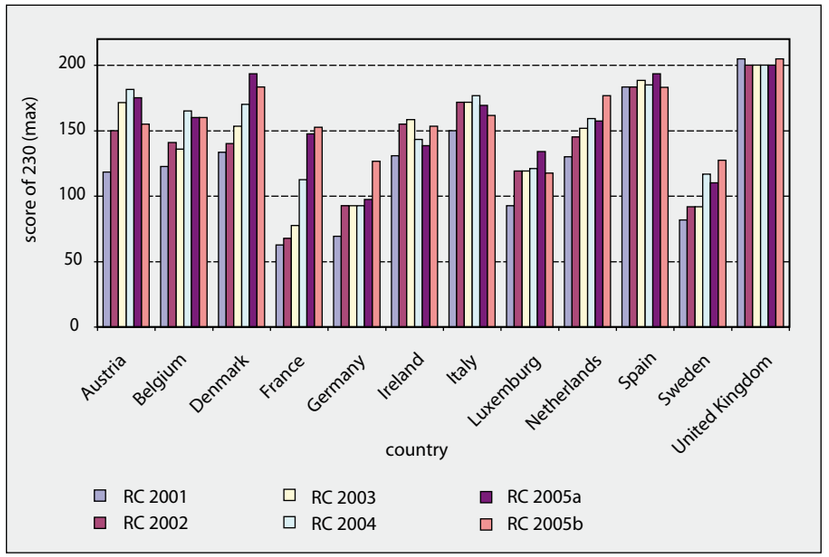


Figure 20: Regulatory comprehensiveness (2000-2005)

Spain was next as a forerunner and immediately adopted the emerging model as its starting position. The regulatory regime in Spain achieved relatively high and stable scores over the entire period and in the final analysis was in third place. Nevertheless, the fluctuations seen are too significant to speak of a plateau pattern as seen in the UK. Especially the dip during 2005, from 193 points to 183 points, suggests a mixed pattern. Austria, Ireland and Italy managed to quickly move from the minimal to the emerging model. Denmark and the Netherlands followed their example in 2003. Belgium joined that group in 2004 and France had caught up by the end of 2005. Altogether, seven countries moved from the minimal model to the emerging model, but none met the best-practice model. Conversely, Germany, Luxembourg and Sweden kept to a minimal model throughout the entire period. Countries in both groups followed either a slope or a so-called roof pattern. The slope pattern reflects a steady movement towards best-practice, whereas the roof pattern shows increasing reluctance towards the end of the examination period to adopt best-practice. However, a particular model cannot be attributed to a certain pattern. Table 26 (below) displays the countries' ranks at the end of 2005. The ranking is based on the score a country obtained for its application of best-practice in terms of regulation-for-competition (see chapter 8).

The Netherlands, France, Germany and Sweden steadily increased their scores. The Netherlands started with 130 points and reached 177 by the end of 2005. France and Germany considerably improved in terms of total scores. Between 2001 and 2005, France added 90 points to reach a total of 153, and Germany 57 points to end up with 127. Sweden increased its score steadily but only reached 128 points in the final evaluation.

Rank	Countries rank (end 2005)
1	United Kingdom
2	Denmark
3	Spain
4	Netherlands
5	Italy
6	Belgium
7	Austria
8	Ireland
9	France
10	Sweden
11	Germany
12	Luxembourg

Table 26: Countries' ranking with regard to regulatory comprehensiveness

Denmark, Italy, Belgium, Austria, Ireland and Luxembourg first increased their scores but, at some point, adopted less favourable measures (i.e. demonstrated a roof pattern). These countries saw low or moderate negative gamma convergence. The 'apex of the roof' was seen in most of these countries in either 2004 or 2005. Despite this 'step back', Denmark remained in second place overall with 184 points, closely followed by Spain and the Netherlands. Denmark's dip in 2005 is linked to a rise in average tariffs from € 2 to € 4 per MWh. Italy fell back to 162 points by the end of 2005 and this reversal is linked to an increase in the minimum booking period to one year in 2005 and the non-publication of accounts on the transmission system operator (TSO) and distribution system operator (DSO) levels for the same year. Belgium's increasing reluctance to meet best-practice shows within the dimension of regulatory competences. Whereas the Belgian regulator was solely responsible for settling disputes prior to 2004, Belgium then opted for a hybrid form of executing this responsibility. Moreover,

the institutional endowment, in terms of staff numbers and budget, was based on data from the third benchmarking report which included regional regulators in addition to the national regulator. In fact, after taking this into account, changes within the national regulator (CREG) appear minor between 2003 and 2005. Given the lack of more precise data, we can only suspect that the roof pattern is flatter than the above figure suggests. This case exemplifies a general problem, stemming from the only partially unified data and definitions, that we faced in our analysis. In fact, gathering the relevant information to execute a sector regulation analysis appeared to be a collective learning experience for all the actors involved. Our benchmarking saw Austria downgraded from 182 points in 2004 to 155 points by the end of 2005. From 2001 to 2004, Austria declared that they used more than ex ante regulation. They were more specific during 2005, explaining the dual system: ex ante regulation for transport within Austria and ex post regulation for transit transport (section 7.5.1). Moreover, since 2005, the balancing conditions are no longer determined by the regulator but instead formulated within the market, although trading is not as mature and the overall regulatory framework not as advanced as in the UK. Finally, the non-publication of accounts for TSO and DSO levels reduced Austria's score at the end of the measurement period (European Commission, 2005a: 81-82). The latter failure also occurred in Luxembourg, reducing its final score to 118 points. Finally, in terms of countries which saw a stepping back from best-practice, Ireland's score shrank to 154 points due to a sharp increase in average tariffs between 2003 and 2004 and the transfer of regulatory competences from the regulator to the relevant ministry and the TSO. Further, during the same period, balancing conditions were no longer determined by the regulator but jointly formulated by the ministry and the TSO. Moreover, capacity allocation rules were for a brief period jointly elaborated by the regulator and the TSO, before returning this task to the regulator's portfolio of competences.

To conclude, our analysis of positive and negative gamma convergence from an indicator perspective in chapter 8 revealed that the phenomenon of member states falling back by adopting less favourable instruments is not generally related to a specific set of instruments. The only distinctive feature that appeared regularly seems to be the failure to publish accounts at the TSO and DSO level at the end of 2005. A more detailed analysis of the empirical results from an indicator perspective was provided in chapter 8.

Both the dimensions of regulatory functions and regulatory competences point in the same direction, indicating a moderate move towards regulation-for-competition. The regulatory function dimension shows a slightly greater impact on inducing best-practice. This suggests that countries are more inclined to change their institutional arrangements by revising a regulatory

instrument than by transferring decision power to a regulator. In terms of a regulatory strategy, this suggests that progress towards best-practice is perhaps more forcefully promoted within the dimension of regulatory competences, although this is also more difficult to achieve. Analysing how the distribution of regulatory oversight changed between 2000 and the end of 2005 showed that the struggle for competences does not only take place between the regulator and the transmission system operator but to a large extent also between national ministries and regulators. As a result, governmental institutions and regulators often share regulatory competences. Re-emphasising public service obligations, such as security of supply, environmental concerns, or the protection of disadvantaged consumer groups, sometimes brings the government back into the process. One early example is the United Kingdom and the Utilities Bill of 2000. Although the regulation of the sector stayed with Ofgem, the Bill provided the government, as represented by the Secretary of State, with more formal opportunities to intervene in the regulatory process by imposing social and environmental guidance or levy schemes for disadvantaged consumers. However, in Graham's judgement, "it is unlikely that these formal powers will actually be used to any great extent but they provide more the possibility for informal influence by the government over the Authority's agenda" (2000: 102-103).

12.5 Impact of European law and energy policy objectives on regulation

The effects of two variables, European law and energy policy objectives, on regulation as deduced from Williamson's four-layer model, were analysed in an exploratory manner. This section considers whether the correlations found relating to our formulated hypotheses 3 and 5 are sufficient to justify them.

According to the fifth hypothesis, we expected that the more the subjects (indicators) of the gas market reform were specified by European provisions (Level 2), the more likely it was that the best-practice would be applied, resulting at the regime level (on Level 3) in a move towards (delta) convergence. On the basis of this general hypothesis, we formulated several sector-specific expectations that have been individually answered in chapter 8. In general, a lack of precision in a European law corresponds with a low or moderate delta convergence; that is, the results suggest a relatively weak correlation. The overall expectations cannot be neatly confirmed in a straightforward manner, and necessitate a more considered answer.

Precise European provisions concerning third party access (TPA) to network and TPA to storage appeared to lead to a high degree of delta convergence. Conversely, a low precision in the legal norms resulted in a low degree of

convergence in terms of trading facilities, capacity allocation rules and balancing conditions. Imprecise European legal provisions evoked a moderate move towards best-practice with respect to components such as incentives regulation, minimum booking period, gas release programme and ratios reflecting gas consumption relative to the staff numbers or budget of the regulator. When it came to legal market opening and unbundling measures, the European Commission started off with precise but somewhat lackadaisical regulatory targets. Legal market opening was incrementally introduced with relatively low targets set by the first Directive, and only achieved a moderate degree of best-practice. The same tendency can be observed for TSO and DSO unbundling. Whereas legal unbundling was widely applied, ownership unbundling is moderate with respect to TSOs and only marginal for DSOs.

The evidence for a positive correlation between the precision of EU legal provisions and the degree of convergence is weakened by reverse observations. In terms of the publication of accounts on the DSO level, for instance, only a low degree of delta convergence was found, even though the prescribed publication of accounts is unequivocal in the first Directive. Conversely, several indicators were not precisely determined by the EU law but still showed clear evidence of convergence towards best-practice. This was the situation for components describing network access conditions such as tariff structure, type of capacity booking, 'Use it or lose it' and balancing, and also true for the two indicators concerning dispute settlement and type of regulator. Thus, this indicates that there must be other factors or mechanisms inducing convergence. One of these is clearly the Madrid Forum, which the European Commission employed to complement the legal instruments. Tariff design is a prominent example of where the Madrid Forum was used to promote the convergence of tariff structures and capacity booking arrangements. Other regulatory instruments not belonging to network access conditions have also been subject to the Madrid Forum, albeit without generating a clear consensus among the participating actors. It is apparent that the success conditions for this mechanism are not sufficiently understood.

To sum up, overall, the precision of regulatory instruments in European provisions shows a weak correlation with convergence towards best-practice. Setting precise and ambitious targets is important since the empirical results suggest that member states tend to apply the provisions to the letter rather than in the spirit of what is finally desired. Moreover, the example of publishing accounts emphasises that the effect of a law cannot be divorced from the degree of law enforcement stemming from action on the European and national levels. The first cycle of enforcement on the EU level has only just begun. Nevertheless,

these efforts will only be successful if they are accompanied by determined enforcement practices by the regulatory authorities in the member states.

Chapter 6 traced the evolution of general and sector-specific policy objectives to identify the impact that institutional factors (Level 2) have on regulation. The analysis shows that the general economic goals formulated in the Lisbon strategy lead to stimuli to encourage the following of the liberalisation track. At the same time, energy and sector-specific European policy opted to combine goals from two energy paradigms: one setting liberalisation, privatisation and competition as pivotal; the other emphasising security of energy supply and limiting climate change. The first energy paradigm evolved in the 1980s and 1990s when the political economy of natural gas was based on supply competition, long-term supply contracts, access capacity and relatively low energy prices. Structural changes in the political economy of natural gas and increasing concerns about climate change have given rise to a new energy paradigm which started to evolve around 2000. Since then, the depletion of indigenous gas resources, rising energy prices, the internationalisation of natural gas markets through an increase in LNG usage, blackouts and transit conflicts between Russia and Ukraine have heavily influenced the perception of the problem to be tackled by the main actors involved, and questions whether market-based solutions are still the most appropriate answer. Stern adds another dimension to the discussion when describing a new security environment for European gas. In his view, the worsening geopolitical situation and the increasing global competition for LNG will influence and most likely lead to a negative revision of the supply outlook for the European gas markets from what has been projected so far (Stern, 2006). This argument supports the expectation that security of gas supply concerns will gain importance in politician's perceptions of the problem.

To date, the two published European energy strategies have not explicitly prioritised either goal. The Green Paper on security of supply (2000) served as an initial step in formulating a comprehensive European energy policy by identifying structural weaknesses in the current and future supply of energy. Furthermore, the Green Paper prepared the argument for bringing together the internal and external energy policy streams and developing an ambitious demand-side management approach. In 2006, the subsequent Green Paper followed this up by combining the goals of the old and the new energy paradigms. Since then, the European Energy Strategy strives to achieve a sustainable, competitive and secure energy supply. The risk with this holistic "all encompassing" approach could be that its strength, the ambition to incorporate several objectives, is also its weakness, because it leaves room for ambiguity. Security of gas supply entered the sector-specific regulations and became institutionalised in the form

of the Security of Supply Directive. In chapters 3 and 6, we elaborated on the argument that, once the security of the energy supply enters the equation, the likelihood of employing approaches other than competitive market models increases. The empirical results support our third hypothesis which postulated that if regulatory authorities (Principal 2 and Principal 3) in a multi-authority structure differ in their prioritisation of policy objectives, then it is likely that a refinement or change in regulatory choices (including modes of coordination) will occur. In other words, we expect ambiguous or rival energy policy objectives to decrease the probability that member states will adopt best-practice. Moreover, in the mid- and longer term it seems likely that the liberalisation of the internal energy markets will not retain such a prominent place on the European agenda. Gas sector liberalisation has been on the agenda for more than two decades already and, for the time being, the Third Energy Package is expected to be the last. In the future, other issues such as climate change or guaranteeing a sufficient gas supply for European markets might be perceived as more urgent and therefore fill the political agenda. Despite indications of a correlation between unambiguous energy goals[154] and the convergence of regulations towards best-practice, the suggestion cannot be definitely verified; to achieve this would necessitate checking for other endogenous and exogenous factors. For this reason, the scientific exploration of natural gas markets needs to dig deeper into the factors that determine regulation, and explain with the help of qualitative case studies how exactly energy policy objectives such as security of supply come into play.

12.6 The effect of regulation on economic performance

In chapter 9, we explained that verifying whether regulation-for-competition positively correlates with favourable economic performance is not possible due to conceptual and data constraints. Now, we will address the main reasons why our second hypothesis cannot be empirically tested, and share our findings stemming from this observation. The second hypothesis claimed that the greater the misalignment between the mode of governance and the transaction characteristics, here interpreted as a regulatory regime reflecting a competitive market (the best-practice of regulation-for-competition), the poorer the performance will be in terms of natural gas prices, network tariffs, productive efficiency and investment in natural gas infrastructures, and the more likely the regulatory choices will be realigned.

In general, econometric research studying the effect of regulation on economic performance in liberalised markets has seen not only a variety of applied methodologies but also contradictory results. Investigations to date

on the impact of single instruments for energy regulation, such as third party access to gas networks or ownership unbundling, on economic performance indicators have resulted in no more than preliminary and tentative results. Regulatory indices to evaluate energy market regulation have been only recently developed (e.g. Oxera, 2007). There are no econometric analyses that have used a regulatory index to assess the degree to which regulation-for-competition is applied in gas markets or included in other economic performance indicators. The reasons for such a lack of econometric analysis will become apparent in the following discussion.

The literature review has demonstrated that neither qualitative reasoning nor quantitative econometric analysis are convincing when trying to justify a correlation between ownership unbundling and economic performance in the form of natural gas prices and investment in gas network or import facilities. The Commission's claim that ownership unbundling results in greater investment in electricity and natural gas infrastructures suffers from a selection bias and an insufficiently long examination period to be reliable (European Commission, 2007: 14; 2007b: 37). Growitsch and Stronzik (2008) found no significant correlation between unbundling and end-user gas prices for households, whereas a clear correlation can be shown between oil and gas prices. The latter finding was not surprising given the lack of gas-to-gas competition in most of Europe, which is a result of natural gas prices being indexed to oil prices throughout Continental Europe. Even if a correlation had been found with both ownership unbundling and oil price, one would not have been able to determine their relative impacts. The impact of oil price changes and other determining factors could not be subtracted in the way that we can subtract the inflation rate from prices. Conceptually, we face the problem of multi-causality for which the impact of a single factor can hardly (if at all) be measured. Essentially, it is impossible to measure the impact that a certain regulatory instrument or regime has on end-user gas prices. Although this is a generally accepted fact among energy researchers, it does not prevent both opponents and proponents of gas market liberalisation attributing natural gas prices to the effect of regulation-for-competition (see section 9.3.2).

Another severe obstacle occurred in terms of the lack of comparable data to investigate efficiency, transmission network tariffs and investment in import and transport facilities on a European scale both before and after the introduction of the European gas market reform. The heterogeneity of tariff methodologies across Europe impeded the assessment of transmission network tariffs before liberalisation and this to an extent persisted during the early years of the gas reform (see sections 5.2 and 9.3.3). The empirical literature that tried to evaluate productive efficiency in natural gas markets indicated a similar conceptual

problem to that identified for natural gas prices: namely, multi-causality. Even if complete and comparable data on pipeline utilisation by companies across the old European member states could be gathered for the period between 1990 and 2006, econometric analysis could not measure the exact impact of regulation on this indicator of productive efficiency (see section 9.3.1). Moreover, due to the way the European market was organised prior to liberalisation (vertical integration), investment levels in the natural gas sector in general, and in transmission systems in particular, are not sufficiently clear to allow a systematic comparison. Companies' annual reports publish only overall investment figures and do not identify how much has been invested in specific parts of their upstream or downstream activities. Investment figures also tend to be misleading in the sense that they reflect ongoing developments. In some years, and even decades, more investments are necessary due to the need to replace ageing assets or increase natural gas imports. Consequently, the effect of regulatory regimes on investment in the gas sector as a whole cannot be scientifically verified on the basis of an EU-wide comparison.

Provided the institutional logic of treating natural gas as a commodity is accepted by the majority of market participants, and applied to activities on all layers, then shifts in the modes of governance in European gas markets are expected to occur after the introduction of liberalisation. Transaction costs reasoning suggests that the duration of import contracts should decrease and companies should become less inclined to invest once regulation-for-competition is applied. The question that we are trying to answer is whether we can observe shifts in the modes of governance in European gas markets after liberalisation, in terms of import contracts and investment, and, if so, can we observe an effect?

In terms of business conduct, Neumann and Hirschhausen (2005) showed that the duration of supply contracts had decreased in liberalised European markets, but less so than for instance in the USA. Liberalisation and gas market globalisation, in the form of an increasing reliance on LNG, has resulted in short-term supply contracts filling a greater share of the overall contract portfolio in European gas markets. Furthermore, those authors revealed that asset specificity matters: "contracts that have been signed in combination with exploration of new resources or building of new infrastructure are on average seven years longer in duration in Europe" (Neumann and von Hirschhausen, 2005). Transactions involving the import of natural gas can still be characterised by a hybrid mode of governance and, in terms of volume, remain dominated by long-term contracts.

According to the applied transaction cost reasoning, investment transactions are characterised by asset-specificity and regulatory uncertainty. Transaction cost economics suggests that hierarchical or hybrid modes of governance are best-aligned with investment transactions, while market-based approaches

will deliver an inferior performance. This is the reason why a low investment level is anticipated when regulation-for-competition is applied. In practice, we found that regulation-for-competition is not adopted when dealing with import facilities such as pipelines and LNG facilities. Article 22 of the second Gas Directive foresaw the possibility of exemptions to third party access. In practice, the European Commission and its national regulatory dependants approved all 11 formal exemption requests received between 2004 and 2007 related to new investment projects. These reflect a total investment of approximately € 11.2 billion in gas transport and import infrastructure for which there is no obligation to grant third party access.[155] Our attempt to empirically quantify the extent to which the EU is suffering from a hold-up problem did not succeed because the regulation-for-competition was in reality not applied with regard to investment-related transactions. Moreover, the optimal investment level, with which we could compare the current situation, remains undefined. Nevertheless, the industry's strong opposition to ownership unbundling coupled with the success in gaining exemptions enabling long-term contracts does indicate that the general argument in favour of their being a hold-up problem has empirical support.

12.7 Case study results

The starting point for national level regulatory decisions remains the European legal provisions which define the regulatory boundaries within which the member states can make choices. In both the case studies, the UK gas storage regime and the Dutch incentive regime, the European law was not sufficiently stringent to determine the regulatory instrument itself. Despite the fact that the EU was striving to establish some sort of policy to coordinate storage, and eventually prescribe minimum storage levels for each country, through the security of supply Directive in 2004 (see section 6.5), this attempt failed and did not translate into a binding law. The failure to adopt strategic gas storage requirements in the UK correlates with the low degree of specification in the legal provisions. In contrast, despite the weak specifications concerning the application of incentive regulations in the EU law, the Netherlands did adopt a revenue-cap regulation in the first place. Here, a cost-reflecting principle was applied in the form of a price-cap method, and this was later revised to a rate-of-return regulation, which both is conceived as best-practice by the European Commission. Accordingly, we have mixed results in our qualitative analysis with regard to our fifth hypothesis.

The same is true for our second hypothesis, which argued that the greater the misalignment between the mode of governance and the transaction

characteristics, here interpreted as a regulatory regime reflecting a competitive market (the best-practice of regulation-for-competition), the poorer the performance will be in terms of natural gas prices, network tariffs, productive efficiency and investment in natural gas infrastructures, and the more likely the regulatory choices will be realigned.

Despite the fact that we observed poor or negatively perceived economic performance triggering actual, or the consideration of, realignment of modes of governance, the results require a more considered analysis. In the British situation, the increasing wholesale prices were not only caused by the British regulatory regime in place, but partly linked to imported gas prices which were index-linked to oil prices. The comparatively low Dutch gas tariffs distorted investment incentives for the transmission system operator, Gas Transport Services (GTS). Here the situation is much clearer and points to a negative implication (partly captured by the Jepma-effect), namely the potential conflict between the short-term efficiency goals promoted by the regulations versus the long-term desire to ensure sufficient import and transmission capacity for the Netherlands. What, however, is clear is that negative economic performance, be it in form of high wholesale prices or too low transmission tariffs, leads to a reconsideration of the alignment, although this does not necessarily translate into a regime change understood as a change in the mode of governance.

The regulatory authorities in the UK, the DTI and Ofgem, did not give much weight to the fact that the resource endowment was decreasing and indigenous production dropping at a faster rate than had been expected, even though this had resulted in increases in wholesale gas prices during winters between 2002 and 2005. Despite the failure of the market to deliver additional import capacity and storage when demanded by the market, the regulatory authorities saw this as a temporary problem which they expected to be solved in the mid term (by 2010). In other words, the regulatory authorities prioritised regulation-for-competition and rejected further security-of-supply measures in the form of strategic storage or other regulatory instruments to force the companies to provide certain storage levels. Given the uncertainties over future supply in the UK in the mid- and longer terms, and the relatively low storage levels now and in the mid term, this regulatory choice can be seen – with regard to security of gas supply – as a bold move which can be attributed to the fact that both the DTI and Ofgem have followed the institutional logic of treating gas as a commodity. As we saw in the case study, the decision to reject further security of supply obligations was announced prior to a cost benefit analysis of potential regulatory measures being undertaken. While the consultation process inquiring into the robustness of the security of gas supply framework had a secondary purpose of serving as an information gathering tool and enabling an exchange of views among

relevant stakeholders, its primarily goal was to establish a consensus which would enhance the legitimacy of the regulatory decision not to impose further security of gas supply measures. As such, our premise that the second principal (P2), here the DTI, would tend to prioritise security of supply over regulation-for-competition was incorrect. The conduct during the consultation process of supporting the regulatory choice can be interpreted as a legitimacy strategy seeking to generate political support for the political actors which could help, or at least not hinder, the re-election of the government in charge. To summarise, the second element of our expectations as formulated in our third hypothesis – that, when regulatory authorities in a multi-authority structure apply the same prioritisation to the policy objectives, it is unlikely that a refinement or change of regulatory choices (including modes of coordination) will occur - is supported by our observations in the UK case study.

The revision of the Dutch incentive regulation, from an approach based on revenue capping to a rate-of-return regulation, reflects the growing importance attached to security-of-supply considerations in a European country which had been at the forefront and an early mover in applying best-practice in terms of regulation-for-competition.[156] Although we differentiate between revenue-cap regulation and rate-of-return regulation, both approaches are considered to be European best-practice and are in line with the institutional logic of treating natural gas as a commodity. Accordingly, this regulatory refinement is perceived as a gradual shift in terms of changing the mode of governance. This change reflects the desire of the Ministry for Economic Affairs to optimise the short-term efficiency goals with long-term security of gas supply considerations. As such, the Dutch revision to its incentive regulation is a shift from a purist application of regulation-for-competition, which prioritised the lowering of costs as the primary regulatory goal, to a more balanced approach giving more prominence to the once secondary regulatory goals. To put it differently, if the transaction effects related to the performance of the tariff regulation impinged negatively on the infrastructure-related transaction, then a re-alignment occurred. During the reconsideration phase of the Dutch incentive regulation, GTS, the economic agent, acted in line with transaction cost reasoning when asking for long-term tariffs to minimise investment risks. The TCE approach reasons that infrastructure-related transactions are characterised by high asset-specificity (especially site-specificity) and high regulatory and business environment related uncertainty and, consequently, are best aligned with hybrid modes of governance such as long-term contracts. Risks and potential hazards, such as a stranded asset, led GTS to push for a revision to the tariff regulations and a regulatory contract which would establish the basis for an economically viable investment. Ultimately, the Ministry of Economic Affairs (Principal 2) pro-

actively engaged in the dispute which had developed primarily between the DTe (Principal 3) and GTS to balance the regulatory priorities. However, it remains unclear whether the Ministry of Economic Affairs was mainly driven by political or economic incentive (see section 3.4.5). Given the dual role of the Dutch State and its relevant ministries (Economic Affairs and Finance) as both shareholder and regulatory authority it is impossible to give a definite answer. Although we could observe a correlation between the wide dispersion of regulatory goals among regulatory authorities and the likelihood of regulatory change, our qualitative analysis lacked a controlling factor which would enable us to confirm (or reject) our third hypothesis. Further research is necessary to test whether in a situation where regulatory authorities (Principal 2 and Principal 3) in a multi-authority structure differ in their prioritisation of policy objectives, it is more likely that a refinement or change to the regulatory choices (including a change in the mode of coordination) will occur.

12.8 Main findings

Ultimately, the conceptual framework and its empirical application enabled us to demonstrate that at least two different institutional logics are present on different layers and responsible for the lack of convergence of regulatory regimes towards the European best-practice model which the European gas reform had envisaged. Located on the second layer, the European legislation aimed to introduce regulation-for-competition. This follows the institutional logic of treating natural gas as a commodity, and this logic should then spill over onto the lower layers. However, the member states were given significant leeway in choosing their regulatory instruments. Depending on their prioritisation of policy objectives, the regulatory choices made by the individual member states often tended to be either more supportive of promoting competition or of prioritising a secure gas supply. To achieve a secure gas supply requires significant investment in gas transport facilities. Due to the asset specificity of such infrastructure, companies favour regulatory instruments which allow vertical integration and long-term contracts to safeguard against potential hazards related to stranded assets or other forms of financial unprofitability. According to this logic, security of gas supply is best achieved by having natural gas under the aegis of a private or public utility. Further, ministries, and to a lesser extent independent regulatory agencies, are inclined to politically opportunistic behaviour in safeguarding measures which promise to secure the gas supply. For these reasons, the responses on the fourth layer are mixed. Some member states did adopt the institutional logic of treating natural gas as a commodity. Others were more inclined to protect the old institutional logic and

were hesitant about introducing regulatory regimes which applied market-based approaches. The European Commission's exemption practice supports the view that asset-specificity and environmental uncertainty are relevant in choosing a mode of governance. Transaction cost economics does provide a micro-analytical explanation as to why third party access is not enforced or applied given the huge investments associated with gas import infrastructure projects. Furthermore, such regulatory choices reflect the prioritisation of security of gas supply over competition.

Although our analysis did not include business responses located on the third layer, the reference to contract characteristics serves as a further good illustration of how prevailing structures organised according to the old institutional logic are still shaping market performance. Contracts were adapted to the new liberal environment by decreasing their duration. What we observed was a gradual decrease in contract duration, rather than a radical restructuring of the contract environment. Long-term contracts and the congested transmission capacity market still shape market conditions. The European Commission elaborated at length on the problem of vertical foreclosure due to the existing long-term import and capacity congestion in its preliminary report on the energy sector inquiry.[157] Despite a gradual decrease in the length of import contracts, old and existing contracts have a major influence on the business conduct of new and existing market players.

Regulatory and business choices on the third layer shape business conduct and economic performance on the fourth layer. As our empirical analyses demonstrate, these choices are often guided or organised according to different institutional logics resulting in heterogeneous regulatory regimes. The effect of regulatory regimes on economic performance indicators, such as wholesale and end-user natural gas prices, transmission network tariffs, efficiency in terms of pipeline utilisation and investments in import and transport infrastructure, cannot be verified on a European scale due to conceptual and data constraints. The regulatory choices being made in the old EU member states suggest that the secondary regulatory goal of securing gas supply is becoming increasingly important. Whether this should be interpreted as the driver for a new institutional logic, or as the persistence of the old dominant logic, remains to be answered.

References

1. The first version of my quantitative analysis can be downloaded on http://www.oxfordenergy.org/pdfs/NG24.pdf

2. Industry-oriented refers here to governments which share with their national energy companies a reluctance to move towards liberalisation.

3. A definition of a regulatory regime is given in section 2.3.1.

4. Regulation-for-competition is defined in section 2.2.3.

5. This expression can be best translated as “standardised sausage” which is supposedly proscribed in a country with a sophisticated tradition of sausages.

6. In a speech held at the conference ‘E-world: energy and water’ in Essen on 5 February 2007, the European Commissioner for Competition, Neelie Kroes, summarised the Commission’s position as follows: “Stronger competition in the energy sector will lead to more choice, security of supply, and prices that on average better reflect the real cost of energy” (Kroes, 2007: 575).

7. Since the mid-1990s, the natural gas companies have been revising business developments in response to the European liberalisation policy. As a counter-strategy to possible vertical disintegration or competition, gas companies have often merged with other gas companies or acquired others across Europe. Another example is the horizontal integration of gas and power companies (International Energy Agency, 2008).

8. Most prominently, third party access, ownership unbundling and a common European energy regulator surfaced.

9. In political science, the concepts and modes of governance capture phenomena ranging from different institutional structures and actor constellations in political decision-making to various types of policy instruments (Treib, Bähr and Falkner, 2007). The concepts of governance and regulation are defined and discussed in depth in chapter 2.

10. Privatisation policies gained more support through the public management movement that successfully influenced the market reform agendas in many capitalist countries during the 1980s and 1990s. However, these have always been contested: Newbery, for instance, argued that “private regulated network utilities are not necessarily more efficient than public network utilities” (2001). A comprehensive discussion of the benefits and shortcomings of privatisation vis-à-vis public ownership is provided by Sclar (2001).

11. On the basis of their research on regulatory reforms and agencification, Christensen et al. go as far as to claim that “re-regulation seems to be a better label than liberalization” (2007: 361).

12. Thatcher summarises “The regulatory state hypothesis argues that both formal institutions and patterns of relationships in the governance of markets have become centred on the production and enforcement of rules. ‘The regulatory state’ is claimed to mark a sharp break with the past and provide a response to the increasing inability of the positive state to cope with new pressures. Moreover, it is a Europe-wide, if not global, line of development” (Thatcher, 2007: 1030).

13. The restructuring of markets is therefore widely associated with an economic imperative which is determined by (neo-)liberal ideas on how to run the economy (Majone, 2008).

14. Recently, the term is increasingly used with a normative connotation when referring to good governance and corporate social responsibility (Bressers and Kuks, 2003).

15. We refer to Williamson's definition of governance in chapter 3 where we also explain his transaction cost approach.

16. Dixit defines the neoclassical view of a production function as follows: "once the quantities of input used in a production process are specified, exogenous technological considerations will fix the quantity of output" (1996: 51). In short, inputs and processes determine production output regardless of how the firm is organisationally structured.

17. Schneider takes the view that governance theory can be conceived of as a modernised form of the theory of the state (Schneider, 2004: 25). See also section 2.1.1.

18. Weinmann notes that "George Stigler (...) argues (1971) that small interest groups rather than large interest groups are the potential winners during a decision process, because the former can organise themselves more easily and have low information costs, like producers of a certain good in an oligopolistic market structure, whereas e.g. the large group of consumers faces high information and organisation costs and each consumer's stake in the result of the process is low, i.e., a marginal increase in prices in comparison to the producer's stake" (2004: 19-20).

19. Economic regulation theory tends to concentrate on the regulatory authority and the firm, whereas political science scholars concentrate on the relationship between politicians or ministerial bodies and independent regulatory agencies.

20. Anticipating information asymmetry, utility regulation and its applied regulatory instrument should be designed and implemented in such a way that they decrease the asymmetry.

21. One example of this is the Arrow-Debreu theory, one of the most general models of competitive economy and a crucial part of the general equilibrium theory (Dixit, 1996: 45).

22. A frequently cited definition of quasi-markets is given by Le Grande: "They are 'markets' because they replaced monopolistic state providers with competitive independent ones. They are 'quasi' because they differ from conventional markets in a number of key ways" (Le Grand, 1991: 1259-1260). The characteristics which constitute a conventional market are not precisely defined and therefore McMaster concludes "by this rationale every observable market is a quasi-market" (2001: 721).

23. "Many of the institutional arrangements that conventional economic theory could not explain as natural outcomes of a model of perfect competition – vertical integration, contractual vertical restraints, joint ventures, and certain other horizontal agreements – were viewed as being suspect within the Bain-Mason branch of industrial organization and were often presumed to be a consequence of monopoly power or efforts to obtain it. This view provided the intellectual basis for anti-trust policies that are now in disrepute and have, to a great extent, been revised" (Joskow, 1993).

24. In the neoclassical understanding, optimal economic efficiency is achieved when goods are produced in the least costly manner (productive efficiency) and distributed to those who value them most (allocative efficiency). See sections 3.4.4 and 9.3.1 for further explanations.

25. "A regulatory race to the bottom ('the Delaware effect') is a reality in which there is a progressive movement of firms from countries with relatively high levels of social and economic standards (like wages, taxation and regulations) to countries with lower levels. Countries might lower their standards when they intend to be more competitive and to attract new firms to transfer their activities to its territories. The opposite phenomenon, a regulatory race to the top ('the California effect'), takes place when in a similar context of economic competition a group of countries raises standards by mutual decision or by imitating a strong regional economy (see also Prakash and Kollman, 2003; Spar and Yoffie, 2000)" (Ginosar and Levi-Faur, 2008, 2008: 3-4).

26. Recently, Van Genugten published a PhD thesis on this subject with the charming title "The art of alignment" (2008).

27. A detailed explanation concerning measurement points, data sources, quality and availability is provided in section 4.2.

28. Source: Treib, Bähr, and Falkner (2007).

29. Sources: Website of the European Commission, Directorate-General for Energy and Transport, retrieved 15 June 2007, from http://ec.europa.eu/energy/ gas/madrid/index_en.htm

30. Source: Jordana and Levi-Faur (2004: 7).

31. Genoud builds his proposition on the works of Eberlein (1999) and Cox (1999).

32. Mastenbroek elaborates further: "The mechanism presented by historical institutionalists draw heavily on the insights of the other two paradigms, in that they need either the logic of appropriateness or the logic of consequence to underpin the stickiness of institutional path" (2007).

33. Founding fathers and prominent scholars have been T. Veblen, W.C. Mitchell and J. R. Commons. For a brief summary of authors and schools of old New Institutional Economics see Hutchison (1984).

34. Level and layer are used interchangably.

35. Source: IGU/CIEP (2006: 23) – Adaption from Williamson (1998) and Groenewegen (2005).

36. Source: IGU/CIEP (2006: 23) – Adaption from Williamson (1998) and Groenewegen (2005).

37. A similar application has been adopted by de Joode (2007) and the Wetenschappelijke Raad voor het Regeringsbeleid Wetenschapelijke (WRR) (2008).

38. The most immediate performance indicators are natural gas prices. Because of their oil indexation one can anticipate approximate price rises half a year in advance.

39. Source: Adaption of Williamson (1998) and Correljé and De Vries (forthcoming).

40. Altogether the authors name ten different possible indicators to analyse external factors. The choice of those indicators have not been systematically explained.

41. In general, "path dependence is characterised as a self-reinforcing sequence of events with its own logic (North, 1990). A path has a distinct pattern of institutionally rooted constraints and incentives that create typically strategies, routine approaches to problem and shared decisions and rules that produce predictable patterns of behaviour. A path constructs mental maps of actors, determines the problem actor perceive and solutions available" (Groenewegen and Künneke, 2005: 16).

42. Künneke's analytical contribution to the second generation of transaction cost economics is based on earlier work that strove to conceptualise economic organisation and electricity market liberalisation (Arentsen and Künneke, 1996; Arentsen and Künneke, 2003).

43. The founding fathers of transaction cost economics are R. Coase and O. Williamson. In his landmark paper on the nature of the firm, Coase challenged the neoclassical assumption that transactions are costless. He claimed that the price mechanism is decisive in the allocation of goods and services. Further, markets and firms were seen as functioning as complementary governance structures (Coase 1937; 1964).

44. According to Williamson, "governance is the means by which order is accomplished in a relation in which conflict threatens to undo or to upset opportunities to realize mutual gains" (1998: 37).

45. Detailed definitions of spot markets and hierarchy can be found in Ménard (1995).

46. Source: Williamson (1991a: 281).

47. By simple contracts we refer to standardised contracts which reduce negotiations over terms and conditions.

48. Sunk costs are defined as a cost which cannot be recovered once they have been incurred.

49. Best practice regulation in European gas markets is defined in more detail in chapter 5.

50. Distribution network tariffs are based on gas transmission networks.

51. Source: Williamson (1999: 336).

52. The opposing argument is that pursuing several goals at once or setting certain constraints offer the possibility of synergies.

53. Frant offers the criticism that "there has been little literature to date about how to distinguish the different types of public organisations or when we should expect these organizations to display one or another feature" (1996).

54. Attempts to subsidise fuel prices for poorer member of society during periods of high energy prices also fall within this category. Social fuel policies were discussed across Europe when the oil price went above $100 per barrel in 2008.

55. Prosser (2005: 37) argues that the organising concept of principal and agent is by no means simple or unproblematic because even a company in itself is characterised by multilateral relationships among the company's management, shareholders, creditors, directors and employers, each pursuing different interests.

56. See section 2.3.2.

57. The degree to which coal and nuclear are self-sustaining is debatable and depends on a country's endowment of coal and uranium.

58. Similarly, Levi-Faur distinguishes between the Policy Sector and the National Pattern approaches to explain variations and similarities in privatisation and regulation-for-competition policies in Europe's and Latin America's telecoms and electricity industries (Levi-Faur, 2003).

59. Mastenbroek systematically develops an argument rejecting the "goodness of fit" hypothesis (Mastenbroek, 2007).

60. We decided not to publish the list of interview partner. Instead, the list is handed over to Prof. Bressers and Dr. Arentsen.

61. Reserve/production ratios are revised from time to time. During our examination period, the relative positions have not changed, although some of the countries' R/P ratios have been downgraded between 2001 and 2007.

62. "Triangulation is supposed to support findings by showing that independent measures of it agree with it or, at least, do not contradict it" (Miles and Huberman, 1994: 266-267). In this sense it is a strategy to enhance the reliability of data. "Following Denzin's classic distinctions we can think of triangulation by data source (which can include persons, times, places etc.), by method (observation, interview document), by researcher (investigator A, B, C etc.), and by theory" (ibid).

63. Table 27 in the appendix displays the main events referred to in this chapter.

64. Source: Applied version of Groenewegen and Künneke (2005).

65. Source: Directive 1998/30/EC, Directive 2003/55/EC.

66. Source: Gomez-Acebo, Abogandos, & Russels (2005: 18).

67. Earlier we discussed the relatively short time frame of our analysis requiring to perceive our results as preliminary. In case the convergence study would be expanded until 2018, the results might differ.

68. Table 28 in the Appendix displays the tariffs and its scores.

69. Table 29 in the Appendix displays the detailed figures.

70. The individual budget scorings are displayed in Table 30 (Appendix).

71. In 2006, the Dutch regulator commissioned an evaluation of energy sector liberalisation to display the cost and benefits of the national gas reform. The introduction of the "Gaswet" (gas liberalisation law) caused administrative costs of 13.6 million Euros in 2002. A comparison of costs with or without the Gaswet is not possible (ECORYS Nederland BV, 2006: 68).

72. Security of supply is often reduced to a buzzword or a black-box concept. Here it is defined “as the guarantee that all the gas volumes, demanded by non-interruptible (firm or protected) customers, will be available at a reasonable price” (Luciani, 2004).

73. Steiner admits price data is not available for the generation market but only for the retail market. Instead, she uses an artifice claiming “generation prices are assumed to be a mean-shifted version of retail prices” (2001: 166).

74. The utilisation is calculated as energy production divided by total average capacity. The optimal reserve margin is generated on the basis of a benchmarking procedure and the reserve margin is calculated as the difference between capacity and peak demand, divided by peak demand (Steiner, 2001: 164).

75. The sample consists of two subgroups, transmission utilities and integrated utilities.

76. Austvik gives a brief and clear introduction into price formulation, contract clauses and effects of liberalisation on prices. Additionally, he explains different schemes of price regulation (1997; 2003).

77. Robinson concisely explains: “To put it intuitively, a variable ß-converges if countries with low original values of the respective variable – in this case gas prices – experience more rapid growth rates in this variable than the other countries in the same sample” (Robinson, 2007: 2349). For a more detailed explanation of beta convergence see Haase (2008).

78. The data is retrieved from the Economic and Social Data Services collected under the supervision of the International Energy Association. The Robinson text is ambiguous whether household end-user prices are included. For instance, he refers to household and industry gas prices in Figure 1 in his text, but in the text itself he explicitly states the data is based on industry prices.

79. The econometric analysis faces a number of shortcomings, namely a small number bias in conjunction with an unbalanced panel (missing data), which Growitsch and Stronzik suggest to counter balance through the application of a corrected Least Squares Dummy Variable (LSDVC) estimator.

80. Adam Scorer, Director of Campaigns of the UK energy watch, indirectly accused the energy companies to apply collusive pricing strategies by saying: “Four double digit rises in four weeks won't do much to persuade consumers that this market works in their interest. Four, supposedly cut-throat, competitors have raised their prices by near identical amounts in days of each other. This is a market where companies do not worry about competition for consumers” (Energywatch, 2008, 1 February).

81. The tariffs are consisting of several elements. In some countries, the costs that are subject to regulatory approval and/or incentive regulation are not more than 10-15% (Haase, 2008). The rest are mainly capital cost related and operational cost which are to a large extent externally determined (fuel costs, electricity, data transfer etc.). Moreover, historical evolutions of tariff levels might need to be taken into account (relative tariff development versus actual tariff level). Steiner discussed this problem in the context of comparing the development of the actual and optimal reserve margin.

82. Even if selected company tariffs serve as proxies for a national average tariff the problem of diverging definitions of tariffs is not solved.

83. The reasoning is that a concentration on the supply side requires a similar concentration on the demand side in order to be able to compete with other strong buyers from other regions and to negotiate favourable supply contracts with the large gas producers such as Gazprom.

84. The willingness to pay for security of supply certainly has its limits and might ultimately result in a change in the energy mix. One should also note that this proposition dates back to periods of comparatively low energy prices.

85. The links between the mirco-, meso- and macro- levels are not explicitly explained or elaborated upon.

86. The authors elaborate on the interdependence of transmission and generation. From this, incentives for investing in the grid will affect incentives for investing in generation capacity (Keller and Wild, 2004).

87. The Commission's line of legal argumentation is briefly summarised in a DG COMP's Newsletter (Lowe, Pucinskaite et al., 2007).

88. In general, an economic agent or organisation is seen as behaving opportunistically if it quickly adapts to the opportunity structure, and votes for its own advantage. Opportunistic behaviour might even imply illegal behaviour. Burns and Riechmann (2004: 216-217) show that companies are responsive to opportunities provided by incentive regulation schemes and adjust the timing of their investments in line with regulatory cycles. The latter is called the periodicity effect and discussed in the context of incentive regulations applied to the electricity sector.

89. Open source literature was complemented by expert interviews.

90. In the case of an interconnector pipeline, the national regulatory authorities of the countries linked by the pipeline are involved. Should the national authorities and the Commission come to conflicting decisions, Articles 3 and 7 of Decision 1999/468/EC shall apply (Article 22, Point 4).

91. Source: European Commission (2004).

92. Sources: European Regulators' Group for Electricity and Gas (2007, September), European Commission Website >http://ec.europa.eu/energy/gas/infrastructure/exemptions_en.htm<, and various project websites.

93. Some projects deviate from the norm by exercising an open season procedure on a voluntary basis, or by not conforming with the obligation to allocate capacity using an open season procedure at all (European Regulators' Group for Electricity and Gas 2007, September).

94. LNG companies criticise the use-it-or-lose-it (UIOLI) principle because it shifts the risks to the LNG company while offering free-riding potential to opportunistic market players. In general, an LNG company needs to provide greater re-gasification capacity than LNG cargo capacity to ensure the gas flow is maintained. The need to run an LNG terminal in combination with a re-gasification facility with asymmetric capacity results in often not being able to use the whole capacity through prior booking. If this market situation is genuinely structural, and a use-it-or-lose-it regime is employed, then other market players could specialise in buying capacity in the secondary market at rock-bottom prices without sharing any of the risks. Moreover, the danger of cross-subsidising free-riders might lead other market players to refrain from signing long-term take-or-pay contracts. This line of reasoning, advanced by LNG businesses, argues that the application of UIOLI principles in effect decreases the competitiveness of Europe as an LNG destination. In times of a worldwide demand-side competition for LNG cargos, the EU runs the risk that the United States or Asia could offer a better investor-oriented market environment and thus succeed in becoming market makers. For further information see the NERA Economic Consulting Report on third party access to LNG Terminals (2006, 10 November).

95. The meaning of different forms of incentive regulation and an explanation of the X-factor is provided later in this chapter.

96. The storage facilities in the Netherlands are mainly located at Alkmaar, Grijpsperk, and Norg. In addition, there are storage facilities on the German side of the Dutch-German border in Epe which are partly owned by former Dutch companies such as Essent and Nuon and feed into the Dutch gas market.

97. In the 1950s, the Nederlandse Aardolie Maatschappij discovered a number of moderately sized oil and gas fields in the north of the Netherlands. In 1959, the giant Slochteren gas field was discovered (Correljé, Van der Linde, and Westerwoudt, 2003: 26).

98. The small field policy intended to extend the availability of the Dutch gas resources by implementing measures to stimulate the exploration and production of for both on- and offshore fields besides the giant Groningen field (Correljé, Van der Linde, and Westerwoudt, 2003: 95).

99. Ownership unbundling was proposed in the first version of the so-called 'separation bill'(splitsingswetsvoorstel) to amend the Electricity Act 1998 and the Gas Act 2000. The separation bill passed the first Chamber of the Dutch Parliament in November 2006.

100. On the distribution level, the NMA details several distribution system operators. A list of distribution system operators is provided on the NMa's website: http://www.nma-dte.nl/nederlands/ gas/transport/ overzicht_ netbeheerders/aanwijzing_netbeheerders.asp

101. This distribution of shares reflects the situation since Gasunie Trade and Supply became GasTerra in September 2006.

102. "A remarkable legal feature should not go unnoticed: the Netherlands did not have any specific gas or energy law prior to this directive. The old scheme was largely based on the Mining Act of 1810, the Nota De Pous from 1962 and a number of concessions" (Couwenberg and Woerdman, 2006: 16). As such, the Gas Act was the first of its kind to regulate the Dutch gas market beyond the setting of the legal grounds for resource allocation.

103. Correljé refers to the range of measures which function as formal and informal institutional frameworks (2008).

104. In June 2008, the DTe's name was changed to 'Energiekamer' ('energy chamber') but without changing the distribution of competences amongst the NMA, the DTe and the Ministry of Economic Affairs (Nederlandse Mededingsauthoriteit, 2008a).

105. The list only includes the most relevant tasks of the NMa in terms of regulating the Dutch gas market and reflects the original wording. The NMa has other duties related to electricity market regulation.

106. "Pursuant to section 81c (2), preamble and clause (b), of the Gas Act, the Board may correct the tariffs which will apply in period t, if the tariffs which applied to the period(s) preceding period t were determined on the basis of incorrect or incomplete data, and the Board would have determined tariffs which it had had the correct or complete data" (Netherlands Competition Authority, 2005).

107. In practice, the distinction between revenue-cap and rate-of-return regulation may diminish in case regulators may end up making implicit decisions on the acceptable real rates of return on capital employed in order to arrive at price limit determinations. Or elements of rate-of-return regulation are combined with the application of an X-factor.

108. Correljé (2008) provides a concise summary of these discussions.

109. For more explanations and a brief discussion of entry-exit, distance based, and postalised tariff systems see section 5.10.2.

110. The total income (without substracting costs and capital costs before tax) amounted 1.42 billion Euros in 2004 and shrank to 1.2 billion Euros in 2005. Gasunie signs the NMa/DTe's incentive regulation responsible for the drop in 'income' ('opbrengsten'), as the figure corresponds with the lowering of the tariffs (Gasunie, 2005).

111. In this context, it is noteworthy that the potential efficiency gains are very limited. The transport tariff is a small share of the end-consumer bill compared to the other components such as the gas commodity and tax.

112. Arthur D. Little refers to cases as to distinct possible gas transport bookings of different volumes (1, 10, 100 million cubic metres) and load factors (8000, 5000 or 2500 hours) applied to several distances in high-pressure and regional networks (2005: 4).

113. Source: Arthur D. Little (2005: 23).

114. During our explorative interviews, representatives of the DTe explicitly referred to the danger of being brought before the Courts if the principle of cost-reflectiveness was not guaranteed by the DTe's regulatory decisions.

115. The Dutch Energy Council first published a full report in January 2005. After discussing the advice contained therein with the government, the gas business and independent experts, a final document was published (Algemene Energieraad, 2005, Januari; Algemene Energieraad, 2005, Mei).

116. In the process of implementing the new strategy, Gasunie succeeded in completing a pipeline from Norway, expanded its assets by buying a transmission network formerly owned by BEB Erdgas and Erdöl GmbH in northern Germany and participated in the North Stream project which links Russian gas fields with the northern German transmission system (Gasunie, 2007).

117. On the transmission level, infrastructure was proposed to expand two trajectories: one optimising gas flows from the north-east to the south-west of the Netherlands, and the other serving the same purpose for the north-east – north-west trajectory.

118. The idea of uncertainty and the theoretical expectations in the event of uncertainty are pertinent and are outlined in sections 3.4.2 and 3.4.3.

119. The DTe indicates that these contracts will end in 2022 (Directie Toezicht Energiesector, 2006, 22 September: 10).

120. The exchange process between GTS and DTe is described in a letter sent by the Director of the DTe to Gas Transport Services on 22 September 2006 (Directie Toezicht Energiesector, 2006, 22 September).

121. The Original text in Dutch is “Kort samengevat heeft de wetgever beoogd dat de tarieven kostenoriëteerd dienen te zijn en dat aan netgebruikers pas kosten in rekening gebracht worden als ook baten worden gerealiseerd. De netgebruiker realiseert pas baten indien het investeringsvoorstel geactiveerd is. Daarom keurt DTe een voorstel voor een aanmerkelijke en uitzonderlijke investering alleen goed als deze in hetzelfde kalenderjaar waarin het voorstel wordt ingediend is geactiveerd” (Directie Toezicht Energiesector, 2006, 22 September).

122. The DTe commissioned a report by Jacobs Consultancy to evaluate the first version of GTS’s investment plan. Based on the first version, not the final version, Jacobs Consultancy predicted a 50% chance that investments would be more than planned (Directie Toezicht Energiesector, 2006, 22 September: 8).

123. H-gas refers to high caloric gas, originating from gas production fields outside the Netherlands. L-gas conversely stands for of low caloric gas. The Groningen gas is often called g-gas because it is characterised by a unique caloric value which is between these two qualities.

124. According to Klop, “total revenues using a 20 years depreciation period are over 13 times larger than when depreciation is spread over 55 years” (2009: 53).

125. In Europe, oil import contracts often provide so-called reopening clauses. These clauses list conditions for which the given contract is valid. If one of these conditions is no longer met, then the contracting parties automatically reopen the contract and renegotiate its terms of conditions. Such an event might for instance be the oil price falling below US$10 or moving above US$70 a barrel.

126. In this context, it is noteworthy that both regulatory approaches impose a relatively heavy regulatory burden on an ownership-unbundled transmission system operator which, following vertical disintegration, naturally has an interest in increasing its capacity and thereby its market share and profits.

127. Phillip Wright: SSE (8.8%), Scottish Power (3.2%), and EdF (0.8%).

128. Oxera offers a concise summary of the legislative acts which form the legal basis for gas regulation in the UK (1999: 31-50).

129. In June 2007, the departmental structure of the DTI, the Department for Education and Skills (DFES) and the Better Regulation Executive were transformed. Major parts of the DTI and the Better Regulation Executive (BRE) from the Cabinet Office became the Department for Business, Enterprise and Regulatory Reform.

130. The wording of Ofgem’s duties are identical to the description of the DTI’s (retrieved on 12 August 2008, from http://www.ofgem.gov.uk/About%20us/Authority/Pages/TheAuthority.aspx).

131. We interviewed current and former members of Ofgem, the OFT and the Competition Commission. None of the interviewees reported serious friction. In addition, the author inquired into possible conflicts between the OFT and Ofgem with respect to the revision of the gas storage regime by asking representatives from companies for their views.

132. Earlier, in January 2000, UK wholesale prices were hovering around 11 pence/therm (Energy Intensive Users Group (EIUG) 15 May 2002).

133. 1 therm is equivalent to 105 megajoules or 29 kilowatt hours.

134. Source: Energywatch (2006).

135. The Interconnector has the capacity to transport 20 bcm per year from Continental Europe to the UK. Sixty percent free capacity translates into 34.8 million cubic metres per day.

136. The figures Energywatch are referring to are based on submissions to the Trade and Industry Select Committee inquiry on gas prices (Energywatch, 2005: 7).

137. INEOS ChlorVinyls was presented as the third-largest petrochemical company in the world and the UK's largest private company.

138. Messrs MacKenzie and Hood presented these facts and figure during the seminar.

139. The CBI website does not provide press releases more than one year old, and the CBI is reluctant to talk to non-members. An interview request by the author was rejected.

140. DG TREN and DG COM were approached by the CBI and other energy-intensive user groups.

141. This impression was confirmed in background talks (October/November 2006) with civil servants from the DTI and Ofgem.

142. According to Energywatch, "Britain has 3 million people living in households in fuel poverty – paying at least 10% of their income on fuel" (Energywatch, 2005: 6).

143. In the context of the consultation process on improving the UK security of gas supply arrangements, the fifth measure discusses demand-side responses (DTI, 2007: 16-17).

144. After taking over the Rough storage, Centrica invested in its maintenance and rebuilding after an accidental fire in 2006 (Centrica, 2007).

145. Cargoes might land at an LNG terminal and be re-exported, or supply contracts might not be honoured due to higher bids for shipment to other LNG markets.

146. Gaz de France proposed the latter variant of regulating gas storage during the consultation process (Department of Trade and Industry, 2007: 15).

147. The 37 responses were more-or-less equally distributed among upstream producers, downstream suppliers, infrastructure operators, consumer organisations and others (e.g. academics). The list of respondents to the consultation is in annex A (Department of Trade and Industry, 2007).

148. In response to Energywatch's views, the Association of Energy Suppliers launched, in 2003, the Face-to-face Marketing Code of Practice in order to prevent the ongoing problems caused by energy mis-selling which created a lot of negative media attention. Energywatch welcomed the suppliers' self-regulation (Energywatch, 2004: 5).

149. "Measure 3 (regulating gas storage) was treated differently in the Oxera analysis as it was not feasible to operationalise the constraints on usage. An alternative approach was applied, focusing on the revenue implications for storage operators" (DTI, 2007: 28). That is, the revenues of storage operators were expected to decrease, resulting in lower investment incentives.

150. The idea of public goods as proposed by Paul Samuelson (1954) suggests that public goods are opposed to private goods non-rivalrous and non-excludable. Especially the latter criterion, non-excludability, is pertinent in case the security of gas supply obligation is taken seriously.

151. Although the EU does not directly refer to externalities as justification for the promotion of gas market liberalisation, an implicit link can be anticipated. One could argue externalities are pertinent insofar as high natural gas prices and inefficiencies in the natural gas value chain may prevent gas to replace less sustainable energy sources such as oil and coal in the energy mix. Having in mind the projected dash-for-gas in Europe is only likely to materialise in the coming decades in case the gas prices are competitive to coal and oil prices, a failure in gas markets may incur negative externalities, because the European Unions CO-2 reduction targets could most probably not be reached to its full potential. Most generally, the structure-conduct-performance paradigm suggests that the introduction of competition by means of regulation stimulates the business conduct in such a manner that economic performance is improved, ranging from expected efficiency gains to more competitive affordable prices. Assuming the expectation the gas market reform alters the competitiveness of natural gas, then the reform can be interpreted as strategy to prevent externalities with regard to the EU's CO-2 reduction ambitions.

152. The preliminary report of the European Commission's sector inquiry displayed the incumbents' share of imports of twelve member states, amongst them old and new member states. In eight out of twelve cases the incumbents share ranged between 90%-100% in 2004 (European Commission 2006c: 31).

153. See for a similar view Correljé (2008).

154. In our context, energy goals are considered to be ambiguous when regulation-for-competition coexists with security of gas supply as regulatory goals without there being an explicit upfront priority (made prior to selecting the regulatory option) in formulating the gas reform objectives. A detailed elaboration of this is provided in sections 3.6 and 4.2.3.

155. A figure for the total investment in gas transport for Europe could not be obtained. Enquiries failed to find any project which had not applied for exemption from third party access. The author would be very interested in hearing of any large-scale gas transport or import projects which have been implemented without applying for third-party access exemption since 2004.

156. In this context, it is noteworthy that both regulatory approaches impose a relatively heavy regulatory burden on an ownership-unbundled transmission system operator which, following vertical dis-integration, naturally has an interest in increasing its capacity and thereby its market share and profits.

157. "The longer the duration of the contract, the greater the loss of scope for competition during its life. Furthermore, with concentrated markets, foreclosure through long term contracts is a particular concern, since in order for competition to develop, new entrants and suppliers seeking to increase their market share must have the possibility to purchase the gas they require, to gain access to network, storage capacity, and to contract with customers. Depending on the market circumstances long term contracts can result in foreclosure" (European Commission, 2006c: 6).

158. Source: Council of European Energy Regulator (CEER), (2005); European Commission (2001, 2002, 2003a, 2004d, 2005a, 2005d).

159. Source: Council of European Energy Regulator (CEER), (2005); European Commission (2001, 2002, 2003a, 2004d, 2005a, 2005d).

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Summary in Dutch

De liberalisering van de Europese gasmarkt is destijds in gang gezet met de bedoeling om de gasmarkten in de EU te integreren en daarmee hun functioneren te optimaliseren. Meteen vanaf het begin bleek de omvang en reikwijdte van dit project, ondermeer doordat liberalisering de complete herstructurering van het multilevel governance systeem van de Europese gasmarkt raakte. De suggesties uit zowel wetenschap als politieke praktijk voor het nieuwe – optimale - organisatiemodel, blijken niet te sporen met de verwachtingen. Ondanks de soms sterke retoriek, bleek men veel minder zeker over het optimale model dan verwacht. Deels ook door het ontbreken van voldoende empirisch gefundeerde wetenschappelijke kennis, is de optimale organisatie van een geliberaliseerde Europese gasmarkt een zoekproces gebleken dat niet alleen door de timing maar vooral ook principieel verklaard dient te worden. Ondanks de nog recente datum ontwikkelen wij daartoe een evolutionair perspectief op de liberalisering van de Europese gasmarkt dat zijn neerslag vindt in de probleemstelling van ons onderzoek. Ons baserend op Neo-institutionele Economie en meer in het bijzonder op het vier lagen model van Williamson (1998), onderzoeken we in dit proefschrift de mate waarin de verandering van de regulering van Europese gasmarkten evenals het effect daarvan op de economische prestaties van die markten, empirisch onderzoekbaar is. Deze vraagstelling hebben we gespecificeerd in twee onderzoeksvragen:

1. Welke factoren bepalen reguleringsregimes en economische prestaties in Europese gasmarkten?
2. Wat is het empirische effect van regulering voor competitie in de EU op de economische prestaties van Europese gasmarkten?

Met onze analyse hopen wij bij te dragen aan een beter begrip van de hervormingen van de Europese gasmarkten tot nu toe.

Ons theoretische begrip van de factoren die van invloed zijn op het hervormingsproces van regulering voor competitie hebben we ontwikkeld op basis van het vier lagen model van Williamson (1998). Dit model hebben we mede met het oog op ons kwalitatieve empirische onderzoek op een aantal punten aangepast. Wij onderscheiden als eerste laag in het model, de laag van de informele instituties, waarmee we meer algemene ideeën over energiebeleid en energiepolitiek in de lidstaten bedoelen. Deze algemene ideeën beïnvloeden de formele instituties die in de tweede laag van het model worden onderscheiden. Daarmee bedoelen we vooral nationale en Europese regelgeving. In de derde laag van het model vinden we de institutionele arrangementen voor regulering die onder invloed staan van zowel de informele als de formele instituties in de eerste en tweede laag van het model. De reguleringspraktijk met zijn invloed op de marktstructuur en de marktprestaties vinden we in de vierde laag van het model.

Wij hebben met behulp van bestaande inzichten in de literatuur het vier lagen model op een aantal punten geamendeerd. In de eerste plaats achten wij de dynamiek in en tussen de lagen hoger dan Williamson veronderstelt. Daarbij gaat het om de snelheid waarmee informele instituties in de eerste laag kunnen veranderen en daarmee de snelheid waarmee deze ideeën doorwerken naar de andere lagen in het model. In de tweede plaats hebben wij het idee van padafhankelijkheid in het model gebracht. Dit stelt ons in staat om rekening te houden met het reguleringsverleden van lidstaten evenals met het al dan niet hebben van eigen aardgasvoorraden om de reguleringskeuze van lidstaten te kunnen verklaren. In de derde plaats bleek het nodig om de relatie tussen formele institutie en institutioneel arrangement conceptueel te verhelderen en te nuanceren om het model te kunnen toepassen op de Europese gasmarkt. Tenslotte hebben we de logica in de relatie tussen de vier lagen van het model met behulp van de literatuur institutioneel gespecificeerd. Daarbij hebben we aangegeven dat de institutionele logica beter kan worden begrepen met behulp van de *alignment* hypothese uit de transactiekosten economie. Deze hypothese biedt namelijk op microniveau een verklaring voor de verandering van de logica die ten grondslag ligt aan economische *governance* in het algemeen en de *governance* van de Europese gasmarkt in het bijzonder. Deze *alignment* hypothese stelt ons in staat om de evolutie in reguleringsregimes van de lidstaten van de EU te kunnen verklaren. In hoofdstuk 3 hebben we dit theoretisch gedetailleerd uitgewerkt en onze conclusies samengevat in 5 hypothesen.

1. Een *misalignment* tussen de kenmerken van de transactie en de *modes of governance* maakt het waarschijnlijker dat lidstaten aarzelen om het door de EU voorgestane *best practice model* van regulering voor competitie toe te passen, met een negatief effect op de delta convergentie van reguleringsregimes.
2. Naarmate de *misalignment* tussen de kenmerken van de transactie en de mode *of governance* groter is (dus het reguleringsregime van lidstaten dichter bij het *best practice model* is), hoe slechter de economische prestatie in termen van aardgas prijzen, netwerk tarieven, productieve efficiëntie en investeringen in gas infrastructuur en des te groter de kans op een aanpassing van reguleringsbeslissingen.
3. Als de beleidspreferenties van reguleringsautoriteiten opererend in een multi-autoriteit setting verschillen, dan is het waarschijnlijk dat reguleringsbeslissingen (inclusief de coördinatie) worden aangepast. Als de beleidsvoorkeuren van deze reguleringsautoriteiten niet verschillen dan is het niet waarschijnlijk dat reguleringsbeslissingen worden aangepast.
4. Als in een land de eigen gasvoorraden afnemen dan is het waarschijnlijk dat het waarborgen van voorzieningszekerheid en de reguleringsbeslissingen die dit ondersteunen, hogere prioriteit krijgen ten koste van regulering voor competitie.
5. Naarmate EU regels hervorming van de gas markt meer specificeren (laag 2), des te waarschijnlijker is de toepassing van het *best practice model*, zichtbaar in delta convergentie van reguleringsregimes (laag 3).

Met behulp van het aangepaste vier lagen model van Williamson hebben we de eerste onderzoeksvraag theoretisch beantwoord die luidde: Welke factoren bepalen reguleringsregimes en economische prestaties van Europese gasmarkten? Ons antwoord op die vraag is dat het reguleringsregime wordt bepaald door beleidsdoelstellingen (laag 1) en formele Europese regels (laag 2). Daarop voortbouwend worden in ons model de economische prestaties verklaard door de specifieke institutionele organisatie van de regulering van de gasmarkt in de lidstaten (laag 3) en het al dan niet hebben van eigen aardgasvoorraden door de lidstaten (externe factor) en het functioneren van de markt (laag 4).

Ons verklaringsmodel voor de reguleringskeuze van landen en in het verlengde daarvan, de economische prestatie van de gasmarkten in die landen, bestaat uit de volgende variabelen: beleidsdoelstellingen, juridische randvoorwaarden van de EU, specifieke keuzen met betrekking tot het reguleringsmodel of te wel de institutionele configuratie die we hebben samengevat in het concept reguleringsregime, de economische prestatie en de beschikbaarheid van eigen

gasvoorraden. Daarmee weerspiegelt ons verklaringsmodel onze kritiek en aanvulling op het vier lagen model van Williamson.

Voor ons empirische onderzoek hebben we met behulp van de literatuur regulering alsmede het effect daarvan op de economische prestatie, nader uitgewerkt. Wij hebben in ons onderzoek gewerkt met het begrip publieke regulering, waarin deze relatie expliciet wordt benadrukt. Aan publieke regulering hebben we twee dimensies onderscheiden, namelijk functie en competentie. Beide tezamen vormen wat wel wordt genoemd de *comprehensiveness* van regulering. Onze operationalisering en toepassing van het reguleringsregime is gebaseerd op beide dimensies van regulering. Verder wordt in onze publieke reguleringsbenadering onderscheid gemaakt tussen eerste orde economische doelstellingen en tweede orde politieke doelstellingen. In ons onderzoek verwijst de economische doelstelling naar de neoklassieke betekenis van het begrip economische prestatie (efficiency) en de politieke doelstelling naar het waarborgen van de voorzieningszekerheid.

In het empirische deel van ons onderzoek hebben we de evolutie in de publieke regulering van gasmarkten in Europa en het effect daarvan op de economische en politieke prestatie van de gasmarkten empirisch onderzocht. Die evolutie hebben we kwantitatief onderzocht in de periode 2000-2005. We hebben met behulp van data van die periode de convergentie in reguleringsregime van twaalf lidstaten kwantitatief onderzocht. Onze bevindingen hebben we beschreven met behulp van drie convergentie indices: stigma convergentie waarmee de toe- of afname in de variantie tussen reguleringsregimes in de tijd kan worden bepaald. Met gamma convergentie kan de mate en richting van verandering van reguleringsregimes tot uitdrukking worden gebracht. In ons onderzoek hebben we voornamelijk gekeken of en in welke mate de evolutie van het reguleringsregime van de lidstaten richting het *best practice model* beweegt. Delta convergentie tenslotte, is een maat voor de aard van de verandering, in ons onderzoek tot uitdrukking gebracht als de relatieve afstand ten opzicht het *best practice model*. De evolutie in reguleringsregimes hebben we kwantitatief onderzocht met behulp van een index bestaande uit 15 indicatoren met in totaal 23 aspecten van regulering. Op deze wijze hebben we onderzocht in welke mate de lidstaten in de periode 2000-2005 het door de EU voorgestane *best practice model* van regulering voor competitie hebben toegepast. De resultaten zijn weergegeven in figuur 20.

Uit de gegevens kan worden afgeleid dat de invoering van het regulering voor competitie model in de periode 2000-2005 stapsgewijs heeft plaatsgevonden. Verder is gebleken dat lidstaten het *best practice model* in de genoemde periode voor ongeveer de helft hebben doorgevoerd (delta convergentie is 54%). In de genoemde periode is ook het verschil in reguleringsmodel tussen de lidstaten wat

minder geworden. Dit hebben we afgeleid uit de afgenomen variantie tussen de reguleringsregimes van de lidstaten zoals weergegeven in de waarde van de sigma convergentie. Deze is in de periode 2000-2005 afgenomen van 142 naar 88. Verder bleek uit onze meting van de convergentie dat in 2005 de gemiddelde afstand ten opzichte van het *best practice model* nog steeds 70 punten bedroeg. Met deze nog grote afstand achten wij onze tweede hypothese bevestigd die stelt dat in het geval van een *misalignment* tussen transactie kenmerken en *mode of governance* in de gasmarkt, lidstaten zullen aarzelen om het *best practice model* in te voeren.

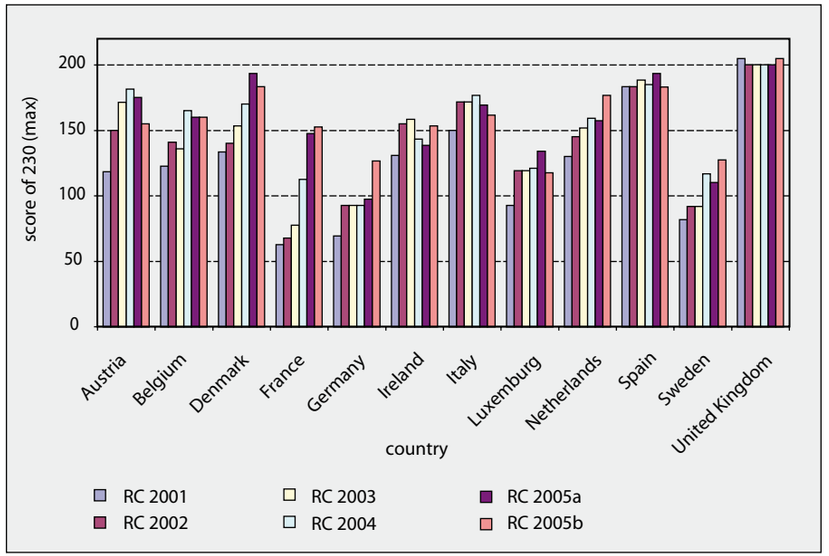

Figure 20: Regulatory comprehensiveness (2000-2005)

De aarzeling van de lidstaten is ook gebleken uit een meer gedetailleerde analyse van de ontwikkelingen per land. Hoewel een behoorlijk aantal lidstaten tussen 2000 en 2005 werk hebben gemaakt van de invoering van het best *practice model* heeft geen enkele lidstaat de implementatie in die periode kunnen afronden. Nadere analyse van de convergentie heeft ons geleerd dat lidstaten eerder geneigd zijn om hun institutionele arrangementen aan te passen dan om bevoegdheden aan de reguleringsautoriteit te delegeren.

Vervolgens hebben we in hoofdstuk 9 het effect van regulering op de economische prestaties van gasmarkten onderzocht. Dit onderzoek heeft

ons geleerd dat de relatie tussen (ontwikkelingen in) reguleringsregime en economische prestatie om praktische en meer principiële redenen niet kan worden onderzocht.

In hoofdstuk 10 en 11 hebben we meer gedetailleerd gekeken naar de aard van reguleringsbeslissingen in twee case studies. In hoofdstuk 10 hebben we de overgang van *revenu-cap* regulering naar *rate-of-return* regulering in Nederland onderzocht en in hoofdstuk 11 de regulering van gasopslag in de UK. Uit beide hoofdstukken blijkt dat de aanwezigheid van eigen gasvoorraden van invloed is, maar dat landen een eigen strategie volgen om de voorzieningszekerheid te waarborgen. De UK beschouwde de toename van de gasimport via pijpleiding en LNG een voldoende waarborg voor de voorzieningszekerheid. Om die reden achtten de reguleringsautoriteiten, DTI en Ofgem, het uitvaardigen van aanvullende wettelijke waarborgen voor de voorzieningszekerheid niet nodig. In Nederland hebben we een samenhang waargenomen tussen diversiteit aan regulatieve doelstellingen van reguleringsautoriteiten en de waarschijnlijkheid van verandering van regulering. Echter onze kwalitatieve analyse miste de controle factor die ons in staat zou stellen om de derde hypothese te valideren.

In het twaalfde en laatste hoofdstuk hebben we de belangrijkste bevindingen van het onderzoek samengevat. Onze bevindingen met betrekking tot de vijf hypothesen luiden:

1. Een *misalignment* tussen de kenmerken van de transactie en de regulering voor *modes of governance* maakt het waarschijnlijker dat lidstaten aarzelen om het door de EU voorgestane *best practice model* van regulering voor competitie toe te passen, met een negatief effect op de delta convergentie van reguleringsregimes.

   Ons onderzoek heeft de eerste hypothese kunnen bevestigen. In onze theoretische analyse hebben we onder verwijzing naar de transactiekosten benadering geconcludeerd dat *regulation-for-competition* niet de meest efficiënte *mode of governance* is vanuit het perspectief van transactiekosten. In onze analyse bleek een *misalignment* tussen *mode of governance* en transactiekenmerken van de gasmarkt. Dit bleek in het bijzonder te gelden voor investeringstransacties. Verder bleek uit onze empirische analyse een zekere onwil bij lidstaten om het *best practice model* te effectueren, zoals weerspiegeld in een bescheiden delta convergentie van reguleringsregimes.

2. Naarmate de *misalignment* tussen de kenmerken van de transactie en de mode *of governance* groter is (dus het reguleringsregime van lidstaten dichter bij het *best practice model* is), hoe slechter de economische prestatie in termen van aardgas prijzen, netwerk tarieven, productieve efficiëntie en investeringen in gas infrastructuur en des te groter de kans op een aanpassing van reguleringsbeslissingen.

   Deze hypothese doet twee voorspellingen. In de eerste plaats wordt gesteld dat een *misalignment* tussen transactie en *mode of governance* leidt tot een slechte economische prestatie. In hoofdstuk 9 hebben we uitgebreid beargumenteerd waarom deze relatie voor de Europese gasmarkt niet wetenschappelijk kan worden gevalideerd voor indicatoren als gas prijs, investeringen in gasnetwerken en productieve efficiëntie (waaronder bezettingsgraad van pijpleidingen). Gegevens voor en na de introductie van de gasmarkthervorming ontbreken om deze relatie empirisch te kunnen toetsen.
   In de tweede plaats stelt de hypothese dat slechte economische prestaties aanleiding geven tot heroverweging van reguleringskeuzen. Beide case studies geven steun aan deze voorspelling. In de UK leidde een drastische verhoging van de groothandelsprijs van gas tot heroverweging van de regulering van gasopslag. In Nederland hebben de lage tarieven voor gastransmissie en het negatieve effect daarvan op het binnenlandse gastransport, aanleiding geven tot aanpassing van de *incentive* regulering.

3. Als de beleidspreferenties van reguleringsautoriteiten opererend in een multi-autoriteit setting verschillen, dan is het waarschijnlijk dat reguleringsbeslissingen (inclusief de coördinatie) worden aangepast. Als de beleidsvoorkeuren van deze reguleringsautoriteiten niet verschillen dan is het niet waarschijnlijk dat reguleringsbeslissingen worden aangepast.

   Ons onderzoek geeft aanwijzingen voor de validiteit van deze hypothese maar kon niet worden bevestigd. Beide reguleringsautoriteiten in de UK bleken een voorkeur voor een marktbenadering te delen. Beide beschouwden gas in hun institutionele logica als een economisch goed. In overeenstemming met onze verwachting werden geen aanvullende regulatieve maatregelen uitgevaardigd om de voorzieningszekerheid veilig te stellen. Uit de Nederlandse case studie bleek dat het ministerie van economische zaken en Dte divergerende beleidsdoelstellingen hadden. Het ministerie legde meer prioriteit bij de middel en lange termijn voorzieningszekerheid terwijl Dte *regulation-for-competition* en statische efficiëntie benadrukte.

4. Als in een land de gasreserves afnemen dan is het waarschijnlijk dat het waarborgen van voorzieningszekerheid en de reguleringsbeslissingen die dit ondersteunen, hogere prioriteit krijgen ten koste van regulering voor competitie.
   Uit onze analyse is gebleken dat de nationale gasvoorraad van belang is bij de heroverweging van reguleringsbeslissingen, maar geen overheersende of beslissende factor is. In de UK case is gebleken dat de reguleringsautoriteiten vertrouwden op de markt om de middellange termijn (2010) voorzieningszekerheid door middel van meer import te waarborgen. Om die reden legden ze geen aanvullende eisen op. Uit onze Nederlandse case studie is gebleken dat de afnemende gasvoorraad aanleiding is geweest om in de regulering van de gasmarkt meer prioriteit te geven aan voorzieningszekerheid ten koste van statische efficiëntie.

5. Naarmate EU regels specifieker de hervorming van de gas markt voorschrijven (laag 2), des te waarschijnlijker is de toepassing van het *best practice model*, zichtbaar in delta convergentie van reguleringsregimes (laag 3).

Uit onze kwantitatieve analyse is gebleken dat ontbrekende precisie in een Europese wet samengaat met een lage tot gemiddelde delta convergentie, waaruit de zwakke samenhang blijkt. Europabreed invoeren van het *best practice model* vraagt om heel precieze Europese regels omdat uit ons onderzoek is gebleken dat lidstaten nationaal regels invoeren naar de letter en niet naar de geest van wat door de EU wordt voorgeschreven. Verder geven de wisselende bevindingen, onder meer in beide cases studies en in de kwantitatieve analyse aanleiding om te concluderen dat ons onderzoek weinig steun geeft aan de hypothese.

Appendix

Date	Event	Category*
22 June 1998	Publication of Directive 98/30/EC EC of the European Parliament and of the Council concerning common rules for the internal market in natural gas	L
30 September – 1 October 1999	1st Madrid Forum	Me/Inst.
23-24 March 2000	European Council in Lisbon calls for rapid progress**	Me
10 August 2000	Implementation deadline for the provisions prescribed in Directive 1998/50/EC (Art. 29 & Art. 30)	I
11-12 May 2000	Second Madrid Forum	Me
26-27 October 2000	Third Madrid Forum	Me
23-24 March 2001	Council meeting in Stockholm without any agreement on the timetable for the next steps concerning gas liberalisation	Me
13 March 2001	First proposal for a Directive amending Directives 96/92/EC and 98/30/EC concerning common rules for the internal markets in electricity and natural gas	(L)
30 September –	1st Madrid Forum	Me/Inst.

Date	Event	Category*
2-3 July 2001	Fourth Madrid Forum	Me
3 December 2001	Publication of the first Benchmarking report	Mo
7-8 February 2002	Fifth Madrid Forum	Me
5 March 2002	Council Meeting held in Barcelona decides to open the market for non-household customers by 2004	Me
13 March	EP amends EC's first proposal for an acceleration Directive	Me
7 June 2002	Publication of the amended proposal for a Directive amending the Electricity and Gas Directives	(L)
26 June 2002	Publication of the final report on the Green Paper "Towards a European strategy for the security of energy supply"	S
2 October 2002	Publication of the second Benchmarking report	Mo
30-31 October 2002	Sixth Madrid Forum	Me
25 November 2002	Energy Council reaches political agreements on second Gas Directive.	Me
2003	Legal market opening required for new market openers (> 28%) and for advanced market openers (> 38%)	I
7 April 2003	Publication of the second Benchmarking report including new member states	Mo
26 June 2003	Publication of Directive 2003/55/EC EC of the European Parliament and Council concerning common rules for the internal market in natural gas and repealing Directive 98/30/EC	L
24-25 September 2003	Seventh Madrid Forum	Me
11 November 2003	Commission decision on establishing the European Regulators Group for Electricity and Gas (ERGEG)	Inst.
1 March 2004	Publication of the third Benchmarking report	Mo
26 April 2004	Publication of Directive 2004/67/EC of the European Parliament and Council concerning measures to safeguard security of natural gas supply	L

Date	Event	Category*
17-18 June 2004	European Council meeting discusses next regulatory steps (applicability of Regulation 1775)	Me
1 July 2004	Implementation deadline for the provisions prescribed by Directive 2003/55/EC (Art. 33 (1))	I
8-9 July 2004	Eighth Madrid Forum	Me
3 December 2004	Ninth Madrid Forum	Me
5 January 2005	Publication of the fourth Benchmarking report	Mo
10 March 2005	DG Competition announces energy sector investigation and second phase of infringement procedure begun (16 March) in the context of the second Gas directive	Mo
15-16 September 2005	10th Madrid Forum	Me
28 September 2005	Publication of Regulation (EC) No 1775/2005 EC of the European Parliament and Council on conditions for access to the natural gas transmission networks	L
15 November 2005	Publication of the report on progress in creating the internal gas and electricity market (fifth Benchmarking report)	Mo
16 February 2006	Presentation of the preliminary results of the energy sector inquiry by DG COMP	Mo
8 March 2006	Publication of the Green paper. “A European Strategy for Sustainable, Competitive and Secure Energy”	S
14 March 2006	Extraordinary Energy Council: presentation of the Green Paper, rejection of a common energy regulator, rejection of a common European energy policy.	Me
23-24 March 2006	Council meeting	Me
18-19 May 2006	11th Madrid Forum	Me
19 May 2006	Implementation deadline for Directive 2004/67/EC	I
8 June 2006	Energy Council	Me

Date	Event	Category*
15 November 2006	Initial findings of the energy sector inquiry published by DG COMP and TREN	Mo
29 November 2006	Meeting of the joint working group of the MF	Me/Inst
11-12 December 2006	Energy Council without any energy related outcomes	M
1 January 2007	Regulation 1775 including Guidelines for Third Party Access comes into force	I
10 January 2007	Publication of the final results of the energy sector inquiry, Strategic European Energy Review, and the energy package	S/Mo
15-16 February 2007	Energy Council rejects ownership unbundling and common European energy regulator	Me
8-9 March 2007	European Spring Council adopts the energy Action Plan, but confirms rejection of ownership unbundling and a common energy regulator	Me
1 July 2007	Deadline for complete legal market opening. DSO exemption for legal unbundling expires (Directive 2003/55/EC, Art. 33 (2)).	I
19 September 2007	Publication of the proposal for the Third Energy Package	L
3 December 2007	Energy Council debates about the proposed Energy Package in general and the unbundling provisions in particular	Me

* Categories: L=Legislation; Mo=Monitoring; Me=Meeting; I=Implementation; S=Strategy; Inst=Institutionalization

** Please note, only those EU Council meetings have been included which were influential with regard to the reform.

Table 27: European gas market reform, 1998-2007: A road map

	network charges 2000 average (E/MWh) *	network charges 2001/2002 average (E/MWh)	network charges 2001/2002 average (E/MWh)	network charges 2003 average (E/MWh)	network charges 2004 (E/MWh) I4	network charges 2005 (E/MWh) I4
Austria	(2.75) =5**	(2.75)=5	(2.75)=5	2.75=5	2.50=5	(2.50)=5
Belgium	(1.50)=10	1.50=10	1.50=10	1.25=10	2.00=10	2.00=10
Germany	(4.75)=0	4.75=0	4.75=0	2.25=5	2.50=5	(2.50)=5
Denmark	(2.50)=5	2.00=10	2.00=10	2.25=5	2.00=10	4.00=0
Spain	(2.25)=5	2.25=5	2.25=5	2.00=10	2.50=5	3.00=5
France	(3.50)=0	3.50=0	3.50=0	2.25=5	1.00=10	5.00=0
Ireland	(2.00)=10	2.00=10	2.00=10	4.25=0	4.50=0	(4.50)=0
Italy	(3.00)=5	3.00=5	3.00=5	2.50=5	2.50=5	2.00=10
Luxembourg	(1.00)=10	1.00=10	1.00=10	1.00=10	1.00=10	1.00=10
Netherlands	(0.75)=10	0.75=10	0.75=10	1.00=10	1.00=10	(1.00)=10
Sweden	(3.50)=0	3.50=0	3.50=0	5.50=0	5.00=0	(5,00)=0
United Kingdom	(2.25)=5	2.25=5	2.25=5	2.25=5	2.50=5	2.00=10

* Euros per Mega Watt hour. Further information concerning source and definition of categories for large users (I4), please find in section 8.2.

** Values in brackets are missing values. The first decimal number expresses the tariff and the second number after the equal refers to the scaling measure.

Table 28: Tariffs between 2001 - 2005

	Ratio staff b1	Ratio staff b2.1	Ratio staff b2.2	Ratio staff b3	Ratio staff b4	Ratio staff b5
Austria	.18 (0) *	.15 (0)	.15 (0)	.11 (0)	.10 (0)	.10 (0)
Belgium	.33 (0)	.20 (0)	.20 (0)	.14 (0)	.21 (0)	.21 (0)
Germany	. (0)	. (0)	. (0)	. (0)	. (0)	.66 (10)
Denmark	.15 (0)	.15 (0)	.15 (0)	.18 (0)	.12 (0)	.14 (0)
Spain	.11 (0)	.10 (0)	.10 (0)	.08 (0)	.11 (0)	.11 (0)
France	.54 (5)	.44 (5)	.44 (5)	.37 (5)	.29 (0)	.29 (0)
Ireland	.13 (0)	.11 (0)	.11 (0)	.09 (0)	.08 (0)	.07 (0)
Italy	.92 (10)	.67 (10)	.67 (10)	.56 (5)	.61 (5)	.57 (5)
Luxembourg	.54 (5)	.27 (0)	.27 (0)	.27 (0)	.22 (0)	.15 (0)
Netherlands	1.05 (10)	.63 (10)	.63 (5)	.63 (5)	.53 (5)	.53 (5)
Sweden	.02 (0)	.02 (0)	.02 (0)	.02 (0)	.01 (0)	.01 (0)
United Kingdom	.26 (0)	.27 (0)	.27 (0)	.29 (0)	.30 (0)	.29 (0)

* Numbers in bracket refer to the scoring values (see section 8.11.6).

Table 29: Data and scoring of ratio market size/staff (Indicator 14)[158]

	Ratio budget b1	Ratio budget b2.1	Ratio budget b2.2	Ratio budget b3	Ratio budget b4	Ratio budget b51
Austria	.93 (0)*	.73 (0)	.73 (0)	.82 (0)	.79 (0)	.70 (0)
Belgium	1.42 (5)	.89 (0)	.89 (0)	.79 (0)	1.17 (5)	1.19 (5)
Germany	.00 (0)	.00 (0)	.00 (0)	. (0)	. (0)	. (0)
Denmark	1.78 (5)	1.48 (5)	1.48 (5)	1.78 (5)	1.11 (5)	1.20 (5)
Spain	.91 (0)	.80 (0)	.80 (0)	.72 (0)	.87 (0)	.87 (0)
France	3.86 (10)	3.90 (10)	3.90 (10)	2.93 (10)	2.54 (10)	2.26 (10)
Ireland	.69 (0)	.57 (0)	.57 (0)	.34 (0)	.48 (0)	.35 (0)
Italy	3.22 (10)	3.22 (10)	3.22 (10)	3.12 (10)	2.07 (10)	2.48 (10)
Luxembourg	. (0)	. (0)	. (0)	1.80 (5)	2.45 (10)	2.45 (10)
Netherlands	8.68 (10)	5.79 (10)	5.79 (10)	4.96 (10)	4.08 (10)	4.96 (10)
Sweden	.21 (0)	.23 (0)	.23 (0)	.23 (0)	.20 (0)	.09 (0)
United Kingdom	.85 (0)	1.51 (5)	1.51 (5)	1.53 (5)	1.68 (5)	1.71 (5)

* Numbers in bracket refer to the scoring values (see section 8.11.7).

Table 30: Data and scoring of ratio market size/budget (Indicator 15)[159]

Questionnaire

Q1. Which allocation method has been applied in the year 2001?
- ☐ auction
- ☐ first come first served (fcfs)
- ☐ others
- 4 planned
- 5 _____

Q2. Have there been 'use-it-or-lose-it' capacity agreements in 2001?
- ☐ yes
- ☐ short-term 'use-it-or-lose-it' option
- ☐ partial "use-it-or-lose-it' option
- 6 planned
- 7 no _____

Q3. Has a gas release programme been put in place in 2001?
☐ Yes ☐ No

Q4. In the European Commissions process of benchmarking the implementation of the gas market reform the Indicator "TPA storage" has only been assessed in 2002.

Was there Third Party Access to storage available in 2001, 2003, 2004 and 2005?

4.1 In 2001	☐ Yes	☐ No
4.2 In 2003	☐ Yes	☐ No
4.3 In 2004	☐ Yes	☐ No
4.4 In 2005	☐ Yes	☐ No

Q5. Which institution/authority decided the capacity allocation rule for the gas market?

5.1 In 2001 the capacity allocation was decided by
- ☐ Regulator
- ☐ Regulator/Transmission Operator
- ☐ Transmission Operator

5.2 In 2002 the capacity allocation was decided by
☐ Regulator
☐ Regulator/Transmission Operator
☐ Transmission Operator

5.3 In 2003 the capacity allocation was decided by
☐ Regulator
☐ Regulator/Transmission Operator
☐ Transmission Operator

5.4 In 2005 the capacity allocation was decided by
☐ Regulator
☐ Regulator/Transmission Operator
☐ Transmission Operator

Q6.1 Who was in charge for the dispute settlement in 2004?
☐ Regulator responsible
☐ Ministry plus regulator responsible
☐ Minister
☐ Regulator/regional government
☐ Competition authority
☐ Hybrid
8 Not regulated/no regulator

Q6.2 Who was in charge for the dispute settlement in 2005?
☐ Regulator responsible
☐ Ministry plus regulator responsible
☐ Minister
☐ Regulator/regional government
☐ Competition authority
☐ Hybrid
☐ Not regulated/no regulator

Q7.1 How much staff did the national regulator have in 2004?
☐ <30 ☐ 30-80 ☐ >80

Q7.2. How much staff did the national regulator have in 2005?
☐ <30 ☐ 30-80 ☐ >80

Q8.1 How much was the budget of the national regulator in 2004? (in Euros)
☐ <10 Million Euros ☐ 10-25 Million Euros
☐ >25 Million Euros

Q8.2 How much was the budget of the national regulator in 2005? (in Euros)
☐ <10 Million Euros ☐ 10-25 Million Euros
☐ >25 Million Euros

Q9. Who decided the network access conditions in 2004?
☐ Regulator responsible
☐ Ministry plus regulator responsible
☐ Minister
☐ Regulator/regional government
☐ Hybrid
☐ Not regulated

Q9.1 Who decided the network access conditions in 2005?
☐ Regulator responsible
☐ Ministry plus regulator responsible
☐ Minister
☐ Regulator/regional government
☐ Hybrid
☐ Not regulated

Q10.1 In which mode was Third Party access regulated in 2004?
☐ ex ante
☐ ex post
☐ negotiated Third Party access

Q10.2 In which mode was Third Party access regulated in 2005?
☐ ex ante
☐ ex post
☐ negotiated Third Party access

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List of Abbreviations

AC	Administrative costs
bcm	Billion cubic metres
BG	British Gas
CEER	Council of European Energy Regulators
CERA	Cambridge Energy Research Associates
CIEP	Clingendael International Energy Programme
CNE	Comisión Nacional de Energía
DFES	Department for Education and Skill
DTe	Directie Toezicht Energie
DTI	Department of Trade and Industry
DSO	Distribution system operator
DG COMP	Directorate-General for Competition
DG TREN	Directorate-General for Energy and Transport
EBN	Energie Beheer Nederland B. V. (EBN)
EC	European Commission
ECIC	International Federation of Industrial Energy Consumers
ECJ	European Court of Justice
EEC	European Economic Community
EFET	European Federation of Energy Traders
EIUG	Energy Intensive Users Group
ERGEG	European Regulators Group for Electricity and Gas
EU	European Union
EP	European Parliament
EZ	Ministerie van Economische Zaken

Fcfs	First come first served
GGPSSO	Guidelines for Good Practice for Gas Storage System Operators
GP	Green Paper
GRI	Gas Regional Initiative
GTE	Gas Transmission Europe
GTS	Gas Transport Services
HubCo	North West European Hub Service Company
I&I Act	Intervention and Implementation Act
IEA	International Energy Agency
IRA	Independent regulatory agencies
LNG	Liquefied natural gas
Mtoe	Million tonnes of oil equivalent
MF	Madrid Forum
MWh	Mega Watt hours
NAM	Nederlandse Aardolie Maatschappij
NBP	National Balancing Point
NIE	New Institutional Economics
NIT	New Institutional Theory
NMa	Nederlandse Mededingingsauthoriteit
NRA	National Regulatory Authorities
nTPA	Negotiated Third Party Access
Ofgas	Office of Gas Supply
Ofgem	Office of Gas and Electricity Markets
OTC	Over-the-counter
OCM	On-the-day commodity market
OECD	Organisation for Economic Co-operation and Development
OMC	Open method coordination
PA	Principal agent
PSV	Punto di Scambio Virtuale
RAB	Regulatory asset base
REM	Regional Energy Market
RGI	Regional Gas Initiative
R/P-ratio	Reserve/production-ratio
rTPA	Regulated third party access
SEER	Strategic European Energy Review
SLC	Standard licensing conditions
SOTEG	Société de Transport de Gaz
TCE	Transaction cost economics
TOP	Take-or-pay contract
TPA	Third party access

TSO	Transmission system operator
TTF	Title Transfer Facilities
UIOLI	Use it or lose it
UK	United Kingdom
VROM	Ministry of Housing, Spatial Planning and Environment
WACC	Weighted Average Cost of Capital