PETER JAMES BENTLEY

ACADEMIC WORK FROM A COMPARATIVE PERSPECTIVE

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Cross-national differences in research orientation, productivity and
time use

DISSERTATION

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on the authority of the rector magnificus,
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Dedicated to the memory of Luke Melfi, my best friend.

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Preface

It may be a cliché to describe a PhD as a “journey”, but it is nonetheless an apt description in this case. Publishing this dissertation at the University of Twente is a clear endpoint to the PhD journey, but the precise starting point is indeterminate in time and place. From 2007 to 2009, I travelled between the Universities of Oslo, Tampere and Aveiro, as part of an Erasmus Mundus European Master in Higher Education. It was during this time that I became interested in international comparative research on the academic profession. It was also when I met the people who would help me develop my skills as a researcher, as well as provide me with the financial support for my PhD and academic career.

In 2009, I was assigned Svein Kyvik as my master thesis supervisor at the University of Oslo. It is no exaggeration to say that Svein’s enthusiastic support during this time was the foundation for the PhD. Many senior researchers have a sharp eye for critique and an ability to foresee potential problems, but it is rare to find one who follows this up with countless hours of training, support and development. Svein has been a mentor and confidant. I am truly fortunate for his support, as well as the broader support of the researchers at the Nordic Institute for Studies in Innovation, Research and Education (NIFU).

In 2008, a visiting academic from Australia, Leo Goedegebuure, taught into the master program in Tampere. I did not realise at the time how my serendipitous meeting with a Dutch academic living in Australia could ultimately shape what would follow. In 2011, Leo offered me the opportunity to work as a research fellow at the LH Martin Institute, The University of Melbourne. He also offered a pathway to a PhD. Academic careers are precarious at the early stages, but I have been provided the opportunity to flourish. Leo has been invaluable to the PhD process and to my career, always having my best interests at heart.

It has been a privilege to have been enrolled for my PhD at the Center for Higher Education Policy Studies (CHEPS) at The University of Twente. I would like to thank Don Westerheijden and Frans van Vught for being my promoters, and for their encouragement and clarity during the PhD process. Higher education researchers are often scattered across different disciplines and departments, rarely achieving anything approaching a critical mass. This can create difficulties developing collaborations at a local level, but also opportunities for international collaborations. CHEPS is a powerful example of the strength of international networks, with its well-connected and world renowned staff and alumni.

International comparative research cannot be done without the support of other researchers, at least not for a PhD candidate. I am very thankful to the many researchers involved in the Changing Academic Profession project who generously shared their country data. I would also like to thank Peter Maassen for introducing me to the field of higher education studies and hosting me as a visiting researcher in Oslo, Magnus Gulbrandsen for his contributions as co-author, and Lynn Meek for his willingness to provide his expert opinion whenever asked. I am also grateful to the anonymous peer reviewers who helped improve my research articles.

Finally, I would like to acknowledge the support of my family. To my parents, thank you for the unconditional support and love. As a father, I can only hope to replicate this for my own children. To Katri and my two beautiful children, thank you for your love and patience. You are a constant reminder of what is most important in life. You helped me place my PhD and work into proper perspective.

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1. Academic work from a comparative perspective

1.1 Introduction

The research university is a pivotal institution in the knowledge society. Through its teaching, research and service missions, research universities hold a unique position as producers of knowledge, trainers of knowledge workers and transmitters of knowledge to economic and societal stakeholders (P. Scott, 2006). The importance of the academic profession has been reiterated many times because, not only are academics central to the functioning of the university, they are intricately connected to other knowledge-based professions as the educator and selector of new entrants. In this way, the academic profession may be understood as the “key profession” (Perkin, 1987). However, understanding who is part of the academic profession and what it is that academics do, is not as straightforward as one might first assume. Unlike other professions, the academic profession is not licenced and has no official codes of practice. It is often presumed to be the case, but one does not need a PhD to work within the academy. Neither is mutual engagement in teaching and research a requisite characteristic of academic work. Many academics engage only in research, others only in teaching. Academics may share a common employer, but their commitment is strongly attached to their academic discipline (Clark, 1983), each of which has its own form of communication and knowledge “territory” (Becher, 1989).

The elements that define the academic profession and unite it around the world are largely symbolic norms and beliefs (Henkel, 2005a). Merton’s (1973) norms of science articulated four guidelines for professional behaviours within academe which have continued to define academic identity: universalism, communality, disinterestedness and organized scepticism. Autonomy and integrity are central to academic work. Academics have traditionally been expected to pursue their research and teaching without external

influence, organising themselves through collegial self-governance (Clark, 1983, p. 91). Clearly such autonomy does not lend itself well to managerial supervision or administrative accountability. Universities are no longer “ivory towers”. Most public institutions are expected to teach more students of previously underrepresented backgrounds and conduct research and service activities of value to their stakeholders. Academics continue to identify themselves as independent professionals, but many lament the perceived decline in collegiality and increased managerial influence, viewing themselves as “managed professionals” (Rhoades, 1998) stuck “between the Ivory Tower and the academic assembly line” (Barry, Chandler, & Clark, 2001). With declining public resources to pay for the increased expectations of universities, academic productivity is an important topic of research (Bland, Center, Finstad, Risbey, & Staples, 2005; K. A. Meyer, 1998) and policy relevance (Bill & Melinda Gates Foundation, 2015; Lumina Foundation, 2011; White House, 2013).

The purpose of this dissertation is to examine how individual academics differ across and within countries on three core elements of their work: time use, research productivity and research orientation. These work activities capture the traditional scholarly activities of discovery, teaching, integration and application (Boyer, 1997). They are examined in six journal articles, which are presented as separate chapters in this dissertation. Five articles are international comparative (Bentley, 2015; Bentley, Gulbrandsen, & Kyvik, 2015; Bentley & Kyvik, 2011, 2012, 2013) and one focuses exclusively on Australia cross-sectionally over time (Bentley, 2012). The data used in these analyses comes from the Changing Academic Profession (CAP) project, an international survey of the academic profession conducted in 2007–08.

The CAP survey contains data on academic staff in 18 countries and the special administrative region of Hong Kong. However, the number of countries included in the international comparative articles ranges from 11 to 15. Portugal and South Africa were excluded from all articles due to data concerns. Other restrictions were due to a combination of timing of data release, ambiguity on certain items and

small sample sizes when restricted to certain sub-sets. These restrictions were not consistent across articles because individual articles were written over a five year period (2010 to 2014), each addressing a different topic and requiring unique sample restrictions. For example, data from the Netherlands and the institutional categories in Korea were either unavailable or unclear until the final articles of the dissertation. Mexico was not included in the two articles investigating working time patterns due to incomplete data on this specific item, but Mexico was included in all other international articles. Respondents were generally restricted to those with full-time employment, involving teaching and research, and within doctoral-granting universities. This led to insufficient sample sizes in some countries (e.g. Argentina, Brazil, Japan, and Malaysia). However, when investigating orientation towards basic and applied research (rather than research output or time use), full-time status was not a relevant restriction and sample sizes were sufficient for these countries to be included. Therefore, the included countries varied across articles. The reasons and the consequences of these restrictions for drawing generalisations are discussed in this introductory essay as well as in the separate articles.

Two research questions are recurrent throughout the dissertation. Firstly, to what extent do academics in research universities differ in their work habits and outputs? Whether addressing these attributes broadly (e.g. time use or publishing) or specifically (e.g. research time, scientific publishing), the descriptive statistics invariably indicate (statistically) significant and meaningful variations between individual academics both within and between countries. This underpins the subsequent research question which asks: how may we account for such variation? When addressing differences in individual work habits a recurring theoretical perspective is the pressure of internal differentiation along axes of discipline, institution, internal hierarchy and country (Enders, 2007). These axes both divide the academic profession into different segments, or even different “professions”, as well as offering bases for academic identity that span geographical and institutional boundaries. These four axes will be discussed in detail in this essay. A second theoretical perspective is

sociological institutional theory and related theories for international convergence across countries or regions and within the academic profession (DiMaggio & Powell, 1983; Gibbons et al., 1994; J. W. Meyer, Ramirez, Frank, & Schofer, 2007; Nowotny, Scott, & Gibbons, 2003).

‘Change’ is explicit in the title of the CAP project and the two main theoretical perspectives – differentiation and convergence – are dynamic change processes. Differentiation is a process towards greater diversity, while convergence describes change in opposite direction towards increased similarity (or decreased diversity). Differentiation ought to be distinguished from the concept of diversity because the latter is static and refers only to the variety of entities at a given point in time (Huisman, 1996). For example, a higher education system may contain considerable diversity at a point in time but this says nothing about any changes in the degree of diversity since an earlier point in time. Likewise, the academic profession in a particular country or institutional type may consist of a diverse mix of persons engaged in teaching-only, research-only or both activities (or neither), but this does not imply that the profession is undergoing differentiation. As a point-in-time cross-sectional survey of the academic profession, the CAP data can only provide a limited indication of change processes, such as perceptions of change from individuals based on recollections of prior times. Even when compared with earlier cross-sectional surveys, trends are not readily apparent because different respondents are part of each survey and sampling procedures also vary. In this way, the CAP data cannot prove the claims that universities and the academic profession have converged towards a common model or is undergoing differentiation. However, the CAP data can be used to examine point-in-time diversity in the academic profession and test certain claims of convergence.

Universal theories assume all universities or professors are responding to similar (often global) patterns. These theories are useful for empirical researchers because the range of possible falsifiers is much larger than singular or particular theories (F. Van Vught, 1996). For

example, Myer and colleagues (2007) refer to institutional theory when claiming professors “enjoy global and practically universal status (analogous to rabbis or priests)...” (p. 188). Likewise, Nowotny and colleagues (2003) claim that the rise of Mode 2 research has meant “... the research that is variously described as ‘pure’, ‘blue-skies’, fundamental, or disinterested, is now a minority preoccupation – even in universities” (p. 184). These universalistic claims, as well as other context-specific theories (e.g. for factors associated with publishing or time use) can be held up to empirical scrutiny with the CAP data because one can examine the degree to which the academic work attributes differ across and within countries for individual academics. In doing so, it allows us to test whether the convergence process is complete (i.e. few meaningful differences across countries, institutions or individuals) or applicable only within certain contexts (i.e. few differences between academics in countries and institutions of particular type, history or development).

An important point which has been drawn out from the CAP data in this dissertation is that analyses of different segments of the academic profession often yield different results. Fundamentally, this is the question over how to define the academic profession as the unit of analysis and how to sub-divide it. If a study defined the academic profession narrowly, such as male professors in research intensive universities, this would likely increase the homogeneity of results. Due to the lack of complete population data, particularly outside full-time staff in research intensive universities, contemporary studies are often at pains to point out their limitations. Nevertheless, the results of these studies are often used by others, or even the authors themselves, to draw generalisations which can be easily misunderstood or misrepresented to reflect the entire academic profession. The opportunity for empirical researchers is to test whether the results change when the unit of analysis changes (e.g. full-time versus part-time, men versus women, discipline, age, motivation, etc.), thereby identifying which axes of differentiation are relevant for understanding elements of academic work. Unscrupulous researchers could feasibly reverse-engineer the sample selection to suit their preconceived position, but more commonly researchers are simply less

likely to question results which fit their expectations (i.e. confirmation bias). As argued by Clark (1987), there may be good reasons to believe certain categories of academics share much in common, but these similarities "...ought to be found, not assumed. They ought to be induced from empirical observation, not deduced from traditional images and statements of personal preference." (p. 3). Though not stated explicitly by Clark, the logical extension is that if "traditional images" or universal theories prove inconsistent with the empirical reality, then our theoretical understandings ought to be replaced by different, better theories (F. Van Vught, 1996, p. 48).

It is not feasible or even appropriate to examine all possible differentiators or subsections of the academic profession in order to check for statistically significant differences in the object of inquiry. The differentiators ideally should be drawn from a solid theoretical framework containing generic elements generalisable to all studies of the academic profession, as well as specific elements based on the object of inquiry (e.g. the academic activity of interest). Enders (2007) outlines four important "axes of differentiation": discipline, sector, internal ranking system, and national differences. Discipline and sector (or institutional type) are the primary axes which have been at the forefront of the literature on academic identity (Becher, 1989, 1994; Becher & Trowler, 2001; Clark, 1987a, 1987b, 1997; Henkel, 2005a, 2005b, 2009; Musselin & Becquet, 2008). The internal ranking system refers to how differences in status, rewards and power, can translate into different academic careers and work attributes. Although the academic profession has always contained a combination of unique national features and international dimensions, the international (or global) dimension has arguably increased in importance as universities have become more strongly embedded in a global market for students and staff (Marginson, 2000). However, one should not assume that any given academic activity operates uniformly across national boundaries even within comparable disciplines and academic ranks. The market for academic employment retains national idiosyncrasies which shape how academics are recruited, their conditions of employment and expected work roles (Musselin, 2009).

The remainder of this essay is structured in two parts. Part I is a selective literature review, specifically focussing on how the academic profession is defined. Research on the academic profession has shifted primarily from characterising the profession as differentiated by disciplinary and institutional identity, to a profession fragmented by a complex mix of internal and international axes of differentiation. Part II describes the empirical research of this dissertation. This includes summaries of the data and methodological choices, and the main findings from the six articles. The essay concludes with reflections and recommendations for future comparative research.

1.2 The academic profession and the axes of differentiation

[A professor] may be a secondary school teacher, an instructor in a barbering college or a business school, a quack 'psychologist', a circus barker, or even a piano player in a house of prostitution. (Wilson, 1942, p. 4)

When Logan Wilson conducted the first comprehensive analysis of the American academic profession in the early 1940s in his book *The Academic Man*, he went to great lengths to define his unit of analysis. The population of professors seemingly included a wide variety of people plying their trades in universities and colleges, as well as high schools, circuses and houses of prostitution. Wilson believed that meaningful generalizations could only be drawn from sufficiently uniform staff and institutions. Therefore, he chose to limit his analysis to academics with greatest influence on the science system, namely men engaged in research and teaching in the top-30 doctoral granting "major universities". As with all studies of the academic profession, his conclusions were shaped by his definition of the profession. Certainly the people employed in major universities were more homogenous in background than we may find today (as well as the students they taught), but by excluding women and others engaged in teaching and research, his study had an elite bias and did not tell the whole story of the academic profession. In his introduction to the 1995 edition of the

book, Philip Altbach remarked that a better title would have been *The Academic Man in the Top Quarter of American Higher Education*.

Contemporary studies of the academic profession certainly take a different approach towards defining the profession, but they face precisely the same choices over who to include and exclude, and these choices can directly influence the results. No study can adequately capture the academic profession in its entirety because the definition of the profession is ambiguous. Certain elements of the profession appear to be clear and stable. Academics will tend to be employed within universities in the scholarly functions of teaching and research. However, these two core defining characteristics – employer and combined teaching and research functions – are not as clear as one might assume. This is particularly the case in comparative research when the need to use comparable terms, such as “university” or “professor” can lead to the loss of important contextual differences (Teichler, 2014). Even within countries there may be little consistency in their use. In terms of academic work roles, there are certain typologies which have become accepted. The most influential has been Boyer’s (1997) scholarly typology of four overlapping functions: the scholarship of discovery, teaching, integration and application. Regardless of whether the mutual engagement in various scholarly activities is complementary, contradictory, coexistent or a myth for the bulk of the academic profession, it has directly shaped the roles and norms of the profession for a very long time. The idea of the academic profession united by a mutual engagement in teaching and research has deep symbolic roots and remains a quintessential defining characteristic of the profession. However, it also is a vague or flexible concept to implement. Many academics are only notionally engaged in research and publish very little, while for others the teaching role extends only to the supervision of research students.

Beyond the work and employer, the characteristics that unite the academic profession are the beliefs and norms that underpin academic identity (Henkel, 2005a). For example, the culture of the academic profession entails the special privileges of personal autonomy, collegial government, and the “freedom of research” and “the

freedom of teaching” (Clark 1983, p. 91). In recent years the shared norms and beliefs have come under strain, but the shared academic values of academic freedom and integrity continue to define the academic community (Henkel, 2009). These values are often traced back to Merton’s (1973) earlier mentioned norms of science. As stated, these norms set out four guidelines for professional behaviours: universalism, communality, disinterestedness and organized scepticism. Universalism is the belief that research findings ought to be assessed, and scientific careers rewarded, based on merit. Disinterestedness refers to the individual-level motivation to advance knowledge for its own sake, rather than for its esteem or financial reward. Communalism prescribes that research results ought to be shared freely within the scientific community and not kept secret. Organized scepticism contends that research must undergo critical evaluation by the scientific community before becoming accepted, and that this norm ought to be internalised through self-criticism. Each of these preferred behaviours are rather generic and can be interpreted in different ways, but they form part of an informal code of practice. This underpins a process of normative conformity within the academic profession which is reinforced by one’s institution, one’s colleagues and oneself (Braxton, 1989, p. 442; DiMaggio & Powell, 1983).

The idea that professionals ought to be self-regulating and motivated by disinterestedness can be found in the early sociological work on the study of professions. Professions were seen to have existed due to growth in specialisation within the economy and “asymmetry of expertise” between the clients and professionals (Abbott, 1988, p. 5). Professionals gained authority within their field based on superior “functionally specific technical competence” (Parsons, 1939). Clients benefited from submitting themselves to the advice and authority of professionals, but they also required protection from malpractice. According to Parsons (1968, in Sharma, 1997), this protection came from collegially-organised structures, such as associations and licensed professions. Professionals were required to adhere to codes of practice which were enforced through normative peer review. Although there was always the temptation to profit from their high level of expertise, professionals were expected to be motivated by altruism and

disinterestedness: "The professional man is not thought of as engaged in the pursuit of his personal profit, but in performing services to his patients or clients, or to impersonal values like the advancement of science.... altruistically serving the interests of others regardless of his own." (Parsons 1939, p. 458). Whereas the "business man" or "economic man" working outside professional structures was free to egoistically pursue self-interest, the professional man was above these "sordid considerations" and devoted their life to service of others (p. 463). Not surprisingly, subsequent theorists questioned the altruism of professional collegial structures and argued that professionalization actually furthered the self-interested intentions of professionals by providing monopolistic control over areas of intellectual or social concern (Sharma, 1997).

Although no direct references were made to the academic profession, and the profession itself does not have formalised codes of practice, clear similarities can be drawn with the idealized histories of universities. Universities have been expected to operate at arm's length from its funders or clients (students, government, society), follow collegial decision making and disciplinary-based peer-review, and adhere to professional standards for teaching and research. Merton's (1973) norms of science clearly imply that academics ought to be motivated by their commitment to expertise and knowledge, rather than explicit self-interest. Whether or not academics on the whole behave in such altruistic ways is debatable. However, if the academic profession is expected to place society's interests above their own, such a system of professionalization makes them reliant on public support and funding. A profession which is reliant predominantly on public funding is inherently susceptible to the changing demands from the public, yet the non-specialist public can only be poorly informed about their professional duties due to their lack of expertise.

For a long time academics have contended that their profession has been undervalued and in "crisis". In 1932, the outgoing chairman of the American Association of University Professors lamented that the academic profession was misunderstood by the public, underappreciated and underpaid (Patterson, 1932). Academics enjoyed

intellectual stimulus, relative security and long vacations, but the profession was apparently failing to attract the most capable and qualified. A doubling in student enrolments since the end of World War I led to a “deterioration in undergraduate intellectual competence” (p. 9) as well as an oversupply of academic labour. According to Patterson, the expanding number of professors meant the profession had lost its prestige and “monopoly value” (p. 12). Similar concerns were reiterated in the following decades as salary growth in other professions appeared to outstrip academic salaries. Teaching workloads also increased with the “flood” of returned servicemen post World War II (general infantrymen, or GIs) (Kyte, 1947; Pringle, 1947). Kyte (1947) made the familiar warning that without increased public financial support (of which he was optimistic about receiving) the economic pressures of the post-war era would lead many more academics to succumb to the temptations of employment within private enterprise. The rhetoric of universities facing a massive influx of underprepared students and a declining attractiveness of academic careers is similar to contemporary concerns about the extension of higher education to previously underrepresented groups (i.e. massification), and the loss of privileges for those who teach the bulk of this cohort. As the mission of the public university changes, so too must the academic profession.

The crisis narrative is pertinent in the titles of many articles on the academic profession (Altbach, 1980, 1997; Altbach & Finkelstein, 1997; Nelson, 1997). Others also refer to similar concerns about the declining attractiveness of the profession (Coates & Goedegebuure, 2012; Huisman, Weert, & Bartelse, 2002; Marginson, 2000). However, the contemporary crisis is often linked to the increased diversification of the profession at an institutional and individual level, particularly for those engaged primarily in teaching and for early career academics (Altbach & Finkelstein, 1997, p. 16). The difficulty with these broad claims of crisis and decline are that if the academic profession is increasingly differentiated or stratified along certain lines, it is quite clear that not all members of the academic profession are impacted equally by change processes. It is quite plausible that certain segments continue to enjoy great privileges, attract high quality candidates and

are not in crisis. For example, Altbach (1997) claims that full-time American professors in the late 1990s remained “largely insulated from the broad changes taking place in higher education... The majority of tenured faculty have been unaffected by the deteriorating academic labor market” (p. 114). Yet to the casual reader scanning the titles, sub-headings or conclusions of these publications, one could be forgiven for misinterpreting the crisis as applying equally to all members of the profession. That is not to say that Altbach’s conclusions or similar ones drawn by other scholars were biased or inappropriate – the shrinking core of the academic profession within the secure segments are largely the exceptions to the rule – but it does illustrate the importance of clearly defining the unit of analysis and identifying the key lines of differentiation.

There is little doubt that the expansion in the size and scope of higher education systems around the world has entailed diversification of the academic profession, as well as institutions engaged in teaching and research (Enders & Musselin, 2008). Academics may be the heart and soul of higher education, but as pointedly described by Enders (2007) “they are not one heart and one soul” (p. 9). The conditions for academic men may have deteriorated, but this does not imply that the academic profession is in decline. The academic profession contains a wide range of professionals engaged in different duties with expertise derived from different areas of specialist knowledge. Some are insulated from changes, others even benefit from them. According to Clark (1997), understanding the academic profession “begins with a willingness to pursue diversity” (p. 23). Of this diversity, the primary axes are the institution and the discipline.

1.2.1 The institution and the discipline – the primary matrix of differentiation

Clark’s 1983 book, *The Higher Education System: Academic Organization in Cross-National Perspective*, was the first to comprehensively and systematically detail how higher education is organised and governed. Clark (1983) paid considerable attention to the role of the academic profession, dedicating the first part of the book to three chapters

addressing academic work, common beliefs, and authority structures. He offered two primary axes of differentiation which have endured and been built upon over time: discipline and institution. Implicit in the title of the book, Clark also viewed the academic profession from a cross-national perspective. He understood higher education systems primarily as national entities, with six levels of authority extending from the department (Level 1) to the national government (Level 6).

When Clark (1987a) turned his primary attention to the American academic profession in *The Academic Life. Small Worlds, Different Worlds*, he reiterated the point that the profession was characterised by polymorphism and differentiation along these two primary axes of discipline and institution. This “double differentiation” meant that the idea of a single entity forming “the university” or “the academic man” was not useful (p. xxii). He described the academic profession as a “profession of professions” (p. 271), a phrase and theme later extended upon by Enders (2007). To Clark, the American academic profession was uncontrolled, boundary-less, diffuse and continually stretched to include all manners of work for all people (p. 260). The “growing unboundedness of this maverick profession... [made] the simple matter of counting the number of academics... a tortured exercise in arbitrary, ambiguous definitions” (p. 271). Claims regarding the academic profession’s size and situation needed to be carefully defined. Unlike Wilson’s (1942) earlier study, women, teaching specialists and those outside the top research universities had become a group too large and important to feasibly ignore on the basis of drawing meaningful generalisations from uniform populations. Clark simplified the complexity by emphasising the importance of institution and discipline, but in doing so rendered other potential lines of differentiation as secondary. Therefore, in Clark’s view the academic profession could be examined in each country as a cross-tabulated matrix for discipline and institution (Locke, 2010, p. 253). This matrix is presented in Figure 1-1 below.

Figure 1-1. Author's interpretation of Clark's institutional-disciplinary matrix

The importance of discipline for academic work and identity has received considerable attention (Becher, 1989, 1994; Becher & Trowler, 2001; Henkel, 2005a, 2005b; Musselin & Becquet, 2008). The study of any academic attribute or duty (e.g. teaching, research, service) must contend with the diversity between academics of different disciplinary backgrounds. The primary academic duties are strongly self-referenced by disciplinary standards via professional associations, accredited curriculum and academic peer-review. These disciplinary ties span geographical and institutional boundaries, linking experts within an "invisible college" (de Solla Price & Beaver, 1966). The strength of collective identity within disciplines is likened to "tribes and territories" (Becher, 1989). Clark (1987a) used the metaphor "small worlds" and "different worlds" to describe disciplinary fragmentation. Perhaps more reflective of the times in the 1980s, Clark viewed universities as divided into specialised disciplinary structures of roughly equal status and power. Clark characterised work arrangements as "unusually flat and loosely joined in the academic world... in which there are many cells of specialization side by side and loosely connected at the operating level..." (1983, p. 17). No single discipline dominated in the system and all disciplines were roughly equal (p. 36). Therefore, the horizontal axis in Figure 1-1 could genuinely be interpreted as horizontal in power, influence and status.

By contrast, institutions were understood by Clark to be organized vertically into "tiers" and "sectors". Tiers referred to level of task (e.g. undergraduate colleges, comprehensive universities, graduate

schools), while sector referred to the hierarchical arrangement of institutions by type (universities, polytechnics, specialised colleges, etc.) and status. However, Clark (1987a) later used the term “tier” more loosely, describing American universities as first-tier, second-tier, and so on, seemingly irrespective of whether they were graduate schools or comprehensive universities. Countries differ in these arrangements, but higher tier institutions tend to have both a greater dedication to teaching advanced levels of knowledge, as well as greater prestige through their research performance. This somewhat insulates them from mass education demands, but the extent varies (Trow, 2007). Disciplinary and institutional identity were viewed by Clark as mutually reinforcing in upper tiers due to greater research engagement, with academics in elite research intensive institutions having great attachment to both their discipline and institution. Nevertheless, disciplinary affiliation trumped institutional commitment: “...give the academic worker the choice of leaving the discipline or the institution and he or she will typically leave the institution” (1983, p. 30). The strength of disciplinary affiliation presumably also implied greater movement of academics between tiers and sectors, compared to disciplines. Therefore, the horizontal borders in Figure 1-1 are represented with broken lines, indicating greater permeability for individual academics across the vertical axis.

The main limitation of Clark’s two-dimensional approach is the relative lack of attention paid to internal dynamics, in particular the hierarchy between disciplines and between junior and senior staff. When describing authority within universities, Clark (1983) believed that universities (like all modern organisations) contained elements of “personal rulership” by superiors over subordinates, as well as more unique forms of “collegial rulership” for matters across departments. The blended form of autocracy and collegiality found commonly in the lower-level departmental “sub-structure” – a version of “guild authority” – allowed masters to control subordinates within their domain and coordinate with others in different domains. Collegiality was presented in a harmonious and patriarchal fashion within departments. Clark rejected the Marxist notions that the guild system created a “capitalist” and “laborer” relationship between

professors/chairs and their junior staff because: "Especially in academia, authority relations were not preempted by the likes of profit-seeking entrepreneurs building factories, hiring wage laborers, and producing for extended markets, even if universities sometimes took on some of these characteristics" (p. 114). Although some higher education systems were coordinated by market forces, the internalisation of these practices did not appear to be a major line of fragmentation within the profession at the time of Clark's writing.

When examining the American academic profession with empirical data in Part II of his 1987 book, Clark (1987a) faced the problem that the two primary axes of differentiation were insufficient to capture the diversity of the profession. He discussed four other dimensions which fragmented the academic profession, but relegated them to "fault lines" in the profession's matrix of careers. These fault lines were: research and teaching engagement; full- and part-time employment; tenured and non-tenured contract; and pure-applied distinctions within professional schools (p. 189). With the exception of the peculiarities of professional schools, the first three fault lines were closely interrelated. Teaching focused positions tended to also be part-time and non-tenured. During the 1970s and 1980s the growth in these positions led to a sizeable proportion of the academic profession looking more like academic labourers than apprentices. Clark variously described these staff as "migrant laborers of academe, gypsy scholars, displaced academics, academic proletariat, marginal academics, disposable dons, freeway scholars" (p. 209). Adding further complexity to the simple two-dimensional matrix, the limited data on the non-traditional faculty suggested these staff were not evenly distributed across institutions or disciplines. They tended to be heavily concentrated in lower status, teaching-focused institutions and within the soft-applied disciplines (p. 39).

If non-tenured and part-time academics were part of the academic profession(s) at all, they certainly did not carry the same status or conditions. Therefore, one could question whether Clark's framework was relevant even during the time of its writing. For example, could one truly know much about the circumstances or "the academic life" of

an academic simply by knowing the institutional type and discipline? Granted, Clark viewed the academic profession as diverse, but it is debateable that academic rank or contract status were minor differentiators. Members of the “academic proletariat” likely shared common experiences with their colleagues in other institutions and across disciplines, but Clark (1987a) retained the view that the American academic career was essentially “a continuous, incremental structure of ranks [that] has become firmly institutionalized” (p. 211). In his view, progression was mostly determined by merit and/or years of service, and in this way, junior and non-tenured academics were not distinct from others, or located within a separate “dead-end” segment. Accordingly, part-timers could be examined as part of the academic profession and not differentiated by their status. However, it is inconsistent to describe such staff as a marginalised proletariat while at the same time denying that the characteristics that define their marginalisation (e.g. lack of tenure, low status, low rank, teaching focus) are only minor characteristics.

Ten years later in a similarly titled journal article “Small Worlds, Different Worlds: The Uniquenesses and Troubles of American Academic Professions”, Clark (1997) reiterated the importance of discipline and institution. He argued that the academic profession as a single entity was merely a stereotype. Academics belonged to a collection of professions, differentiated by an increasingly diverse range of institutions and expanding array of disciplines. He concluded that internal stratification was a major and growing concern, but stopped short of acknowledging internal hierarchy (by rank or contract type) as a “third” primary axis of differentiation. By this stage, one could reasonably criticise Clark for failing to do so because there were clear inconsistencies in his approach. Clark severely criticised those who made broad generalisations for *the* college professor, in particular empirical claims such as: ““On the average, American professors teach eight and a half hours per week”” (p.22-3). But he did not see a problem with drawing generalizations for professors within his two-dimensional matrix. For example, he described teaching loads of the humanities professor in the leading universities as between four to six hours per week (p. 23). While the unit of analysis was appropriately

circumscribed by discipline and institutional type (the humanities professor in a leading university), Clark's need to specify "professor" implied that academic rank was important for teaching loads. Either teaching loads were not generalisable to lower ranks within humanities, or persons outside professorial ranks were not really part of the profession. Therefore, if one was interested in time use of academics more generally (which Clark clearly was), his two-dimensional matrix would be insufficient to capture diversity within departments.

Clark's two-dimensional matrix certainly extended beyond Logan Wilson's claims about the academic man, but parallels can be drawn between Wilson and Clark in how their unit of analysis excluded the new entrants into the profession. For Wilson this was women, for Clark this was part-time staff. The contradictions in Wilson's definition of the academic profession were transparent and obvious. He believed that too many women competing for work lowers the wages and downgrades a profession due to the customs and practices of paying women less for equal work (p. 137). This is inconsistent. If women were doing the same academic work and part of the same occupation, then realistically they were part of the same profession. Clark (1997) clearly did not ignore the role of the non-traditional workforce, but he likewise claimed that "part-timeness" was inextricably linked to a lack of credentials and poor pay, which downgraded the profession overall due to such workers competing with the traditional academic staff (p. 38). Clark excluded part-time staff from both his analyses. They were not part of his theoretical "small worlds". Part-timers were located within the "academic subworlds" and, like women in Wilson's accounts, downgraded the academic profession. Any study which focused exclusively on the "small worlds" could be seen as suffering from an elite bias, even if they include institutions across all tiers, because they fail to account for the role of internal stratification. This is the third axis of differentiation, as argued below.

1.2.2 Internal stratification – A third axis within national systems

Universities and departments are not collegiums where academics share equal power and authority, united through a common purpose. There are elements of partnership, but academic lives are sharply differentiated by internal hierarchy. The collegiate model arguably supported equality and collaborative partnership, but even the purer forms of academic oligarchy (typically attributed to Germany and continental Europe) contained sharp distinctions in autonomy between junior and senior staff. Many countries where universities have been influenced by the American research university's broader participatory departmental structures have experienced an expansion in the part-time, specialised and non-tenurable segments who have little voice in departmental decision making. The outcome is an academic career structure characterised by a hierarchy of appointments of differential status and conditions, even for academics of comparable rank and engaged in similar work. Enders (2007) describes the role of internal hierarchy as the "internal ranking system", including it as a third axis of differentiation. Internal ranking system does not translate directly into academic rank, it more broadly captures how academics differ in status, rewards and power, within their given discipline, institution/sector and country. As argued above, in most cases this justifies examining the role of internal hierarchy and being careful when drawing generalisations across different contexts.

Enders also considers country (or "national differences") to be a fourth important differentiator. It is increasingly difficult to discuss internal stratification without mentioning both how national systems differ, as well as the interaction between national systems and international mobility of academics. However, for now the focus will remain on the internal ranking system and how it differentiates academics within countries, rather than how internationalisation shapes internal hierarchies and the academic profession (which will be discussed in the next section). This assumes that academics belong to separate, national-level labour markets (or professions) which can be analysed separately and contrasted in terms of national-level differences. Therefore, Figure 1-2 presents an (over)simplified version of Enders'

four axes of differentiation by relegating the national dimension as a horizontal differentiator. This is not an accurate representation of Enders' position, but sequentially it is the next step beyond the institutional-disciplinary matrix.

Figure 1-2. Author's simplified interpretation of Enders' four important axes of differentiation: discipline, sector, internal ranking system, and national differences (Enders, 2007)

Two transformations may be found in many countries which tend to increase internal differentiation: more individualised assessment of academic work, and expanded institutional management of issues previously the domain of the academic profession (or regulated by the discipline/academic oligarchy) (Musselin, 2005). The Humboldtian tradition emphasised that education and research coexist at an individual level for all academics. This provided a degree of complexity, autonomy and uniqueness to the organisation of academic work. The decline in this tradition has meant that universities now establish their overarching functions like other organisations by developing an employer/wage earner relationship at the individual level (Musselin, 2005). Managerial practices tend to deconstruct and compartmentalize academic work into specialised functions and challenge traditional power structures by distributing access to time and resources unevenly based on perceived merit or managerial priority/strategy (as opposed to collegial practices emphasising unity and equity). This sort of specialisation segments the permanent academic profession (Musselin, 2007, pp. 4-5).

It is important to recognise the difference between labour market segmentation and the division of labour. Division of labour refers to the functional separation of tasks, whereas segmentation refers to a systematic devaluing of certain types of workers (Bauder, 2006, p. 235). Labour market segmentation theory suggests that workers in the primary segment gain stability, high wages and superior benefits, whilst those in the secondary segment experience instability and fewer benefits. The core principle is that labour market segments are separate, with minimal competition or mobility between segments. This is in contrast to neo-classical analyses of labour markets which broadly assume that individual workers can choose among a range of job options and receive rewards based on their productivity or human capital endowments (e.g. education, ability, motivation) (Leontaridi, 1998). From an academic labour market perspective, the shift from being multi-task to specialised workers represents a division of labour, but the segmentation of labour occurs when academics doing certain types of work are not rewarded equally and cannot progress into the better paid segments.

Specialisation and segmentation are related in the sense that scientific management techniques can break complex tasks into components and lead to deskilling (Braverman, 1974). For example, Macfarlane (2011) argues that the dissolution of the teaching and research nexus at the individual level has meant that “all round academic” has become easily replaced by a “semi-skilled para academic”. Jones (2013) describes segmentation in terms of “vertical fragmentation” within academic departments between tenure-track and other staff. Similar though stronger characterisations between tenured and untenured jobs include a core versus periphery (Lafferty & Fleming, 2000), a “caste system” (Altbach, 1997) and an “academic underclass” (Jacobs, 2004). What these characterisations have in common is that academics belong to certain segments which can be arranged vertically (i.e. good versus bad jobs) with limited competition or mobility between segments.

All countries have internal ranking systems or hierarchies whereby young academics spend considerable time proving themselves. These

two-stage processes continue to retain strong national patterns, including the tenure-track in the USA, the “survivor” model in Germany, and the broader “protective pyramid” of civil service status in some European countries (Enders & Musselin, 2008). The core issue is the extent to which positions at the bottom of the hierarchy contain similar roles and duties to senior positions, and offer a career pathway. If academics of all ranks are broadly engaged in similar duties with similar levels of support, career progression and vertical mobility ought to be more linear, continuous and incremental, even if remuneration levels differ greatly. Career progression would be strongly related to the accumulation of human capital endowments gained from experience in junior ranks. (Leontaridi, 1998). If there are considerable differences in expected work roles between junior and senior ranks, the academic labour market is likely to be segmented with weaker opportunities for vertical mobility because experience and skills development gained in junior positions are either irrelevant or insufficient to gain access to the senior ranks (Bauder, 2006; Broadbent, Troup, & Strachan, 2013; May, Peetz, & Strachan, 2013).

In systems of German tradition, junior staff may spend 10-15 years of continuous learning and work before attaining professorship and becoming “full members” of the academic profession (Teichler & Höhle, 2013, p. 2). The long timeframe for progression is not unique, but under the German system and others strongly influenced by it (e.g. Japan and parts of Europe), academics are heavily dependent upon individual “chair” holders until gaining full professorship late in one’s career (Clark, 1983; Muller-Camen & Salzgeber, 2005). This is in contrast to departmental structures found in the USA, the UK and other countries influenced by these systems. Autonomy over academic work and participatory decision-making rights tend to be less exclusive and come earlier in one’s careers in departmental structures (Enders, 2007, p. 10). For example, the tenure-track segment of the American academic profession provides a relatively clear career structure with autonomy in lower ranks (Clark, 1987a, p. 211). Assistant and associate professors on the tenure track are recruited based on an “up or out” system. Departments search for junior candidates not on the basis of meeting the immediate teaching or

research needs of professors, but with the intention that juniors will one day become the departmental leaders (Musselin, 2009). While it may be an exaggeration to describe departments within the American research university as a “community of equals” (Altbach, 1997, p. 107), the American research university’s departmental structure (and its British variations) concentrates less power into the hands of a handful of full professors. However, it is also more open to managerial influences (e.g. by appointed deans and presidents) (Altbach, 2011), which may have partly facilitated the growth in adjunct staff who are rarely part of the departmental decision making structure. In other words, the vertical distinction in the USA is more aligned to contract and tenure status, rather than academic rank.

The impact of internal hierarchy is complex and it would be overly simplistic to infer that departmental systems in English-speaking countries are inherently flatter, more open or egalitarian. For example, the Norwegian system was strongly influenced by the German tradition, but contains a flat academic rank structure with few differences in salary and work expectations across ranks and relatively strong vertical mobility (due to merit-based promotion). Norwegian universities also have deep traditions in broad participation in university government (Bleiklie & Lange, 2010). Overall, the meanings of particular titles and ranks should not be assumed to operate uniformly across countries or regions. Holding a professorial rank within a given discipline may unite academics across different geographies, but this ought to be derived from the empirical data. In some countries, the ranking structure is relatively flat with few differences in status, contract-type and tasks (e.g. Norway), in others rank is associated with a hierarchy of status (e.g. Germany), contract type (e.g. USA) or duties (e.g. Australia). Arguably, the increasing global competition and international exchanges between universities will lead towards a convergence in academic systems, perhaps leading to a global academic labour market. The value of comparative research is to examine to what extent international differences remain despite growing international connectedness.

1.2.3 International dimension

So far, the academic profession has been presented as differentiated along dimensions of institution, discipline and internal hierarchy. The international dimension has been discussed, but mostly in terms of how national context separates academics into different academic professions. Similarities across countries exist in terms of labelling, such as “university” or “professor”, but each country has its own institutional/sectoral and academic ranking hierarchy. The exception is discipline. Discipline is expected to unite academics across geographic boundaries and support collective identities within departments containing academics of different ranks (Becher, 1989; de Solla Price & Beaver, 1966). Clark (1983, p. 30) claimed that disciplinary affiliation dominated institutional affiliation due to the higher costs of leaving one’s field of expertise, but this characterisation can easily be extended to an international dimension. Many academics find it less costly, or even beneficial, to move to another country (compared to changing discipline). The improvements to information technology and the decline in costs of travel facilitate international mobility, but the impact of these changes ought not be overstated. It would be wrong to assume that increasing international connectedness has created a “global academic marketplace” (Altbach, Reisberg, & Rumbley, 2009, p. 93). There is considerable evidence that the global dimension has not displaced national academic labour markets for the bulk of the academic profession (Musselin, 2004, 2005, 2009). For a minority of influential academics the global dimension may be more relevant (Marginson, 2007a, 2009), but the starting point ought to be that the academic labour market is foremost a national one (as depicted in Figure 2) with the potential for international similarity.

Internationalisation is not new and may be no more important for academics today compared to earlier times. Academics have been internationally mobile for many hundreds of years, perhaps even thousands of years if one traces the scholarly profession back to the itinerant Greek intellectual “sophists” in the 5th century BC who travelled teaching wisdom for a price (Welch, 1997). The patterns of higher learning from academies, lyceums and gymnasia of ancient

Greece spread throughout the Roman Empire and were maintained well after the fall of the empire in the early centuries AD (Rudy, 1984, pp. 13-14). During the seventh and eighth centuries AD the spread of Islam saw the Graeco-Roman learning translated into Arabic, extended upon and taught in Muslim centres from Spain to Mesopotamia. The “academic pilgrimage” of students and teachers to centres of learning was influential in maintaining the classical studies during the Dark Ages and predates the medieval universities which emerged in the post-12th century Renaissance. However, the characteristics of the staff and institutions were not reflective of contemporary academic work or universities (Perkin, 2007; Rudy, 1984). The Islamic schools of learning of the twelfth century were the forerunners to universities offering the *baccalarius* (the Latin term for the preparatory studies for a variety of social careers), but they lacked the autonomy, permanence of infrastructure and regular staff, and specific curriculum (e.g. routine examinations and accredited diplomas) that are associated with modern universities (Rüegg, 1992).

The university emerged in corporate form(s) at around the turn of the thirteenth century as a guild of students in Bologna, and probably soon after as a guild of masters in Paris (Perkin, 2007, p. 163). Even at these early stages, geographical mobility was important. Students were drawn to these towns from across Europe to listen to the great masters, and their collective organisation helped ensure they held economic power within their towns and over their teachers due to their dependence on student fees for their wages, particularly in Bologna. The spread of universities was in large part based on the mass emigration of academic teachers and the return of students to their homelands. Language was certainly no barrier. Up until the 17th century Latin was the language of instruction in all universities (de Ridder-Symoens, 1992), “...from St Andrews to Salerno, and from Cracow to Coimbra” (Morison, 1935, quoted in Rudy, 1984, p. 36). Students and teachers were able to use this geographical power to gain special protections from the Pope and the local authorities. In 1231 the University of Paris received approval from the Pope for its scholars to teach across the Christian world, which further facilitated migration and international careers (Rudy, 1984).

Academics may have been geographically mobile, but the structures of the academic profession retained strong regional elements. By the end of the Middle Ages, many teachers had gained stable careers in single locations (Verger, 1992, p. 154). This was largely due to the introduction of municipal salaries as a method to reduce mass emigration and the threat of establishing new universities in other locales (Perkin, 2007, p. 165). The primary mission of the European medieval university was teaching and this was closely tied to supporting the local region's administration (of the church, secular states and municipalities). The early modern universities in Europe and Latin America at around 1500 AD, incorporated a nationalisation agenda into service to the government of the emergent nation state (J. C. Scott, 2006, pp. 5-6). The responsibilities and accountabilities of universities to their local communities or stakeholders are most obvious when discussing nationalised universities which are owned by the state (Neave, 2002). In these cases, the state operates as a mediator (via the national ministry) between outside interests and the university. The German (or Humboldtian) university was created with the purpose of supporting "nationalistic philosophical, historical, and literary culture" (Ben-David, 1971, in J. C. Scott, 2006, p. 20). The American colleges, which were not nationalised institutions, were also established with explicit (utilitarian) commitments to their communities. In other words, as employees of institutions with regional missions, academic career structures were shaped to support these regional goals.

During the 20th century the modern research university saw the teaching, research and service missions augmented by an internationalisation mission. Internationalisation contains a variety of elements, including flows of research, curriculum, staff, students, policies and ideas (Kerr, 1994 in J. C. Scott, 2006). The 21st century has arguably seen internationalisation become a fourth explicit mission for universities, characterised by "service to the body of nation-states" (2006, p. 5). However, the academic profession's size, privileges and clientele are still largely shaped by national characteristics, such as the economy, geography, culture, language and integration with the intellectual centres (p. 32). From an international comparative

perspective, the academic profession is not only differentiated by discipline, institutional type and rank, it is also distinguished by country context and how each country fits within the internationalisation process. Universities in the USA, and to a lesser extent the UK, have traditionally been considered central to the internationalisation process, acting primarily as hosts to foreign academics and enjoying hegemony over the language that defines international research and reputation (Enders and Musselin 2008). Although the flows of people and ideas are at times multi-directional, there has historically been “vertical” mobility of students and academics from the “Southern” to “Northern” countries (Teichler & Jahr, 2001), or from the scientific “periphery” to the “centers” (Altbach, 2009; Enders, 2007; Enders & Musselin, 2008; Welch & Zhen, 2008).

The flow of students and academics, however, is not entirely unidirectional. Within the developing world, there are increasingly important flows from sub-Saharan Africa to South Africa, and from parts of Asia to the wealthier Arab countries (Altbach et al., 2009, p. 93). There is also mobility within the Southern and Northern countries (Enders, 2007). In terms of the flow of students, this may be considered “horizontal” mobility because there are no push factors or lack of opportunity forcing students to migrate (Teichler & Jahr, 2001, p. 443). Nevertheless, the international flows have often been portrayed as a “brain drain” from the South to the North. This is understandable when data on migration flows indicate that few emigrants from the largest countries in the developing world return home. For example, less than 30% of the Chinese students who studied abroad between 1978 and 2006 returned to China (Royal Society, 2011, p. 27). For Chinese doctoral graduates from US universities in 2000, an estimated 92% were still residing in the USA five years later (Finn, 2007, p. 8). This was similar to doctoral graduates from India (85%), but considerably higher than those from Japan (42%) or Korea (39%). The emigration patterns are likely due to relative opportunities and attractiveness of research careers within the Northern centres, but these are historical patterns and the USA’s hegemonic position has become challenged by state-led initiatives seeking to reverse the trend of brain drain by targeting expatriate diaspora and internationally

mobile academic staff (Altbach et al., 2009; Royal Society, 2011; Welch & Zhen, 2008).

The highest profile example of a state-led initiative targeting individual academics is China's Ten Thousand Talents Program. China's almost unlimited reservoir of highly-skilled human resources and sustained increases in funding have underpinned a spectacular growth in domestic research capacity and output (Adams, 2013; Larsen, Maye, & von Ins, 2008, p. 27; Royal Society, 2011; Zhou & Leydesdorff, 2006). The Ten Thousand Talents Program is an example of China's attempt to entice expatriate academics and scientists back, including relocation schemes for established and relatively early career researchers, as well as temporary mobility schemes. Although the financial incentives are generous, it is not clear whether the scheme will be effective in the long term to reverse the permanent flow of talent, particularly in the less prestigious Chinese universities where an independent research culture may not be strong (Schiermeier, 2014). Nevertheless, it is clear that China and other East Asian countries with state-centric policies have increased their international influence and number of world class research universities on the back of high levels of research publishing productivity (Cheng, 2015; Marginson, 2011).

Smaller countries have also sought to become regional hubs by developing and internationalising their local universities and attracting international staff, as well as attracting world class universities to their shores. Abu Dhabi has spent \$50 million in donations in order to attract New York University to establish a branch campus. It is also committed to spending an estimated \$100 million annually in student support services in order to attract the highest calibre (mostly non-Emirati) students (The Economist, 2015). Singapore has enjoyed success internationally by having a clear structural differentiation between its research intensive universities and other higher education providers. Public funding has been targeted into a limited range of strategic areas where Singapore's two comprehensive universities have comparative advantage. The limited scale of Singapore's higher education sector means that the Singaporean government has been active in attracting world class university branch campuses and

centres of excellence, including MIT, University of Pennsylvania, University of Chicago, University of Manchester, Duke University, Glasgow and INSEAD (Ng, 2012). However, successful branch campuses in Singapore require more than just brand name recognition, as demonstrated by the failures of the University of New South Wales and John Hopkins University (p. 344). Qatar is another country where the internationalisation and human capital strategies have involved attracting world class universities. The Qatar Foundation has helped fund the establishment of branch campuses of several high profile North American and British universities, though with a more explicit focus on training local citizens than in the UAE (Witte, 2010).

Contrasting the historic South-to-North flow of people, the flow of ideas has for a long time been assumed to predominantly flow from North-to-South. As universities compete in their ranking vis-a-vis all others, institutional theory predicts isomorphic change towards the practice of the most successful institutions (J. W. Meyer et al., 2007). This theoretical approach is concerned with the diffusion of ideas and practice from countries possessing a cultural hegemony to the rest of the world, and the subsequent institutionalisation of similar organisational structures, rules and norms across countries. The size, power and economic success of the USA guarantees a worldwide influence and elements of the American research university model have been exported to many countries across the globe (D. R. Jones, 1992). European models of higher education have also shaped higher education systems, particularly in former colonies (Enders, 2007, p. 7). From this perspective, the academic world is hierarchic, with research universities within the scientific centres (and primarily North America), setting the standards and practices for others to follow. However, as the examples of China, Singapore, Qatar and the UAE show, recently industrialised countries are not passive recipients of global models. The outstanding performance of East Asian countries has been credited to a state-centric model for higher education development, rather than institutional autonomy and capacity for imitation (Sirat, 2010). While the core of the global science and education system continues to lie within the Northern centres, there

are reasons to believe that this power is shifting towards a multi-centred or multipolar world (Jacob & Meek, 2013; Naidoo, 2011)

Given the potential for movement between categories and the role of intermediate categories (e.g. regional centres or disciplinary centres), it is reasonable to question the relevance of the centre-periphery dichotomy. These platforms tend to overemphasise hegemony and underemphasise self-determination, particularly with regards to policies and ideas (Postiglione, 2005). For example, when Altbach asked in 1981 "Can peripheral universities become central in the international context?" (cited in Postiglione, 2005, p. 209), the peripheral universities and countries were different from those when he revisited the centre-periphery typology in 2004 (Altbach, 2004). Peripheral universities had changed again by 2012 and 2013 when he noted that universities in China have slowly moved towards the centre and become regional centres (Altbach, 2012, 2013). Characterising the academic profession as divided between mutually exclusive categories of Northern and Southern countries, centre and periphery countries, or "mature" versus "emerging" higher education systems (Teichler, Arimoto, & Cummings, 2013b, p. 26) also ignores institutional diversity within these categories. For example, some universities within the South will be more closely connected to the scientific centres than lower-tier universities in the North. This is the natural outcome of stratification. Less than 5% of universities in the USA receive the bulk of public research funding and only these universities can be considered research universities. The remaining universities and colleges lie "on the periphery of the research centres" (Altbach, 2004, p. 8).

If the research centre-periphery divide is an appropriate characterisation of the international dimension, it is probably more relevant at an institutional or individual level rather than for characterising entire countries. However, even at these lower levels of disaggregation there are problems determining which universities lie in the core or periphery, and their implications for academic careers. Marginson (2007b) offers a clear-cut distinction at both the institutional and country level. He argues that the global market is

two-tiered based on the university world rankings (specifically the Shang Hai Jao Tong rankings) with clear ranking thresholds operating as cut-offs between institutional types (e.g. top-500, top-100, top-20, etc.). Although highly critical of the use of university rankings as summative measures (2007c), he nevertheless considers rankings as proxies for research university status by formalising international hierarchies and creating “super-league universities”, as well as “super-league university nations” in the USA and UK (2007b, p. 12). These are clear distinctions, but the national-level categories have similar problems to the typical core-periphery divide. For example, the non-super league nations contain a variety of failed states, emerging giants (e.g. India and China) and successful smaller nations (e.g. Northern Europe, Australia, South Korea). Extending upon the idea of a global hierarchy of institutions, Marginson asks: “Have global academic flows created a global labour market?” (2007a, p. 305). He argues that the international hierarchies permeate the local environment, converging or dissolving the national dimension into the global dimension. This has left national labour markets bifurcated between a small “globally employable elite” with global freedoms, and those bound to the national labour market (Marginson, 2007a, 2009).

The distinction between a globally employable elite versus locally bound academic workforce is a much more narrow idea of convergence than the global or “universal status” that Meyer and colleagues (2007) ascribe to full professors. It is also more ambiguous because it is not clear which professors are part of the globally employable elite or whether being a professor is a prerequisite to membership in the elite group. Many high profile academics may not necessarily be globally employable or mobile, particularly within the social sciences where teaching and research can be highly contextual. Likewise, many academics who are globally mobile may not be part of the elite. Indeed, the opposite may be the case whereby the global labour market may have the greatest impact on those in the lowest academics ranks, such as PhDs and post-doctoral researchers for whom there are limited career opportunities. The lack of data available on academic migration flows means it is difficult to estimate

the types of academics who are globally employable or bound to the national labour market, but the indications from the Changing Academic Profession data used in this dissertation are that few academics move to another country permanently after their PhD. This is particularly the case in the main science centres where foreign trained academics are a small minority of the academic workforce: 3% in the USA and Japan, 6% in Germany and China, and 14% in the UK. It may be the case that the globally employable elite use their negotiation power to command better conditions at their home institution or seek positions in other institutions within their home country, but it does not appear that many academics relocate internationally after their PhD.

The persistence of national academic careers, even for those with global employability, is likely due to a combination of regulatory, financial and cultural traditions (Musselin, 2009). National academic career structures traditionally reward academics with ongoing employment after demonstrable periods of productivity following internal and external competition (e.g. the earlier mentioned tenure process in the USA, the “survivor” model in Germany, and the “protective pyramid” of civil service status in other countries) (Enders & Musselin, 2008). This means that the push to be internationally mobile on a permanent basis may be weak for many of the most successful researchers. National labour markets are also only weakly tied to global markets in terms of remuneration. Academic salaries and non-salary benefits differ widely between countries of comparable wealth (Altbach, Reisberg, Yudkevich, Androushchak, & Pacheco, 2012). Conditions also differ widely within countries and not necessarily due to differences in the market value or global research reputation of individual academics. In most cases, the pricing of academic labour is ambiguous, idiosyncratic, differs by department and institution, and often includes judgements about “good citizens” committed to teaching and other services (Musselin, 2009).

Even though the national labour market retains its pre-eminence for most academics, the international dimension has permeated the types of research which academics engage in and are rewarded for. In a

recent article in *Nature*, Adams (2013) claimed that research has progressed from being individual led or collaborative between academics within institutions or countries, to a new era of international collaborative research between elite research groups. Based on bibliometric data from 1981 to 2012, much of the growth in published output within the USA, UK and Western European countries was attributed to internationally collaborative research, rather than purely domestic research. This was particularly the case in Switzerland, which is consistent with other claims that international collaboration is essential for academic careers in smaller countries (Enders, 2007; Kyvik & Larsen, 1997). Although the choice not to fractionalise articles for co-authorship (i.e. double-counting international publications in multiple countries) undoubtedly exaggerated the international versus domestic patterns, it unlikely affected his broad conclusion that internationally collaborative research receives greater citation impact (Adams, 2013, p. 559). However, the most interesting results were the comparisons with Brazil, China and South Korea. In these countries, the exponential growth in published output has been predominantly from domestic publications.

The international dimension permeates the academic profession in multiple ways and can be analysed at different levels. The international dimension impacts countries differently, arguably stratifying them between regions or cores and peripheries. National-level typologies may or may not have any clear empirical basis, but as long as the academic profession is analysed based on individual academic behaviours, national-level typologies only influence the hypothesised or expected results, not the results themselves. In this way, they offer typologies (or stereotypes) to be tested, such as through the data utilised in this dissertation. Likewise the international dimension differentiates academics within countries, between those who are engaged with the international community and those who are not. Therefore, the international dimension is also relevant to studies single-country studies, such as the role of international networks in explaining “productivity puzzle” of why men and women publish at different rates (Bentley, 2012; Cole & Zuckerman, 1984). The international and individual levels interact because individual-level

engagement in internationally collaborative research or international conferences varies across countries. A key theme of the articles in this dissertation is to ask whether these variations in international engagement at the individual-level are consistent with the existing international typologies for different countries, and whether these individual-level differences account for most of the cross-country differences in publishing productivity, time use and research engagement.

1.3 Data and methodology

The data analysed in this dissertation comes from the Changing Academic Profession (CAP) project, an international survey of the academic profession conducted in 2007–08. The target population of the CAP survey were academics in universities or other higher education institutions offering a baccalaureate degree or higher. The full CAP sample included 26,000 higher education employees across Hong Kong and 18 countries: Argentina, Australia, Brazil, Canada, China and Hong Kong, Finland, Germany, Italy, Japan, Malaysia, Mexico, the Netherlands, Norway, Portugal, South Africa, Republic of Korea, UK, and the USA. The CAP survey contained a section for personal background and demographics, plus five substantive sections (Career and Professional Situation, General Work Situation, Teaching, Research, and Management). These sections were intended to cover six themes: the meaning of the term “academic”; the unifying and competing values and identity within the “profession”; academic work and the functions of higher education; academic freedom; national models and global trends; and academic careers (Teichler, Arimoto, & Cummings, 2013a, pp. 7-15). The CAP survey was partly a follow-up to the first large scale international survey of the academic profession, the 1992-93 Carnegie Survey of the Academic Profession (hereafter “Carnegie”) (Altbach, 1996). About half of the countries participating in the Carnegie survey also participated in the CAP survey. This included Australia, which was the exclusive focus of one article in this dissertation which examined changed in publishing productivity of men and women over time (Bentley, 2012).

The construction of the common international survey instrument and random sampling protocols were outlined in detail in numerous documents (RIHE, 2008, 2009, 2010; Rostan, Finkelstein, & Huang, 2014; Teichler et al., 2013b). The project published a survey audit report in 2008 which outlined any deviations from the standard guidelines, as well as standardised spreadsheets documenting the country samples relative to their population statistics and weighting procedures for academic rank, discipline and gender. There were three thematic reports which provided solid references for further details about the academic profession in each country and the survey methodology (RIHE, 2008, 2009, 2010), as well as numerous conferences and tracks within conferences dedicated to the CAP data. Additionally, the Springer book series *The Changing Academy – The Changing Academic Profession in International Comparative Perspective* has included at least 11 volumes dedicated to the CAP data. The response rates, including partially completed questionnaires, were mostly below 40 percent. Response rates to surveys of the academic profession have experienced a decline over time (Kyvik & Olsen, 2008). This may due to a range of factors such as survey fatigue or difficulties contacting transient academics on short term contracts, but it is speculated that the CAP survey's length contributed to the relatively low response rate (Rostan et al., 2014). Due to the extremely low response rates in Portugal and lack of sampling information in South Africa, both countries were excluded from all articles in this dissertation. The remaining national samples were found broadly representative of the respective populations on strata such as gender, academic rank and institutional type (Cummings & Finkelstein, 2012; RIHE, 2008; Rostan et al., 2014; Teichler et al., 2013b; Vabø & Ramberg, 2009).

Clearly an enormous amount of effort has been dedicated to the CAP data collection and its analysis. Two book chapters by Rostan and colleagues (2014) and Teichler and colleagues (2013b) are dedicated specifically to describing at a project level (rather than for individual countries) the sampling, response rates and the construction of internationally comparable variables for institutional type and academic rank. Teichler and colleagues provide detail about the

sampling process and rationale for the study, while Rostan and colleagues are more descriptive in their accounts. It would have been beneficial to this dissertation had these chapters been published early on in the process because, engaging in secondary data analysis, there was some confusion regarding how certain variables were constructed and which sorts of institutions and academic workers were included in the sampling (or excluded). However, these chapters (in conjunction with the survey audit) will be valuable references for future researchers. The main limitations of the two chapters were that they alluded to difficulties and inconsistencies across countries, but at times were vague on their causes or impacts.

One important example of ambiguity was response rates. It is unclear why response rates varied from 86% in China to less than 4% in Portugal, or why no information was available for South Africa. It is not clear what the published response rates actually refer to: "The response rates cannot be established precisely for all countries as a consequence of complex procedures of contacting potential respondents... it is not clear whether the number of responses refer to all responses or to those responding to major parts of the questionnaire." (Teichler et al., 2013b, p. 32). The latter point can be partially clarified because the final CAP data set contained partial responses and the totals were used as the nominator for the response rates. However, a bigger problem was that in some countries the denominator (number of surveys sent and successfully received) was unclear. It is also difficult for secondary researchers to accurately gauge whether item non-response was random or systematic due to certain questions not being asked or not relevant to a sub-sample. For example, despite the 86% response rate in China, less than two thirds of respondents answered questions on research output (compared to less than 10% item non-response in almost all other countries). It is not clear why Chinese respondents were hesitant to declare their research output and associated behaviours. This sort of systematic item non-response is hidden from the overall response rates and is particularly concerning for comparative studies of research behaviours.

More important than the overall response rate is how non-response impacts the representativeness of the sample to the target population. It is clear that substantial efforts were made to verify the representativeness of the data sets, but it is also clear that the level of detail varied across countries. Based on the survey audit report in conjunction with national reports, it varied from highly detailed in Norway (but unfortunately only available in Norwegian, in Vabø & Ramberg, 2009) to seemingly non-existent in South Africa. The Netherlands data collection was also not completed in time for the project survey audit, making it difficult to verify its representativeness. For most countries, but not all, there were post-stratification weights for gender, rank and discipline. This allowed for the samples to be weighted in some countries to the population statistics on each stratum (gender, rank and discipline), but not all three together because the weights were aggregated for each stratum. For example, samples could be weighted for non-response for females, but not amongst female professors of humanities. Presumably the variability in reporting reflected the availability of population data in each country, but it would have been helpful for secondary researchers to know which countries were able to verify their samples based on disaggregated strata, which countries could only verify it by aggregated strata, and which countries were reliant entirely upon the random sampling procedure. Based on the available documentation, one cannot be confident that all CAP teams followed the methodology protocols in a consistent way. It may be that the spirit of comparative research projects undermines open and public critique of fellow researchers, but the availability of detailed population data and the representativeness of each country's samples on these strata ought to have been made more transparent in the aforementioned book chapters.

The CAP project sought an effective sample of at least 800 respondents in each country (Teichler et al., 2013b). In most countries it achieved this goal, though often not by the sizable margins cited in the book chapters if one accounts for item non-response on key variables. For example, if one was specifically interested in the role of discipline and academic rank in shaping academic behaviours in

research universities, national sample sizes of around 800 respondents may be insufficient to fully capture statistically significant differences across countries. Dividing the sample by sector (university; other), rank (senior; junior) and 11 disciplinary categories results in 44 different segments ($2 \times 2 \times 11$). If each segment were roughly the same size, this would leave sub-samples of around 20 respondents. For this reason, in most articles in this dissertation the disciplinary categories were merged into five academic fields based on the UNESCO's (1978) guidelines with the associated loss of precision.

Overall, the common sampling protocols and the various documents describing the process were helpful, but the quality of the CAP data sometimes appeared to be taken for granted. The vast amount of existing publications based on the CAP data makes it easier for researchers to use the data unquestioningly, leaving it to individual authors (and editors) to determine whether the data quality in each country data set meets their own standards. As indicated earlier, Portugal and South Africa were not included in any of the articles in this dissertation due to data quality concerns, but this was a personal judgement. In other cases, researchers have chosen to include these countries in their analyses notwithstanding (or at times, not declaring) the risks.

In this dissertation, the academic profession is generally limited to respondents with full-time employment, involved in teaching and research, and within doctoral-granting universities. This is for the following reasons. First, there is a need for consistency in the institutions included. Non-university institutions were beyond the primary scope of the survey, but were included in some countries due to their role in performing teaching and research functions. In other countries (often with unitary higher education systems), universities were included which did not have strong research missions. For international consistency, the analyses are restricted to doctoral-granting research universities, a restriction that the dataset allowed. Second, the distribution of part-time staff across countries and disciplines was uneven, and countries did not include contingently employed part-time academics in their survey. There would be little

meaningfulness in drawing cross-country comparisons via an aggregate for all academics in universities. Faculties, institutions and countries differ in the share of academics in full-time employment and this would inflate the averages in countries with a greater share of full-time staff. One cannot easily control for these differences by creating a full-time equivalent basis for comparison because part-time academics are diverse, often employed for a specific function in lower academic ranks. Therefore, for pragmatic and consistency reasons, analyses needed to be restricted to full-time staff for whom all countries had reliable data. Finally, the restriction to teaching and research staff (i.e. excluding teaching-only and research-only academics) is essential because many of the investigated behaviours and theoretical concepts address the interaction between teaching and research. Most commonly this meant restricting the sample to full-time academics engaged in teaching and research functions for at least 30 hours per week.

The restrictions of the unit of analysis are essential for consistency across countries, but defining the academic profession in identical ways in all countries leads to a relatively homogenous sample which may not reflect the typical work practices in certain countries. Defining the academic profession by mutual engagement in teaching and research within the university sector is inherently restrictive, increasingly so in countries where a growing share of academic work is done by PhD students, part-time staff, research specialists and staff outside the university sector. However, comparative research on the entire academic profession is impracticable (if not impossible) and would lead to nonsensical results if one included all persons engaged in academic work (e.g. full-time and part-time; university, research institute and college staff; specialised and combined teaching and research positions; PhDs and post-docs through to professor). While this may make sense for aggregate national-level comparisons (e.g. for the total number of people working in research or teaching, or total resources devoted to these activities), at an individual level the results would be based on a motley crew of disparate employees in each country sharing little in common. Further, many countries do not keep accurate data on the activities of part-time research and teaching

specialists or support staff, so it would not just be nonsensical but also impossible to gather the data. Further still, drawing comparisons across countries would be wrought with problems of different staff and institutional categorisations. Overall, presenting averages without limiting the sample to a comparable core would have no informative meaning. Nevertheless, by narrowing the unit of analysis to teaching and research staff within research universities, the results do not account for how cross-country differences in support staff and others outside this definition may influence academic work within the university sector.

As outlined above, the academic profession can be understood as differentiated along four primary axes: discipline, sector, internal ranking system, and national differences. These implicitly form the basis of how the academic profession is defined and analysed in the six articles. Additionally, there are secondary attributes which are relevant for explaining variation on specific work habits, such as demographics, qualifications and levels of motivation. Given that the focus is on individual-level differences across a range of work habits and outputs, each article contains a different framework of theories and independent variables. Subtle differences also occur in how the academic profession is defined, which is an inevitable compromise between consistency and meaningfulness. For example, part-time academics are included in the research on basic and applied research orientation because such academics are engaged in research, only to a lesser extent due to their fraction of employment (Bentley et al., 2015). Nevertheless, all articles control for sample differences in the primary axes of differentiation via sample restrictions and the inclusion of independent variables. The approach for defining the unit of analysis and the control variables is summarised in Figure 1-3. The grey-shaded areas in Figure 1-3 indicate where the main axes of differentiation restrict the unit of analysis. The broken lines indicate where categorical independent variables divide the national samples. Note that the share of academics within each segment differs across countries, which is one of the reasons why international comparisons need to control for differences by axis.

Figure 1-3. Sample restrictions and control variables based on the primary axes of differentiation, within each country

The CAP survey included 11 disciplinary categories. Due to the limited sample sizes, these are classified into five broad academic fields in accordance with the UNESCO (1978) guidelines. Most of the discipline groups were straightforward, but the category for “Medical sciences, health related sciences, social services” was problematic. For example, academics within biomedical sciences will likely have different publishing behaviours compared to those within the professional disciplines of nursing, physiotherapy, psychiatry or psychology. Sometimes these professional disciplines are located in other faculties, sometimes not within the university sector at all. The aggregation of these disciplines removes this detail and potential variability across and within countries. However, the CAP project’s approach to disciplinary categories was probably sufficient to control for disciplinary differences in aggregated national-level comparisons.

The sectoral axis was considerably trickier to implement consistently. For international comparison purposes, the CAP project and the data file distinguished between “university” and “other higher education institution”. Universities were defined as “institutions that are more or less equally in charge of teaching and research” (Teichler et al., 2013b, p. 28), while other higher education institutions were “those with a dominant teaching function”. Therefore, the CAP project reference to “university” was not analogous to carrying the university label, but was a subset of institutions based on relative strength of their research mission (compared to teaching mission). There are numerous problems with this definition. Firstly, in some countries it is confusing to present data for universities versus others when both groups contain universities. This is mostly a problem for countries with unified national systems (i.e. countries where all CAP data comes from universities). It is not a critical problem if adequately defined and explained to the reader, but even the publications dedicated to the CAP methodology present data for universities versus others without explaining that both groups may contain universities (Rostan et al., 2014; Teichler et al., 2013b).

Secondly, the definition of university refers to the relative strength of the research and teaching missions, rather than substantive

engagement in either. This a subjective determination which will differ across countries. For example, a university in a mature higher education system may have a dominant teaching function but still support considerable research output, award many doctorate degrees and be highly ranked on international research benchmarks. Such an institution ought to be considered a university for international comparisons by virtue of substantive research engagement, irrespective of its teaching function. Had the institution been located in a less mature higher education system, it would have counted as a research university. In other words, the definition of university based on relative teaching/research mission is too easily shaped by national context, rather than being based on an internationally comparable research dimension. This leads to inconsistencies in the types of institutions included under the university category, as well as ambiguity.

In Canada, the UK and USA, universities referred to all institutions carrying the university title (4-year universities in the USA), while other institutions referred to two-year colleges. Although the university category contained institutions with different research mission emphases, it was a clear and understandable distinction. The problem is that in other countries comparable universities were not included within the university category. In Korea, the university category was unclear but presumably referred to what Shin (2009b) described as the most research intensive universities (or “research universities”). This category appeared to be an extremely narrow classification for university, excluding CAP respondents from what Shin (2009b) labels “doctoral universities” and “comprehensive universities” (confusingly, both of which grant PhDs). In a different article Shin (2009a) provides evidence that “doctoral universities” in Korea publish more articles and award more doctorates per year than “doctoral granting universities” in the USA (as per the Carnegie classifications). It is inconsistent that the CAP institutional classification considers all American doctoral granting universities to be universities, but only a fraction of all doctoral granting Korean universities despite their relatively strong research profile. There was also an apparent error in the classification of Australian universities,

which excluded unaffiliated universities. To address these concerns, the articles within this dissertation departed from the CAP project definition of university and broadened it to include all universities in Korea and Australia, but the confusion surrounding the Korean data file meant that most of the articles of this dissertation excluded Korea (Bentley et al., 2015; Bentley & Kyvik, 2011, 2012, 2013).

The academic profession is hierarchic and highly selective with full professors at its apex. Although one should be sceptical of the claims by Meyer and colleagues (2007) that title “professor” is “defined, measured, and instantiated in essentially every country in explicitly global terms” (p. 188), in all countries there is a formalised system of academic ranks. The difficulty is that each country has its own internal ranking system with varying degrees of hierarchy. The CAP project teams developed an agreed upon internationally comparable variable for academic rank, classifying academics as senior or junior. According to Teichler and colleagues (2013b), senior rank was based on the equivalent to full professor and associate professor in the USA. Junior rank basically applied to everyone else. The authors noted that the borderline between senior and junior positions could not be clearly drawn in all countries, but they did not elaborate further on its implications.

A few complications for internationally comparable academic ranks were identified from the analyses in this dissertation. Firstly, the distribution of senior ranking staff sometimes differed within countries based on sectoral lines. It is likely that the titles of associate and full professor have different meanings and status within universities compared to colleges. This was not a problem for articles in this dissertation due to the exclusive focus on research universities, but it would be a problem if one aggregated all seniors and did not control for institutional factors. Secondly, the flatness of hierarchy within some countries made cross-country comparisons more complicated. For example, almost all academics within Norway are senior ranked, split roughly evenly between associate and full professors. One cannot compare individual-level research behaviours of academics in Norway to other countries whilst controlling for

senior academic rank if Norway does not have any junior ranked staff. One could label associate professors in Norway as junior relative to full professors and this would be suitable for within-country analyses (e.g. investigating the role of rank as a differentiator within Norway compared to other countries). However, such a classification would be inappropriate for international comparisons because it would assume Norwegian associate professors were equivalent to assistant professors in other countries. This is the flipside to the problem of the institutional axis which often defined university within countries based on research mission relative to other universities within the country, rather than based on an international benchmark.

There is no single solution to examining or controlling for academic rank. One must be aware of both how senior ranks relate to others within the internal ranking system, as well as how titles carry meanings across countries. Even though senior academics often hold similar titles, their tasks and status are shaped by their position relative to others within their national system. For example, Norwegian professors are paid relatively less than their professorial counterparts in English-language systems (Altbach et al., 2012) which is likely due to their large share of the academic workforce and more egalitarian values. Working time analyses within this dissertation also indicate that full professors within Norway engage more in teaching but less in administration compared to professors in countries with steeper hierarchies (Bentley & Kyvik, 2012). This is not a problem if one is comparing full professors across countries because the differences across countries can be identified, but it is a problem if one assumes that senior rank operates similarly across countries.

Other difficulties of internationally comparable academic ranks stem from the extreme diversity in junior ranks, both within and between countries. Whereas there can be uniform agreement about which positions are at or near the apex, junior ranks are not demarcated by a clear entry level. This means that certain teaching-only or research-only positions may be considered entry-level in some countries, but not others. In the Norwegian case, junior positions do exist but they tend to be full-time salaried PhD, post-doctoral researchers and

lecturer positions (positions which have since become obsolete). These staff are often employed to both research and teach (or provide departmental service), but by virtue of their label (which implied specialisation or below-entry level rank), they were excluded from analyses within this thesis. Other countries are less specific in how titles relate to duties, which meant that engagement in teaching and research could only be defined by substantive engagement (i.e. hours spent on teaching and research). Consistency across countries in junior ranks is extremely difficult to rectify, but it would have been improved if the CAP survey had included a question for formal duties of employment (i.e. teaching and research, research-only, teaching-only, other).

The creation of both country-specific and internationally comparable variables for academic rank and institutional type in the CAP data file were useful and could be relied upon in most cases. Occasionally full professors were separated from other seniors, but this was made clear in the respective publications. Academic rank held fewer problems than the institutional axes of differentiation primarily because academic rank is a more accepted and transparent hierarchic differentiator. Each country listed their respondents by rank and title, and it was clear which ranks were considered senior. If one disagreed or wished to investigate whether results changed with a different definition of senior rank, this could be done easily. This was not always the case for the institutional axis because universities were often grouped as a single category or only differentiated based on public/private dimensions. The institutional and academic ranking classifications are summarised in Appendix 1-A and Appendix 1-B.

1.4 Results and Discussion

The academic profession includes people in different countries, disciplines, institutions, ranks, roles and engaged in different duties. The wide spanning nature of the profession means that empirical studies also vary in their degree of specificity, methodology and perspective. For example, the Carnegie international survey in the

early 1990s led to publications which drew broad international comparisons across many dimensions and activities (Altbach, 1996; Enders & Teichler, 1997; Welch, 1997), as well as research articles dedicated to a specific activities or issues affecting the academic profession, such as research article publishing (Teodorescu, 2000), the teaching-research nexus (Gottlieb & Keith, 1997) and job satisfaction (Bornholt, Poole, & Hattie, 2005; McInnis & Anderson, 2005). Publications were united by their common data source and unit of analysis (i.e. the individual academic). Often they were also integrated into a single publication, such as the edited book *The Professoriate* (Welch, 2005) and the journal special issue of *Comparative Education Review* (Welch, 1998). However, the wide range in topics and methodologies meant most articles were best read in isolation. Integration across countries and topics was often partial and limited to an introduction or concluding chapter.

The six articles included in this dissertation can also be read in isolation and perhaps best understood as separate entities with limited integration or overlap. Each article has its own specific topic, underwent independent peer review, and often addressed a different target audience. The six articles are published in five different journals which are published and edited in different countries (the UK, USA, Australia and two in Western Europe), and only half of the articles are located in journals primarily focussed on education (*Higher Education* and *Research in Higher Education*). The remaining three articles are located in journals dedicated to sociology (*Journal of Sociology*), library and information studies (*Scientometrics*) and journalism and professional writing (*Public Understanding of Science*) (based on the Australian Research Council's classifications). The articles also vary in their international coverage. Five of the articles are international comparative, while one article focusses exclusively on Australia and includes a temporal dimension for changes over time. The articles were published over a four year period (2012-2015), but were not written in the chronological order of their publishing.

Despite the semblance of haphazardness, there most certainly is a coherence to the articles and their approaches. The first article may be

considered a “big picture” study, a country-level comparison of working time patterns in 13 countries and across five academic duties (Bentley & Kyvik, 2012). With so many countries and duties included, the limitation of this study is its lack of attention to the individual academic level. This is partly due to the 8,000 word limit of the journal, which does not permit detailed analyses when interesting results arise. Therefore, the second article specifically examines research time across the same 13 countries, with attention paid to individual-level attributes as correlates of research time (Bentley & Kyvik, 2013). The third and fourth articles examine scholarly publishing productivity and are also different in their scope. The third article is a broad country-level comparison of individual publishing productivity (Bentley, 2015), while the fourth is narrower and examines gender-based differences in scientific publishing in Australia over time (Bentley, 2012). Both draw upon similar theoretical frameworks for factors associated with individual publishing, but the latter article is considerably more focussed on the internal processes within Australian universities. The final two articles share a common international comparative approach and focus on research communication beyond the traditional scholarly community, but have different focuses. The fifth article examines popular science communication and its relationship to scientific publishing in 13 countries (Bentley & Kyvik, 2011). The sixth article examines relative engagement in basic and applied research in 15 countries (Bentley et al., 2015). Similar to the first article (Bentley & Kyvik, 2012), this is a big picture study which draws upon a universal theory for understanding academic work. The general claims made by the advocates of Mode 2 research that basic research is now a minor activity are placed under empirical scrutiny across different contexts.

The collective coherence of the six articles is also supported by the similar methodological approaches. By utilising a common data set, the dependent and independent variables are constructed consistently across articles. This type of coherence is not present in the reviews of studies of academic work by different authors with different data sources (K. A. Meyer, 1998; Rosser & Tabata, 2010). All of the analyses within the articles pay attention to the axes of differentiation for

discipline, rank and institution. The articles often do not contain direct references to this framework and in many cases results are presented at a more aggregated level, but these dimensions formed a check-list for determining whether results were different within different segments. Often these data checks were at the insistence of the peer-reviewers, but in most cases the articles themselves present only a fraction of the analyses made. Undoubtedly some claims made in the articles may be untrue for academics within certain segments, but the articles are an honest representation of the many analyses conducted over the course of their writing. The articles are listed in Table 1-1 in the order they are discussed below.

Table 1-1 Articles included in the PhD dissertation

Article 1.

Bentley, P., & Kyvik, S. (2012). Academic work from a comparative perspective: a survey of faculty working time across 13 countries. *Higher Education*, 63(4), 529-547.

Article 2.

Bentley, P. J., & Kyvik, S. (2013). Individual differences in faculty research time allocations across 13 countries, *Research in Higher Education*, 54 (3), 329-348.

Article 3.

Bentley, P. J. (2015). Cross-country differences in publishing productivity of academics in research universities. *Scientometrics*, 102(1), 865-883.

Article 4.

Bentley, P. J. (2012). Gender differences and factors affecting publication productivity among Australian university academics. *Journal of Sociology*, 48(1), 85-103.

Article 5.

Bentley, P. J., & Kyvik, S. (2011). Academic staff and public communication: A survey of popular science publishing across 13 countries. *Public Understanding of Science*, 20(1), 48-63.

Article 6.

Bentley, P.J., Gulbrandsen, M., & Kyvik, S. The relationship between basic and applied research in universities, *Higher Education*

1.4.1 Academic working time - Articles 1 & 2

The first article, “Academic work from a comparative perspective: a survey of faculty working time across 13 countries” (Bentley & Kyvik, 2012), is a broad study of engagement in teaching, research, administration and other duties. Former studies undertaken in different countries show that there are large differences between individual faculty members in research universities in how they spend their working time (e.g. Altbach, 1996). There is also ample evidence of differences in working time patterns between universities within single countries (Milem, Berger, & Dey, 2000; Schuster & Finkelstein, 2006). But while the distribution of working time has been examined by many individual universities and in many countries, cross-country comparative studies are in short supply. The Carnegie study of the international academic profession undertaken in 1992–1993 included questions on working time, but the results were only analysed at an aggregate level (e.g. for both full and part-time employees) (Altbach, 1996; Enders & Teichler, 1997). Therefore, the issue of national similarities and differences in faculty working time in comparable full-time positions is not yet fully examined.

This is a “big picture” study which draws upon a similarly broad theoretical framework based on sociological institutional theory (J. W. Meyer et al., 2007). In their paper on higher education as an institution, Meyer and colleagues (2007) use such a perspective to interpret change in educational systems, structures and contents. They argue that the nature and meaning of higher education has been institutionalised over a very long period of time and now applies commonly throughout the world. This implies that the meaning of categories such as university or professor “may be locally shaped in minor ways but at the same time have very substantial historical and global standing. These wider meanings obviously have pervasive impacts on the content and character of local settings” (J. W. Meyer et al., 2007, p. 187). Furthermore, “universities and colleges, together with their disciplinary fields and academic roles, are defined, measured, and instantiated in essentially every country in explicitly global terms” (p. 188). This is essentially a universal theory for

understanding universities and academics. It assumes that local context is strongly shaped by global patterns, such that professorial positions have common meanings across different national contexts and, therefore, similar workload expectations. As noted by Van Vught (1996), such claims and theories are difficult to confirm empirically for all possible contexts, but it is possible to hold these claims to contextual scrutiny via a range of possible falsifiers.

We put forward three hypotheses. Firstly, at this stage in the historic development of research universities differences in working time patterns across countries should be relatively small. If the meaning of universities and the academic profession apply globally, then this ought to be borne out in the day-to-day activities of the core workers in different national contexts. Second, if differences do exist, they ought to be smallest between English-speaking countries and those culturally close to the English-speaking world. If the academic world is hierarchic, then it is likely that the Anglo-American research universities set the standards and practices to which institutional isomorphism suggests the rest of the world will follow. The size, power and economic success of the USA has guaranteed a worldwide influence (D. R. Jones, 1992). The internationalisation process and formalised global rankings places the USA, and to a lesser extent the UK, in a hegemonic position (Enders & Musselin, 2008; Marginson, 2007c). Third, because the notion of full professor is presumed to be common across countries, we expect working time patterns to be most similar between those sharing the highest professor rank. The academic profession contains codes of conduct and common socialisation patterns from the entry level to full professor that are normatively sanctioned and legitimated. This supports normative isomorphism, or increased similarity as one progresses up the ranks as non-conformists adapt or are filtered out of the profession (DiMaggio & Powell, 1983).

We find that working time patterns differ significantly across countries, even controlling for the important axes of rank and academic field. This suggests conditions of academic work remain heavily dependent on national higher education traditions. Therefore,

we confidently reject the assumption that the meaning of the academic profession applies globally, at least in terms of day-to-day work functions. Academics in English-speaking countries shared more in common than those in other geographical regions in total hours and in the relatively heavy administrative load, but the balance between teaching and research was not common within this region. Overall, there was only partial evidence that the academic profession held a common meaning within the English-speaking region or other countries with historical ties to it. Finally, academics holding the highest professorial rank tend to share more in common with each other across countries than academics holding lower academic ranks, particularly within the English-speaking region, Western Europe and parts of Asia. These characteristics include stronger interests in research and a greater time dedication to research over teaching.

The relationship between working time patterns and rank is perhaps the main finding of the paper because it is consistent with the normative isomorphism process. Research competence and performance is valued by academics in senior ranks and likely replicated through the promotion process. However, this does not imply that professors across different countries engage equally in research, countries such as Brazil and Malaysia are atypical in their patterns with relatively weak research time engagement. The role of the internal hierarchy as a differentiator between full professors and others is also different across countries, with the steepness of the internal ranking system appearing to influence working time patterns. Professor positions in countries with steeper hierarchies are more sharply differentiated from their junior colleagues in terms of fewer teaching hours and more administration. This suggests that universal claims regarding the global status of professorial titles have some merit for those in the highest ranks and within similar regions, but professorial responsibilities are influenced by the structure and exclusivity of the national academic ranking system.

The second article, "Individual Differences in Faculty Research Time Allocations Across 13 Countries" (Bentley & Kyvik, 2013) makes a more detailed examination of the distribution of research time across

academics. In research universities— where tenure, promotion, salary and prestige are closely related to research output— research time is scarce and is increasingly managed. Research engagement is characteristic of professorial positions, but former studies from the United States and Australia indicate that research time is also shaped by a combination of personal, family, career and institutional characteristics (Guest & Duhs, 2002; Link, Swann, & Bozeman, 2008; Singell & Lillydahl, 1996). However, drawing international generalizations from single-country studies is fraught with conceptual and theoretical complexities. Virtually all studies define faculty tasks and roles differently, or use different methods of data collection (K. A. Meyer, 1998; Rosser & Tabata, 2010). Additionally, as indicated in the first article of this dissertation (Bentley & Kyvik, 2012) and other international studies (Enders & Teichler, 1997; Gottlieb & Keith, 1997), the proportion and number of hours spent on research, teaching and other activities differs greatly across countries and between universities.

Whereas the first article of the dissertation addressed cross-country differences in working time and was based largely upon a single unifying theory (institutional theory), this second article takes a more micro-level perspective seeking to account for within-country differences in research time allocations. There is a wide range of possible factors which may be associated with dedicating more or less time to research. The CAP survey certainly contains many questions which can be constructed as independent variables. However, variables ought not to be included simply because they can be included or because their inclusion results in statistically significant correlations with research time. The variables must be drawn from a theoretical framework. We propose three different groups of explanations for skewed patterns of research time, including differences in: (a) university policy, (b) individual motivation towards research, and (c) family commitments. Each of these three explanations contain their own theoretical rationales and groups of independent variables for operationalisation. Although the framework used in this article does not explicitly refer to the four axes of differentiation outlined earlier in the essay, the axes are clearly

implied by the inclusion of variables for academic rank and academic field, the exclusion of teaching-focused universities and the separate regression analyses for each country. In other words, it is not assumed that the variables included operate uniformly for each segment of the academic profession.

The strategic objectives of universities—which include multiple missions of research, teaching and service to the community—underpin the rationale for discretionary management of research time via university policy. If universities can identify individual faculty with the greatest potential for contributing towards institutional research goals, human resource and performance management policies can create incentives that skew research time towards preferred recipients rather than equally allocating research time to all. However, allocation systems entail transaction costs and must be balanced against considerations of fairness, which can lead to systems involving a combination of strategic objectives and fixed standards for recipients based on certain status (e.g. academic rank, PhD and published output) (Elster, 1992; Kyvik, 2009). The sources for motivational differences are numerous, but we put forward two possible explanations for variation in research motivation. “Sacred spark” theory contends that some academics have a greater inner compulsion to do research (Cole & Cole, 1973). Utility maximization theory contends that faculty will seek to maximize the utility of their time in terms of income, prestige or intrinsic outcomes (Stephan & Levin, 1992). Family and caring responsibilities limit total working hours (Bellas & Toutkoushian, 1999), particularly for female primary caregivers because, when faced with competing demands, research often receives lowest priority (Probert, 2005).

Our results suggest that the factors associated with additional research time vary across countries, but an individual’s level of interest in research is the strongest predictor of one’s research time allocation. Consistently across all 13 countries, we find academics primarily or mostly interested in research spend significantly more hours on research than their teaching oriented colleagues. This remains the case after controlling for the effects of research

qualifications, previous publications, research funding and other factors one may associate with highly motivated researchers. In other words, some academics have a stronger inner compulsion to do research and such faculty manage to find extra hours for this activity, lending strongest support to the “sacred spark” theory (Cole & Cole, 1973). This is also consistent with Gottlieb and Keith’s (1997) earlier international study. University policies towards research and the research status of individual faculty, are relatively weak predictors of individual research time, though stronger effects are generally found in English-speaking countries which may again be due to the steepness of the internal hierarchy as method for distinguishing between academics.

Utility maximization theory suggests that academics will engage more in research when research quality is included in university personnel decisions. It also implies that eminent and more experienced researchers may experience diminishing marginal returns for additional research due to their already strong record. We find no evidence to suggest that personnel policies towards research quality are related to research time use. Although research hours typically decrease with age, which is consistent with a decline in motivation, this pattern differs by academic field and the decline is not linear. As noted by Becher (1989), mid-career ‘burn out’ and inertia is more common in scientific disciplines with cumulative knowledge bases, while ‘late-bloomers’ may be more common in softer disciplines of the humanities and social sciences where knowledge is contested. There is some evidence to support these claims whereby later-career humanities academics experience no clear decline in research hours. This again reemphasises the importance of including control variables for academic field. Family and gender are weak predictors of research time, but we cannot dismiss the possible indirect influence of these variables on research time due to the exclusion of part-time academics from our sample (who are likely to include women with children) and the imprecise data on the age of children.

1.4.2 Scholarly publishing productivity - Articles 3 & 4

Research publishing for the scientific community is the focus of the third (Bentley, 2015) and fourth articles (Bentley, 2012). Spending time on research and teaching may be defining characteristics of the academic profession, but commitment to scholarly publishing is perhaps the core activity which unifies the academic profession across disciplines, institutions and countries. Through international disciplinary conferences and publication networks, academics communicate their research ideas and generate status. As the tangible and measurable output of the research process, publications are research performance indicators for institutions and academics. Scholarly publishing in these articles is approached in a similar way to time use in the first two articles. The third article, titled “Cross-country differences in publishing productivity of academics in research universities” (Bentley, 2015), takes a macro approach by examining whether cross-country differences in scientific publishing can be attributed to cross-country differences in the factors claimed to be associated with higher levels of publishing. The main question is whether cross-country differences in publishing productivity remain significant after controlling for these factors. The fourth article, titled “Gender differences and factors affecting publication productivity among Australian university academics” (Bentley, 2012) is a micro-level analysis of publishing. It specifically asks whether the often-found lower levels of research publishing amongst female academics remain statistically significant after controlling for the individual-level and organisational factors. Additionally, this article examines changes in publishing patterns of men and women, and the factors associated with productivity, over time with reference to the Carnegie survey of the academic profession in the early 1990s.

In both articles, the analyses take care to control for the axes of differentiation for discipline, institution, internal ranking system and country. Research universities are the institutions of analysis and academics are classified into five academic fields. In these articles, discipline is also controlled for via the weighting of publication types as article equivalents (5 points per authored book, 2 points per edited

book, 1 point per article). This weighting procedure reduces mean publishing differences across disciplines by accounting for disciplinary differences in the typical communication channel, as well as the relative work associated with each publication type. For the Australian article, academics are differentiated based on type of research university and across the five academic ranks, whereas the international article is restricted to a two-rank category and does not differentiate between research universities. This greater level of detail is one of the benefits of single-country studies because there is no need to aggregate these categories for international comparisons.

Studies seeking to explain individual-level differences in publishing between or within countries tend to use a rather standard mix of variables, such as individual-level characteristics (e.g. demographic characteristics, psychological abilities, work habits, status, demographics), environmental or organisational factors, and feedback which reinforce behaviours (Fox, 1983, 1992; Rosser & Tabata, 2010; Teodorescu, 2000). Academics differ in their abilities, interests and experiences, while institutions differ in their missions and incentive structures that stimulate productivity. Feedback processes reinforce behaviours through differential resource allocations, leading to long-run cumulative advantages for some and cumulative disadvantages for others. The main difference between the international and the Australian article is that the former is concerned with whether the distribution of factors across countries possibly account for cross-country differences in publishing productivity, whereas the latter is concerned with whether the factors associated with publishing productivity operate similarly for men and women, as well as changes over time. The international article also examines whether publishing productivity differences remain statistically significant for peer-reviewed and English-language publications, with the implication that high productivity may be associated with publishing in non peer-reviewed outlets or double-publishing in foreign language and English-language outlets.

Many of the factors supposed to be associated with publishing are similar to those previously mentioned for research time allocations.

This is partly because research time is both a cause and an effect of increased levels of publishing. This reciprocal relationship is clearly problematic for drawing causal relationships. For example, publishing research may cause one to be allocated more time for research, and having more time for research may cause one to publish more. Similar problems occur when using rank, PhD or other status criteria as independent variables. These problems are greatest for comparisons between men and women in the same country. Women and men may publish at similar rates after controlling for research time or rank, but these factors may reflect the lower mean publishing of women as a group. Therefore, it is meaningless to conclude that men and women publish at equal rates when controlling for research time or rank. However, at a descriptive level it is meaningful to analyse the extent to which men and women differ in publishing productivity at a given rank or dedication of research time, as well as factors associated with higher levels of output.

The overrepresentation or 'vertical segregation' of women in lower ranks in Australian universities has often been justified by the apparent lower research productivity of female academics. However, few multi-disciplinary Australian studies have examined the extent that men and women differ in their publication productivity or whether gender differences have changed over time. Nor have Australian studies separately examined the factors associated with differences in publishing productivity for men and women. It is possible that gender differences in publication productivity may be due to women exhibiting fewer of the characteristics associated with high publication productivity, but it may also be that certain characteristics are uniquely negative for female productivity, such as marriage and children.

Both articles find that publishing productivity is highly variable between individual academics, while the international article also indicates large differences in mean publishing productivity across countries. This is not surprising, the skewness of publishing towards a small minority of researchers has been noted previously (Kyvik, 1991; Ramsden, 1994). Much like the previous articles addressing working

time, academics are neither united by a common engagement in duties or by their level of published outputs. The relationship between research time and output, while positive and statistically significant is a relatively minor factor accounting for individual-level differences between men and women or across countries. The strongest factors associated with publishing productivity are the individual-level work habits, such as doctoral degree, research collaboration and rank or experience.

At a country-level the mean differences in publishing productivity of individual academics are statistically significant and meaningful after controlling for individual-level demographics, work habits and institutional characteristics (Bentley, 2015). In other words, differences across countries cannot be attributed entirely to their academic labour force characteristics. Academics in some countries, notably China, Korea and Italy, tend to publish more after controlling for these factors. However, when fractionalised for English-language and peer-reviewed publications, cross-country differences are relatively smaller. This suggests that publishing productivity in certain countries is inflated by a tendency to publish in non-peer reviewed outlets. Academics in large, non-English speaking countries also potentially benefit from a wider range of domestic publication channels. This appears to be particularly the case in China where the mean level of total publishing is very high, but the mean level of English-language and peer-reviewed publishing is very low. Overall, demographic, motivational and institutional characteristics associated with high individual-level publishing productivity account for part of the publishing productivity differences within and between countries in English-language and peer-reviewed publishing productivity, but not in total publishing productivity where such workforce characteristics only account for within-country differences.

The Australian article (Bentley, 2012) is more modest and descriptive in its ambitions with the initial objective simply to quantify the size of gender differences in publication productivity and changes over time. The results suggest an overall improvement in the position of women in research since the early 1990s. Australian female academics in full-

time research and teaching positions have become increasingly similar to their male counterparts in publication productivity and many of the factors affecting publication. The results for the 2005–7 period showed that women published 24 percent fewer article equivalents than men, compared to 46 percent fewer over the 1991–3 period. The increase in female publication productivity and overall reduction in gender differences is mostly due to a reduction in the proportion of women with zero or very few publications. The factors associated with publishing productivity operated similarly for men and women. Even the family caring responsibilities, which were expected to have a stronger role for women due to the uneven division of household labour, were insignificant for both men and women. The only area where women appeared to gain fewer benefits is international collaboration and international conference attendance. Women tend to have weaker levels of engagement in these activities and these factors were more weakly associated with published output for women. Therefore, part of the gender differences in publication productivity may be due to deficiencies in certain characteristics, such as women not having the same quality of international networks.

An important limitation of both articles is the sample of academics included in the survey. Part-time academics in specialised teaching positions and research assistant positions were either not part of the survey or subsequently excluded from the samples analysed. In the case of gender differences within Australia (Bentley, 2012), it may be that the improved output of women over time (in absolute levels and relative to men) is due to the decline of the combined teaching and research position as standard employment classifications, as well as other policies which have discouraged lowly publishing academics or those with caring commitments from such positions. For example, if the workplace relations systems within Australian universities make it particularly difficult for women or lowly publishing academics to remain in full-time positions involving research, then the increased levels of mean output may be more due to the filtering-out process. In other words, full-time female academics may have become an increasingly selective group, successful on the traditional and masculine terms that circumscribe the academic career. For

comparisons across countries at a single point in time there are similar concerns (Bentley, 2015). Countries differ in the proportion of academics working in full-time teaching and research positions. This group may be broadly representative of the academic profession in some countries, but very selective in others where various assistant positions support the output of the few.

1.4.3 Popularization and basic/applied research orientations - Articles 5 & 6:

The final two articles are also international comparative studies of research behaviours, but these studies move beyond purely scholarly research by examining research popularisation and orientation. Academics are often characterised as preoccupied with publishing for a disciplinary community which values disinterested, theoretical and esoteric research. There are increasing calls for academics to engage in research of greater societal relevance and for the assessment of research quality to extend beyond the disciplinary community. The Mode 2 thesis, first outlined in *The New Production of Knowledge* by Gibbons and colleagues (1994), argued that disinterested, academic-oriented, disciplinary and autonomous research conducted exclusively within universities (Mode 1) is no longer the core mode of knowledge production. In many countries, there is also a greater emphasis now being placed on the dissemination of research results to a general or non-specialist public. However, the literature on science communication has dealt primarily with the role of science journalists in the popularization of research and public understanding of science. Popularization by academic staff members themselves has received little attention in the field of science studies (Felt, 2003), and only a handful of single-country studies have attempted to quantify the extent of these activities in the academic community (Kyvik, 1994, 2005; Jensen et al., 2008). Likewise, there is a lack of empirical evidence supporting claims that disinterested, academic-oriented, disciplinary and autonomous research is no longer the core mode of knowledge production within universities.

The fifth article of the dissertation examines the levels of engagement in science communication to a general public, the types of academics involved in these activities, its relationship to scientific publishing, and variability across 13 countries (Bentley & Kyvik, 2011). Given the limited number of prior studies on this topic, this article is more exploratory and contains a mix of theoretical perspectives drawn from earlier studies. These include: (a) popularization of research is considered secondary to scientific publishing, (b) there are large individual differences in the propensity to perform such activities, (c) there is a positive relationship between scientific and popular publishing, and (d) engagement in popularization differs across disciplines.

The sixth article examines relative engagement in basic and applied research in 15 countries (Bentley et al., 2015). Nowotny and colleagues (2003) are unequivocal that pure, fundamental and disinterested research is no longer the preoccupation of universities: "... the research that is variously described as 'pure', 'blue-skies', fundamental, or disinterested, is now a minority preoccupation – even in universities" (p. 184). They are also clear regarding three generalizable causes for this pattern: increased steering of research priorities; increased commercialisation of research; and broader accountability of science. Increased steering is tied to the worldwide decline in block-grant public funding of research. What separates the Mode 2 thesis from other characterisations of the changing research agenda is its lack of nuance. The Mode 2 claims are not limited to certain disciplines or policy-relevant fields, the process of change is believed to be complete across all contexts (Weingart 1997). Like the role of institutional theory in the first article of this dissertation (Bentley & Kyvik, 2012), the Mode 2 thesis is universal in its claims and its blindness towards contextual factors leaves it open to a range of possible falsifiers. Therefore, the goal of the sixth article is to hold these general claims to contextual scrutiny via the empirical evidence of the CAP data, as well as extending the understanding of how individual academic conceptualise their own research.

The types of research academics predominantly engage in – scholarly or popular, basic or applied – likely differs by the four axes of differentiation, by country, discipline, rank and institutional type. For example, according to Becher (1994) academic disciplines differ in their cognitive knowledge structure from pure (theoretical) to applied (pragmatic). The results of the few existing studies on popularization suggest that popularization of research is more common in the “soft sciences” (humanities, social sciences) than in the “hard sciences” (natural sciences, medicine, technology) (Kyvik, 1994, 2005). One of the barriers to publishing for the lay public is the belief by scientists in a public deficit in either literacy or interest in science (Winter, 2004) and this may be greater in highly codified fields. The relationship between seniority and popularization is somewhat contested. Some scientists believe that popularization is an activity engaged in by those not good enough for an academic career (Royal Society, 2006b), but the results of existing studies suggest the opposite.

Although Nowotny and colleagues (2003) do not consider the possibility of large differences by discipline or institution, we examine three possible explanations for why we may find differences across academics in their specialisation in basic or applied research (or combining both). Firstly, the ability to seek external funding for research projects is affected by the closeness of one’s discipline to market (Slaughter and Leslie 1997). Academics able to source business funding for research will be less reliant on dwindling institutional funding and more open to practical research. Secondly, institutional expectations for applied research differ. Universities have the capability to respond to stakeholder needs by promoting commercial and interdisciplinary research. Academics working in universities with a stronger commercialization focus may be more engaged in applied research. Thirdly, a defining characteristic of academia is autonomy and protection from external influence (Altbach 2001). Given the challenges that applied research pose to traditional scientific norms, engagement in applied research likely reflects how individual norms towards these activities.

Our results for popularization confirm the belief that popular publishing is far less common than scientific publishing and committed to by a minority of scientists in most fields (Bentley & Kyvik, 2011). Academic staff with popular publications generally have higher levels of scientific publishing and academic rank, and this pattern is consistent across all countries and academic fields. This generally does not support the contention that there is a trade-off between interest in scientific publishing and popularization, or that popularization is an activity undertaken by those unable to publish in scientific channels. Engagement in popularization is less common in the natural sciences and medicine, which may be related to codification and public interest in such research, compared to research in the humanities and social sciences. We find large differences across countries in popularization, which may be due to different reward structures and perceptions of public scientific literacy.

Our results for engagement in basic and applied research similarly question the logic of a large trade-off between these activities (Bentley et al., 2015). Basic research is rarely the exclusive preoccupation of academics (it is commonly combined with applied research), but with 93% reporting at least some engagement with basic research it cannot be considered a minority preoccupation in universities. Rather than conceptualising basic and applied research as separate dimensions, we distinguish between five distinct research orientations: Pure basic; Leaning towards basic; Equally basic and applied; Leaning towards applied; and Pure applied. Engagement and specialisation in basic and applied research is highly variable across countries and disciplines, with research specialisation closely aligned with Becher's (1994) disciplinary typology of pure/theoretical and applied/pragmatic knowledge structures. Pure basic researchers are most common in the humanities (28%), life sciences (22%), social sciences (19%), and physical sciences (18%). While not uniform, these disciplinary patterns are similar across countries. The large differences across countries and disciplines suggests that claims regarding basic, theoretical or blue sky research ought to be nuanced with reference to national and disciplinary context.

Taken together, engagement in basic/applied research and popularization are highly variable across countries and disciplines. Individual-level engagement is not only related to funding and university strategies; it is even more strongly related to individual norms about academics obligations towards popularization or producing knowledge applicable to problems in society. National and institutional policies for more applied and practically-related activities are, therefore, not necessarily out of touch with engagement in basic research or scholarly publishing. Our main finding is that different types of research activities are mixed and combined at the individual level, despite variations between countries and between academic disciplines. This does not imply that there is an equal balance between basic and applied research, or between scholarly and popular publishing. Scholarly research is clearly pre-eminent over popular research, but the relatively greater engagement in applied research does not appear to come at the direct cost of commitment to basic research. Nor are the popularisers of research necessarily forgoing scholarly publishing. As such our results can be interpreted as a warning against policies developed on the assumption that academics tend to overly specialise and are unable to combine practical research and communication with theoretical and scholarly output.

1.5 Reflections and recommendations for future studies

The conclusion borne out repeatedly in each of the articles is that the academic profession contains a diverse mix of individuals with highly variable levels of engagement in teaching and research, as well as different perspectives on these activities. There are strong reasons to distinguish between academics on their discipline, institution, rank and country, but even within these categories there is considerable diversity. Academics within similar categories (or segments) may share relatively more in common with each other than with their fellow academics in other categories, but this is mostly because of the extreme levels of diversity across the broader profession. The primary matrix of disciplinary and institutional affiliation tells us something about the “small worlds” of academic life (Clark, 1987a). Understanding the location within the internal hierarchy and the type

of national system provides further important information (Enders, 2007). None of these axes ought to be taken for granted, but neither should it be assumed that they create a strong uniformity or understanding of the academic profession within them. Even with fine grained details about individual-level attributes, it is difficult to confidently draw broad generalisations about what it means to be an academic, at least in terms of day-to-day time use and research behaviours.

The diversity within the academic profession makes it relatively easy for researchers to criticise or refute universal claims about the academic profession. The range of possible falsifiers is extremely broad when the sample is so heterogeneous (F. Van Vught, 1996). For example, how can the academic profession possibly be converging towards a common global model with practically “universal status” (J. W. Meyer et al., 2007, p. 188) if publishing patterns are highly skewed (Bentley, 2015) and the standard deviation in research time (even for full professors) is close to ten hours per week (Bentley & Kyvik, 2012)? It is similarly straightforward to refute claims that Mode 2 research or its variants is now the dominant model for academics in research universities (Gibbons et al., 1994; Nowotny et al., 2003). Engagement in research is too variable to suggest any overarching claims that academics have shifted their attention away from basic/theoretical research and towards applied/practical research, or from single disciplinary to interdisciplinary research, etc.

The greater challenge is how to take these existing theories and either adapt or replace them in response to the empirical data. Most of the articles within this dissertation did not take the next step and create or modify existing theories, but were rather cautious. Null hypotheses were created on the basis that universal theories assumed homogeneity, data was presented which invariably showed statistically significant differences and diversity, but the articles mostly limited themselves to speculating about what may account for the patterns of diversity. Future research will have to build upon these speculative conclusions by developing or extending the theories of

academic work, as well as gathering new empirical data to test the revised perspectives.

Nevertheless, disproving certain claims about homogeneity does improve understanding of academic work and provides some practical benefits. If the academic profession is characterised by diversity, then there are a few reasons to be concerned that the profession is rigid, specialised and unresponsive to society's needs. Academics do not appear to be preoccupied with narrow and theoretical disciplinary research, even though the common perception is that such activities carry the strongest extrinsic rewards. Most academics view applied research positively and engage with it alongside their scholarly research. Although few academics engage in popularisation of their research in newspapers and magazines, those that do tend to be prolific publishers within the scholarly community. Research time and scholarly publishing may be a defining characteristic of academics in senior ranks, but most academics report having interests in both teaching and research. In other words, academics are not incapable of being good at both scholarly and applied research, or motivated towards teaching and research. Certainly not all academics are equally proficient at all types of work, but nor should we assume that specialisation is inherently the most effective, efficient or inevitable outcome.

Perhaps it should not be surprising that a profession generally characterised by its high degree of work autonomy would contain people engaged in a wide variety of activities. What remains unclear is what role individual academics play in the diversification process relative to top-down and external pressures. At an institutional level there have certainly been strong external pressures. Massification of higher education has probably pushed differentiation onto academics as public universities have expanded and become expected to enrol more students from previously underrepresented backgrounds (Enders & Musselin, 2008). New universities, often with a relatively stronger teaching mission, also have been created in order to meet excess demand (sometimes via reclassification from college to university status, or via mergers with universities). This has drawn

new types of academic workers into the higher education sector. The rapid growth has meant that the traditional privileges which have come from holding a PhD or academic position, such as ongoing contracts and guaranteed access to research time and resources, have become the exception rather than the standard form of employment. Under these sorts of conditions, to what extent do academics remain in control of their own careers? This is a fundamental question which divides much of the literature but which we have little empirical data to rely upon.

Optimists view the differentiation process as providing universities and academics opportunities to experiment with the different permutations of academic work (Coates & Goedegebuure, 2012). Academics and institutions may plan dynamic career trajectories that flow between different roles, such as moving from teaching intensive “classic academic” engaged predominantly in teaching in the early career, to a “senior academic leader” engaged mostly in leadership and discovery later in one’s career (p. 882). Where segmentation does exist, it is from a rather unitarist perspective whereby workers and employers benefit from customising jobs to individuals based on their strengths and motivations (Cantrell & Smith, 2010). Diversification and specialisation may increase the potential for university management to control academic tasks due to the greater ease of managing single-task workers (Musselin, 2007), but the interests of academics and universities are not inherently in conflict. The customisation process allows for the realisation of mutually beneficial outcomes for academics, universities and students (Cantrell & Smith, 2010). Seemingly all that is required is good data on the individual worker attributes, strengths and preferences, and good communication and long term planning.

For pessimists, the differentiation process exposes the conflicting interests between academics and their employers. Such a perspective is typified by advocates of labour market segmentation theory (Bauder, 2006; May et al., 2013) or similar core-periphery models (Jacobs, 2004; Lafferty & Fleming, 2000). Differentiation is understood as creating multiple career tracks in specialised roles, but with equally

poor outcomes and few opportunities for mobility. In its simplest conception, it is a dual labour market of “good” tenured jobs in the primary market containing teaching and research, and “bad” casual or adjunct jobs in specialised roles in the secondary segment (Bauder, 2006). Jobs which ought to be in the primary segment have been replaced by casual positions in the secondary segment in order to keep costs for the entire academic labour market low. Academics in the primary segment control the supply of labour in the secondary segment, overproducing PhDs and forcing academics compete fiercely within the secondary market segments, keeping wages and conditions poor. There is no competition between segments or transition from the secondary to the primary market. Academics get stuck in the secondary segment and assignment to this segment is somewhat arbitrary. For example, the disproportionate number of women in the secondary segment is cited as evidence of a “gendered” segmentation which has little to do with differences in ability, motivation or other unobserved characteristics (Bauder, 2006; Jacobs, 2004). However, others have also acknowledged that discipline may be a stronger line of segmentation than gender (May et al., 2013). At best, the interests of academics and their institutions are pluralist, containing some scope for mutually beneficial outcomes, but often in conflict.

The argument surrounding segmentation is closely tied to the extent of barriers and opportunities for secure employment. No one can argue with any empirical basis that teaching-only and research-only academics are not characterised by insecurity and lower rank, at least not in Australian universities where comprehensive data is available. In Australia, 85% of all research-only employment is fixed-term and 80% of all teaching-only work is casual, with the vast majority of specialised positions located in the bottom two academic ranks (Department of Education, 2013). Where segmentationists differ from others is that they contend that segmentation is permanent and the positions are not entry-points or stepping stones to academic careers. For example, Broadbent and colleagues (2013) and May and colleagues (2013) claim that staff on insecure contracts aspire to be part of the secure academic workforce, but are stuck in specialised roles with few opportunities for advancement and security. Both studies cite data

from an Australian survey of more than 11,000 academics in casual and non-causal employment to support their claims. May and colleagues (2013) describe the barriers to secure employment as “high” for casuals in teaching positions due to their weaker qualifications and research training, and lack of competitiveness within the international market (p. 272). Broadbent and colleagues (2013) are even more blunt for fixed-term research-only staff, claiming they have “limited or no career path options either within their institution or the university sector” (p. 280).

The problem with these claims is the lack of empirical validity. How is casual teaching associated with gaining a secure academic position? Do research-only academics actually have no mobility to other institutions or sectors? Empirically proving segmentation and immobility is extremely difficult (Leontaridi, 1998). However, it is also difficult to prove the opposite, that differentiation creates possibilities for dynamic academic careers involving transitions from one role to another. These future career transitions will not be evident in cross-sectional surveys which only provide a point-in-time description of one’s career. What is clear is that academic jobs remain highly skilled, retain high levels of autonomy, low surveillance and share little in common with the routinised jobs within the service sector (Nadolny & Ryan, 2013). Likewise, experience in specialised positions often operates as a prerequisite (but not guarantee) for advancement into the limited number of secure positions. Casual positions are not a “springboard to an academic career” within Australian universities (Nadolny & Ryan, 2013), but more than three quarters of academics in fixed-term or ongoing positions have worked as a casual either during their PhD or afterwards (Strachan et al., 2012).

Experience in casual academic employment appears to improve one’s chances of gaining ongoing or fixed-term employment, which is what one would expect if the academic labour market is competitive, rather than strictly segmented. Those who transition from the secondary (insecure) labour market to the primary (secure) market do so based at least partly related to what neo-classical analysts would describe as their different human capital endowments. For example, specialised

teachers have lower levels of qualifications with only 17% of casuals having PhDs (with a further 54% studying a PhD) compared to 80% of those on more secure contracts (May et al., 2013). It is also likely that insecure staff in teaching-only and research-only roles differ from staff in ongoing employment in other unobserved ways, such as motivation and general ability. However, this is not evidence of a clear career pathway for the qualified and most motivated any more than statistics showing that the majority of full professors worked in associate professor and junior roles earlier in their careers. Does completing a PhD, publishing research and gaining teaching experience open up opportunities for entrance into the securer academic positions in similar ways to previous generations? Unless there are sufficient positions available on the more secure tracks, it will not. The extensive use of part-time and contingently employed academics is a phenomenon in mature and developing higher education systems alike (Altbach et al., 2009, pp. 90-91). Future research must explore not just how academics in full-time positions perceive their work and careers at a given point in time, but how academic careers develop and change over time.

The first step in understanding how the academic profession is differentiating or segmenting into different roles is to broaden the definition of the unit of analysis. The CAP survey sampling framework excluded the adjunct and sessional staff, a group most likely to be engaged only in teaching. This group was likely excluded due to the difficulty of contacting them, rather than any disregard towards their importance. However, if we are serious about understanding the changing nature of academic employment, it is imperative that surveys include the staff in the positions where there has been the greatest growth. Such positions offer the first taste of academic employment for many aspirants. In many countries these positions outnumber the traditional academic positions. Regardless of whether or not they are entry-points into academic careers or dead-ends, academics in these positions contribute greatly to the university mission. Therefore, the first recommendation for future comparative studies on the academic profession is to:

1. Broaden the scope of academic surveys to include casual, sessional and adjunct staff.

The growth in specialised academic positions at the bottom of the internal ranking system is an outcome of the differentiation process, but it does not necessarily create segmentation. It is possible that academics can move freely between roles depending on their preferences and circumstances. Nevertheless, at any given point in time the formal work role (teaching-only, research-only, combined teaching and research, administrative leadership) as well as the split between activities (e.g. 40:40:20 division between teaching, research and other duties) creates an important additional differentiator. This differentiator goes beyond the four axes discussed in this essay (discipline, internal ranking system, institutional type and country). It potentially unites people of different backgrounds with common work roles, while also fragmenting people within the same areas of the institution. Work roles are most closely tied to the internal ranking system due to the often uneven distribution of work roles by rank, but the distribution is also uneven by institutional type and discipline (with low ranked research-only roles more likely to occur within the hard sciences in research intensive institutions).

The CAP survey did not ask academics whether their formal role was specialised or combined teaching and research. The extensive diversity of results within each country means it is unlikely that formal work roles strongly unifies the profession across different disciplinary or institutional axes, but future international surveys ought to investigate its role as a potential axis of differentiation and unification. For example, much of the evidence for specialisation and differentiation focusses on the expansion in academic employment outside the traditional ongoing teaching and research positions, but it is also likely that the differentiation process is occurring within the teaching and research positions (i.e. a dissolution of a standard 40:40:20 division into other divisions such as 60:20:20). Identifying academics by formal role can also help verify (or dispel) assumptions that teaching-only staff do not contribute to the research output of universities or research-only staff do not contribute to teaching. If complemented with other data, it

may also be possible to investigate how work role affects career progression. Specialised positions have been equally criticised for their limited promotional opportunities (Broadbent et al., 2013; May et al., 2013), but it is likely that the career prospects of a low ranked postdoctoral researcher will differ from a comparably low ranked teaching-only academic. The cumulative long term benefits of research publications and their relatively greater contribution to institutional prestige (compared to teaching) may mean that research-only staff have greater mobility to more secure combined teaching and research positions within their institution (or to competitor institutions). Therefore, the second recommendation is for future comparative studies to:

2. Investigate formal work roles as a potential axis for differentiation

Investigating formal work roles and increasing the coverage of academic surveys to those studying PhDs and/or on contingent contracts better captures the range of people engaged in academic work, but it says little about the types of people who enter academic careers, the types who remain, and the impact of early career decisions on career progression. The academic profession has typically required people to be willing to dedicate many years studying towards a PhD before (or whilst) proving themselves in short-term and insecure entry-level positions. This requires considerable financial and opportunity costs for individuals. Training the next generation of academics also involves considerable costs to universities and their funders in terms of scholarships, infrastructure and supervision. These individual-level and institutional costs will always be relatively high because the higher education sector relies on recruiting the most capable people within the labour force and training them to be at the frontier of knowledge. Teaching experience and research qualifications are also demonstrable human capital endowments that open up more opportunities than just academic careers. Many qualified and capable people may shun casual work or academic careers after some time. Others may “tick all the boxes” in terms of teaching experience and research productivity but find themselves underemployed or unemployed. Unfortunately, cross-

sectional data only informs us about those who currently work in academe. It tells us nothing about those who leave or never entered academe in the first place.

Academic work is highly autonomous, complex and difficult to tightly supervise. Universities are reliant upon a workforce that ought to be motivated by principles of the ethical and disinterested pursuit of knowledge and training. If academics do not believe that their efforts are rewarded or that they will have long term job prospects within academe, they are unlikely to be motivated towards improving their levels of productivity or engaging in duties of long-term benefit to their institutions. The CAP survey indicated most academics had considered a major job change in the previous five years. In the UK and Australia, around three quarters of academics had considered a major change (77% and 74%, respectively). Even more concerning, close to half of all academics in these countries had taken concrete action towards a major change (43% and 41%, respectively). As potentially troublesome as these stated intentions are, they likely underrepresent the extent to which early career academics in these countries are actively seeking alternative employment (due to their concentration in short-term contracts). However, without being able to track respondents it is not possible to verify how stated intentions relate to actions, and the characteristics of those who ultimately leave.

Longitudinal analyses often require more resources and commitment than are available at the time of the project. It would be difficult to sample and track people who were awarded PhDs but chose not to pursue academic careers, but opening up the cross-sectional survey of academics to longitudinal follow-up surveys ought not be burdensome. Respondents could be asked to “opt in” to a follow-up survey and provide the relevant personal contact details (e.g. name, email, telephone, address, etc.). Invariably there would be some difficulty contacting some respondents for follow-up surveys, but even if contact details changed, many of those remaining within academe can be tracked via publications databases and unique author identifiers (e.g. ResearcherID, ORCID), and professional websites such

as academia.edu and LinkedIn. Additionally, one could contact former institutions directly (e.g. in cases of retirement).

Longitudinal data could illuminate some of the topics which were partially addressed in the CAP survey, such as research and teaching productivity over time, and the impact of gender and family on academic work. For example, does individual-level teaching and research productivity increase with experience, or is the correlation between productivity and experience due to other factors, such as a filtering out of underproductive staff? Likewise, young children are supposed to more negatively impact female participation in academic work due to the uneven distribution of domestic labour. These impacts are also meant to have long term, cumulative disadvantages for female research careers (Long, 1992; Long, Allison, & McGinnis, 1993). Cross-sectional data can only partly address such topics. Academics with caring responsibilities are likely to be missed from surveys of the academic profession due to opting out of academic work during the time of sampling. Those that remain within the profession with certain caring responsibilities can be examined compared to others, but the results will be inconclusive. For example, we may find that women with older children report higher levels of publishing productivity compared to similarly experienced women with young children, supporting the theory that young children have a greater impact on research publishing than older children (Kyvik & Teigen, 1996). But we can't assume from cross-sectional data that publishing productivity recovers after children reach school age because we don't know if the types of women with young children who remain in academe were high achievers to begin with. Tracking respondents over time would provide better evidence because productivity could be compared before, during and after periods of caring responsibilities.

The CAP project team made clear efforts to align the survey methodology with the earlier Carnegie survey for comparability reasons. Future surveys of the academic profession will doubtless look to the CAP survey for similar reasons and wish to contrast results on identical questions over time. In times when the bulk of the

academic profession were employed on an ongoing basis, cross-sectional surveys offered reasonable insights into the core academic behaviours. But as valuable as cross-sectional comparisons over time are, the growing insecurity and diversity of academic careers means that the ambition ought to be to track individual academics over time. Longitudinal international comparative studies may not always be feasible, but efforts could be made to facilitate longitudinal comparisons for a sample of respondents who are contactable. Therefore, the third recommendation for future cross-sectional surveys to:

3. Track individual academic careers via follow-up surveys.

Broader and more detailed sampling frameworks are important goals, but the quality of the data must be transparent and easily verifiable. The CAP project contained solid procedures for random sampling and reporting the representativeness of the sample, but these details were spread across many different documents and attachments. It would be beneficial for researchers to be able to cite a single repository for up-to-date information on the sampling procedures and results. Whereas some countries were able to verify the response rate and representativeness of their sample on multiple and disaggregated strata, others did not appear to know how many survey invitations were sent, who they were sent to or have any population data on certain strata. In short, countries differed in the extent to which they followed the sampling methodology and this ultimately affects the degree of confidence researchers can place in the data.

The detailed sampling documents ought to be complemented by a summary document listing which countries: (a) met all of the sampling methodology standards; (b) partially met the standards; or (c) failed to meet the standards (or did not provide information). Key standards should include details for how random sampling was conducted, reports for the sample representativeness on key strata (as well as the sources for the population data) and provision of data weights by strata. If in a single repository or source, it would be easier

for journal editors and peer-reviewers to be assured of the quality of the data. It would also better inform researchers interested in conducting secondary analyses. Therefore, the fourth recommendation is to:

4. Establish a single repository for details on sampling methodology

The institution differentiator has traditionally been understood as a dimension separating the research and postgraduate training universities from the others (Clark, 1983, 1987a; Wilson, 1942). More recently, distinctions have been drawn within the research university sector based on university world rankings (Marginson, 2007b). The implications for these distinctions in terms of academic work are that those in the less research intensive institutions are supposed to have weaker research abilities and less access research resources. However, the importance placed on the institutional dimension is partly based on the historical assumption of stable academic careers that involve both teaching and research. While it is true that research resources will, on average, be greater within top-tier institutions, differentiation within the academic profession means that many academics within these institutions will not have access to such resources. For example, roughly half of all Australian university teaching staff are employed on a casual teaching-only basis, with the remainder employed in combined teaching and research roles (generally on an ongoing basis). Research intensive Group of Eight universities are no more likely to employ their teaching staff in ongoing roles involving both teaching and research (May et al., 2013, p. 266). Therefore, knowing that an academic is employed in a research intensive university does not provide adequate information regarding their access to research resources.

When specialised roles were rarer, institutional affiliation probably held greater meaning in terms of teaching and research behaviours. However, in many countries universities have capacity to concentrate their teaching and research resources within certain areas via

specialised positions. The lack of opportunities for ongoing employment, particularly for research-only positions, also means that academics trained and commencing their careers in top-tier universities are unlikely to spend their entire careers within these universities. The implied requirements for institutional mobility in academic careers and differentiation between academics within institutions, means that the institutional distinction may have less relevance at the individual level compared to academic role. However, given that the academic employment conditions still retain strong national character, the prevalence and implications of institutional mobility between sectors/tiers ought to be examined on a country-by-country basis. In other words, the importance of the institutional dimension (or lack thereof) ought to be derived from empirical observation.

The CAP survey contained useful national and international institutional types, but future international surveys ought to investigate ways in which more fine-grained institutional detail can be provided. These could include variables for PhD granting (or not), comprehensiveness (e.g. the range of PhD programs), and inclusion in the Shanghai Jiao Tong University top-500 institutions or certain bands. Such characterisations would be transparent, simple and allow researchers to investigate how research behaviours and policies differ across universities of a certain research standing. The difficulty of greater institutional detail will be how to maintain confidentiality and there are no simple answers to this. However, for countries with multiple universities within the Top-500, it ought to pose less of a problem (e.g. 10 of the 18 CAP countries had at least 10 universities in the top-500, a further five countries had at least three in the top-500). For countries with few or no institutions within the Shanghai rankings this variable may not be appropriate, but it would remain relevant for benchmarking comparisons to others countries' top-500 universities.

A more complex and potentially insightful approach would be to utilise the dimensions offered by U-Multirank (F. A. Van Vught & Ziegele, 2012). These institutional dimensions extend beyond research and include internationally comparable institutional data on teaching

and learning, knowledge transfer, international orientation and regional engagement. For example, one could classify institutions internationally based on their bachelor or master graduation rates and examine its relationship to individual-level academic perspectives and engagement in teaching. Likewise, one could examine how individual-level engagement and perspectives on knowledge production differ between institutions based on industrial collaborative research or commercial income. Unfortunately it would be impossible to maintain institutional confidentiality of respondents if all dimensions were utilised. Further, as yet there are also only a limited number of universities included in the U-Multirank database. But for national teams who have the institution details for each respondent, the U-Multirank database could be a valuable tool for investigating or understanding differences in survey responses across institutions, particularly those that relate to teaching. Therefore, the fifth recommendation is to:

5. Increase institutional-level detail to include multiple institutional classifications.

Teichler (2014) outlines the dangers and pitfalls of comparative research projects which lead to unfulfilled ambitions. Many of these challenges have been noted in this essay and the individual articles contained in the dissertation, such as a lack of detailed contextual knowledge and difficulties translating concepts into English which carry different meanings in different countries. This can lead to overly descriptive research, such as comparing results across countries, but ultimately leaving it up to the reader to determine whether the comparisons are meaningful. These challenges are not necessarily unique to comparative research. Many researchers struggle to apply complex concepts to different contexts, but an additional challenge of comparative research is the selection of countries. Comparative research often involves teams of researchers, each sourcing their own resources. Decentralised funds can impact the quality of the data collection, such as adequacy of resources for survey translation, survey mail outs and the time available to staff for verifying the data against the sampling framework. Although many publications discuss

the limitations of cross-country comparisons and the quality of country-level data (sometimes excluding certain countries in the process), few describe how the selection of countries is strongly shaped by coincidental factors such as interpersonal relationships between project members and adequacy of funds. Lack of finances was noted as the reason why some important countries, such as France, India and Russia, were not part of the CAP project (Teichler et al., 2013b).

The CAP project was commendable for the number of countries and regions covered, spanning the Americas (five countries), the European Union (seven countries), Asia (four countries, plus Hong Kong), Australia and South Africa. However, the sample was skewed towards OECD countries (13 in total), while the remainder were middle income countries (Argentina, Brazil, China, Hong Kong, Malaysia, South Africa). Only one country was from Africa and its data was not suitably verified. Low income developing countries were absent. The challenges of including more developing countries within international comparative projects should not be underestimated, but nor should the significance of their inclusion be underestimated. It is within the developing world that most of the growth in university participation will occur in the coming decades. Within the OECD countries, around half of all persons under the age of 25 already enrol in tertiary education (OECD, 2012, p. 348). Many of these mature higher education systems are approaching universal domestic participation in higher education, and have small and aging population bases by world standards. Although OECD countries are expected to expand their domestic participation further and continue to host many international students, the most rapid expansion in student participation is expected to be outside this region. It is estimated that by 2020, four countries will account for half of the world's 18-22 population (India, China, USA and Indonesia), with a further quarter located in 10 countries (Pakistan, Nigeria, Brazil, Bangladesh, Ethiopia, Philippines, Mexico, Egypt and Vietnam) (British Council, 2012). Only three of these fourteen countries were part of the CAP project. Likewise, by 2020 China, India, USA and Brazil are expected to account for more than half of the world's

tertiary enrolments, with Indonesia, Turkey and Nigeria also becoming key players (British Council, 2012).

The academic profession faces different challenges in different countries. In developing countries, there is likely to be an undersupply of qualified academic labour to meet education demands. It is estimated that less than 10 percent of the academic profession holds doctoral degrees in the developing world (Altbach et al., 2009). Even within China, less than 10 percent of academics outside the top research universities have PhDs (p. 92). This is not the case in many OECD countries where there is an apparent oversupply of PhDs relative to academic job openings, plus an inbound flow of academics and postgraduate students, often from developing countries (Smaglik, 2014; The Economist, 2010; Wadman, 2012). These flows are expected to continue, with the USA, UK, Germany and Australia projected to be the four main destinations for postgraduate students up to 2024 (British Council, 2014). What remains to be seen is what role international postgraduate students will play in the expansion in higher education within their home countries. Traditionally, the expatriate academics remained within the wealthier countries in the scientific centres, but more recently countries in East Asia have encouraged the return of their academic diaspora. Wealthier countries in the Middle East have also sought to compete internationally for academic talent (Altbach et al., 2009; Welch & Zhen, 2008).

Much like a national survey of the academic profession would underestimate diversity and differentiation by excluding casual and adjunct staff, international comparative studies provide an incomplete picture if certain types of countries are systematically underrepresented. Future surveys do not necessarily need to include more countries, but a more balanced representation of countries by geography and economic status would provide a better indication of the status of the academic profession around the world. A priority ought to be the inclusion of countries from South Asia, Africa and the Middle East, in exchange for countries from regions where academic

surveys are more common, such as Western Europe and North America. Therefore, the sixth recommendation is to:

6. Extend the coverage of academic surveys to South Asia, Africa and the Middle East.

Finally, rather than offer another recommendation which will likely require additional resources, I would like to conclude with an acknowledgement of one of the successes of the CAP project which had very few financial costs and enormous benefits. Reflecting on the pitfalls of comparative research, (Teichler (2014)) concluded that in most comparative research projects he had been part of, the dedicated funds had expired before the stage of interpretation and intensive data analysis. This meant that the full value of comparative data could not be fully realised. While this may or may not have been the case with the CAP project, this PhD dissertation (as well as my previous master dissertation) demonstrates that dedicated project funds are not a barrier to deep analysis of comparative data. When project teams are competent in the collection of data and willing to share it openly, it provides great opportunities for students and junior researchers to conduct secondary data analyses and become part of an international network of researchers. This network is large and productive. When the University of Kassel published a bibliography for the CAP project in April 2012, there were more than 200 publications with around 90 unique first authors. Since then, there have been at least another 200 CAP publications recorded in Google Scholar. The CAP project leaders' inclusiveness and openness has without doubt meant that the ground is fertile for future comparative research on the academic profession.

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Appendix 1-A. Classification of research universities

Country	Included	Excluded
Argentina	Elite University	Teaching Institution
	Massive University	
	Elite and Massive University	
	Massive & Teaching Institution	
	Teaching & Research Institution	
	Teaching & Research Elite Institution	
	Teaching & Research Massive Institution	
	Teaching & Research Massive Elite Institution	
Australia	All Go8, ATN, IRU, and other universities	None
Brazil	Public Federal University	Municipal University
	Public State University	Private University
	Public Federal Research University	Federal College
	Public State Research University	State College
	Private Elite University	Municipal College
	Private Elite College	Private College
Canada	Medical/Doctoral University	None
	Comprehensive University	
	Primarily Undergraduate University	
China	National Public University	Local Public College
	Local Public University	
Finland	Higher education institution or research institute	Type of higher education institute

Appendix 1-A. Classification of research universities (cont.)

Country	Included	Excluded
Germany	University	University of applied sciences (Fachhochschule) Art academy (Kunsthochschule)
Japan	National Research University Private Research University	National non Research University Private non Research University
Korea	Comprehensive university Research university Doctoral university Research active university	None
Malaysia	Public University Private University	University college Private university college Private college, Other
Mexico	Universities (research oriented & doctoral granting)	Other higher education institutions
Netherlands	University	HBO/ University of Applied Sciences
Norway	University	University of applied sciences (Vitenskaplig hoegskole)
United Kingdom	Russell Group Other pre-1992 Post-1992 Post-2004	HE college
United States	Public University Private University	University college Private university college

Appendix 1-B. Classification of academic ranks for international comparisons

Country	Senior position	Junior
Argentina	Titular	Adjunto
	Asociado	Jefe de Trabajos Prácticos
		Ayudante de 1ra
		Others
Australia	Level E (Professor)	Level C (Senior Lecturer)
	Level D (Associate Professor)	Level B (Lecturer)
		Level A (Associate Lecturer)
Brazil	Full professor or researcher	Assistant professor or researcher
	Associate professor or researcher	Assistant
		Not in the career track
Canada	Professor	Assistant Professor
	Associate Professor	
China	Professor	Lecturer
	Associate professor	Assistant lecturer
		Undecided rank
		Other
Finland	Professor	Lecturer
	Principal Lecturer	Other Junior
	Assistant Professor	
	Other Senior	

Appendix 1-B. Classification of academic ranks for international comparisons (cont.)

Country	Senior position	Junior
Germany	Professor Category C4, W3 or similar	Professor category C2 or similar
	Professor category C3, W2 or similar	Junior professor
		Other kind of Professor (Hochschullehrer)
		Other academic Position above entrant position
		Other academic Position on typical entrant position or below
Hong Kong	Professor	Senior lecturer
	Associate professor	Assistant professor
		Lecturer
		Other
Italy	Professor	Assistant professor
	Associate professor	Other
Japan	Professor	Lecturer
	Associate professor	Other
Korea	Professor	Assistant professor
	Associate professor	Lecturer
Malaysia	Professor	Senior lecturer
	Associate professor	Assistant professor
		Lecturer
		Other
Mexico	National specific method	National specific method

Appendix 1-B. Classification of academic ranks for international comparisons (cont.)

Country	Senior position	Junior
Netherlands	Professor	Assistant professor - UD
	Associate professor - UHD	Research fellow Postdoc
	Senior researcher 2	
Norway	Professor 1	Assistant professor (Amanuensis)
	Associate professor (Foersteamanuensis)	Assistant professor (Univeristets- og hoegskolelektor)
	Associate professor (Foerstelektor)	
United Kingdom	Professor	Lecturer
	Senior lecturer/researcher/reader	Other
United States	Professor	Assistant professor
	Associate professor	Lecturer
		Other

2. Academic work from a comparative perspective: A survey of faculty working time across 13 countries

Peter James Bentley & Svein Kyvik

Abstract

Sociological institutional theory views universities as model driven organizations. The world's stratification system promotes conformity, imitation and isomorphism towards the "best" university models. Accordingly, academic roles may be locally shaped in minor ways, but are defined and measured explicitly in global terms. We test this proposition using data on the allocation of working time between academic tasks at research universities in thirteen countries: Argentina, Australia, Brazil, Canada, China, Finland, Germany, Hong Kong, Italy, Malaysia, Norway, UK, and the USA. We find that working time patterns differ significantly across countries, suggesting that conditions of academic work remain heavily dependent on national higher education traditions. Faculty members holding the highest professorial rank share more in common, with generally stronger interests in research and a greater time dedication to research over teaching. However, in countries with comparably steep academic hierarchies, professor positions typically entail significantly fewer teaching hours and more administration.

Keywords: higher education, academic profession, working time, workloads, isomorphism.¹

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2.1 Introduction

North America, Europe and emerging Asian countries stand on the brink of a postindustrial knowledge society. The modern research university – with its teaching, research and service missions – stands as the pivotal institution because it produces knowledge (research), and transmits knowledge to students (teaching) and to societal stakeholders (service) (Scott 2006). Internationalization has brought about a worldwide convergence in the mission complexity of universities, and in an overview of challenges to the faculty in many countries, Welch (2005) notes that there seems to be a pressure to do more with fewer resources and difficulty in meeting multiple research, teaching and administrative responsibilities, as each component has become more demanding. Traditional self-determination and autonomy over faculty working times has come under increasing scrutiny as universities around the world have faced calls for improved productivity, efficiency and accountability. Faculty still consider themselves as independent professionals, but management discretion has grown relative to academic autonomy in many countries, leaving academics as increasingly “managed professionals” (Rhoades 1997; Slaughter and Leslie 1997). Yet, we know relatively little about the extent to which the emphasis on various missions and work tasks differ between countries.

Former studies undertaken in different countries show that there are large differences between individual faculty members in research universities in how they spend their working time (see e.g. Altbach 1996). There is also ample evidence of differences in working time patterns between universities within a single country (see e.g. Milem et al. 2000, Schuster and Finkelstein 2006). But while the distribution of working time has been examined by many individual universities and in many countries, cross-country comparative studies are in short supply. The Carnegie study of the international academic profession undertaken in 1992-93 included questions on working time, but the results were insufficiently analyzed (Altbach 1996). Based on that study, Enders and Teichler (1997) show evidence of cross-national differences in the allocation of time in research universities across

countries, but their findings are affected by the inclusion of faculty members with different temporal employment contracts (e.g. part-time faculty) and duties classifications (e.g. teaching-only and research-only faculty). Thus, the issue of national similarities and differences in faculty working time is not yet fully examined.

The purpose of this study is to compare national aggregates of individual working time patterns of faculty in universities with similar research missions in a selection of countries across the globe. To ensure national differences in the extent of non-standard academic employment do not skew cross-national comparisons, this study examines differences in working time patterns of full-time faculty in combined teaching and research positions.

Our analytical approach is drawn from sociological institutional theory. In their seminal paper on higher education as an institution, Meyer et al. (2007) use such a perspective to interpret change in educational systems, structures and contents. They argue that the nature and meaning of higher education has been institutionalized over a very long period of time and now applies commonly throughout the world. This implies that the meaning of categories such as university or professor “may be locally shaped in minor ways but at the same time have very substantial historical and global standing. These wider meanings obviously have pervasive impacts on the content and character of local settings” (Meyer et al. 2007, 187). Furthermore, “universities and colleges, together with their disciplinary fields and academic roles, are defined, measured, and instantiated in essentially every country in explicitly global terms” (Meyer et al. 2007, 188).

As universities compete in their ranking vis-à-vis all others, institutional theory predicts isomorphic change towards the practice of the most successful institutions. In the USA, there is some evidence of this process, as institutions with different research and teaching missions have become increasingly similar in their faculty working time patterns (Milem et al. 2000). There are also good reasons to

assume that this process is taking place across the globe. This theoretical approach is concerned with the diffusion of ideas and practice from countries possessing a cultural hegemony to the rest of the world, and the subsequent institutionalization of similar organizational structures, rules and norms across countries. An underlying assumption is that universities and their faculty in other countries will try to emulate the research and teaching practices of research universities in the English-speaking world, including the working conditions of academic staff. Faculty members collaborate increasingly with colleagues in other countries, preferably in the leading research nations, they have sojourns at universities abroad, and norms for good professorial practice and working conditions are effectively spread.

Based on this theoretical approach we have put forward some hypotheses that can be tested. First, at this stage in the historic development of research universities differences in working time patterns across countries should be relatively small. The academic world is hierarchic, with Anglo-American research universities setting the standards and practices to which institutional isomorphism suggests the rest of the world will follow. The purposeful management of universities based on standardized ranking scales de-emphasizes horizontal differences and diversity in institutional mission (Marginson 2007). Performance management of faculty, as well as institutions, has been implemented across a range of countries. Such practices have reduced self-determination over how academics divide their time between teaching and research (Enders and Musselin 2008).

Second, differences in working time patterns should be smallest between English-speaking countries and those culturally close to the English-speaking world. According to Enders and Musselin (2008), the effects of internationalization varies across countries based on the dominance of the national higher education system, economy, geography, culture, language and integration with the international center of the academic world. The size, power and economic success of the USA guarantees a worldwide influence and elements of the

American research university model have been exported to many countries across the globe (Jones 1992). Academics in the USA, and to a lesser extent the UK, are comfortably placed in the center of the internationalization process, acting primarily as hosts to foreign academics and enjoying hegemony over the language that defines international research and reputation (Enders and Musselin 2008). Faculty in large, non-English speaking countries with strong higher education traditions may also be relatively insular in their outlook, due to large domestic research audiences. By contrast, international networks are indispensable to academics in small and peripheral countries.

Third, because the notion of full professor is common across countries, we expect working time patterns to be most similar between faculty sharing the highest professor rank. Institutional theory contends that the professionalization and structure of the academic career supports “normative isomorphism” as one approaches the highest rank of professor (DiMaggio and Powell 1983). The academic profession contains codes of conduct and common socialization patterns, from the entry level to full professor, which operate as a filter for career progression. Individuals with the highest rank share a common set of attributes and approaches to work that are normatively sanctioned and legitimated. Throughout their career, professors observe a common pattern of time allocated by other faculty, which is mimicked and reinforced by the academic socialization and reward systems (Milem et al. 2000, 472).

The results of this study should be of theoretical as well as practical interest. Theoretically, the study examines to what extent institutional theory can provide a basis for explaining similarities and differences in academic practice across countries. Practically, the study provides useful information to policy-makers, institutional leaders and faculty members on working time patterns in research universities in different national settings.

2.2 Data and methods

The data for this study comes from the Changing Nature of the Academic Profession (CAP) project, an international survey of faculty members conducted in 2007/2008. We distinguish between countries in four culturally different regions: *English language region* (Australia, Canada, UK, USA); *Western Europe* (Finland, Germany, Italy, Norway); *Asia* (China, Hong Kong, Malaysia); and *Latin America* (Argentina, Brazil).

The sample

The sample is confined to 13 countries in which the quality of working time data holds a sufficient level for our analysis. To ensure all included respondents are employed in combined teaching and research positions at research universities, we excluded all staff employed in teaching focused universities, all staff classified as researchers, those without at least one hour per week on both teaching and research activities, all respondents without full-time contracts, and those who reported fewer than 30 hours per week.

The response rates were mostly below 40 percent. Non-respondents may differ from respondents in their research profile and there is a risk of non-response bias in the sample. While the national samples were found to be broadly representative of the respective populations on strata such as gender, academic rank and institutional type, full professors were overrepresented in most samples. Therefore, we weight the national samples based on academic rank. We classified respondents into five academic fields based on the UNESCO guidelines (1978). Details of the national samples by academic field, the size of the sub-sample used in our study and survey response rates, are listed in Table 2-1.

Table 2-1 Proportion of faculty by academic field, sample size (N) and response rate

	Social sci.	Humanities	Natural sci.	Technology	Medicine	(N)	Response rate
Argentina	17%	12%	39%	21%	11%	(371)	34%
Australia	36%	15%	23%	7%	20%	(526)	25%
Brazil	26%	11%	29%	10%	24%	(261)	26%
Canada	37%	17%	23%	8%	15%	(702)	17%
China	21%	13%	30%	31%	4%	(429)	86% ^a
Finland	33%	20%	20%	12%	15%	(393)	29%
Germany	25%	11%	31%	20%	14%	(612)	32% ^a
Hong Ko.	44%	22%	14%	8%	12%	(527)	13%
Italy	21%	12%	41%	16%	11%	(1,358)	35%
Malaysia	24%	8%	23%	35%	10%	(316)	30% ^a
Norway	29%	16%	28%	10%	17%	(366)	36%
UK	35%	20%	19%	9%	17%	(569)	15% ^a
USA	37%	21%	19%	9%	13%	(687)	23%
Total	29%	15%	28%	15%	13%	(7,117)	28%

^a Response rate includes a small number of universities without combined teaching and research missions, excluded from our final sub-sample.

Further national-level sampling details, see: Vabø and Ramberg (2009) (Norway) and RIHE (2008) (all other countries).

Time use: measurement and methodological challenges

The CAP survey asked academic staff to report the number of hours they typically spend per week across five categories of tasks: teaching, research, service, administration, and other academic activities. Staff members reported these estimates for two separate time periods:

when classes are in session and *not* in session. The survey question is reproduced in Table 2-2.

Table 2-2 Considering all your professional work, how many hours do you spend in a typical week on each of the following activities? (If you are not teaching during the current academic year, please reply to the second column only.)

Hours per week when classes are in session	Hours per week when classes are <u>not</u> in session	
		Teaching (preparation of instructional materials and lesson plans, classroom instruction, advising students, reading and evaluating student work)
		Research (reading literature, writing, conducting experiments, fieldwork)
		Service (service to clients and/or patients, unpaid consulting, public or voluntary services)
		Administration (committees, department meetings, paperwork)
		Other academic activities (professional activities not clearly attributable to any of the categories above)

Self-reported measures of working time raise, however, several methodological problems. Firstly, self-estimates of typical working hours are subject to errors of recall. When compared to diary-keeping records, which arguably offer a more accurate measure of actual working hours, self-reports have been found to over-represent working time for persons reporting the longest hours and under-represent actual hours for those reporting the shortest hours (Robinson and Bostrom 1994). In addition, flexible work schedules

may negatively affect the accuracy of self-reported data when compared to actual working hours.

However, Jacobs (1998) compared self-reports to documented arrival and departure times at work and found no systematic bias based on job attributes (e.g. flexibility) or personal attributes (e.g. stress and family responsibilities). Self-reports of extremely long or short working hours did, on average, differ more from arrival and departure times, but this is due to “regression from the mean” rather than systemic bias. As both methods of working time measurement are subject to random error (and therefore not perfectly correlated), predicting actual hours from self-reported hours (and vice versa) will always be subject to greater error at the upper and lower extremes. Given the professional autonomy academics have beyond teaching and administrative hours, self-reports seem appropriate when estimating typical working hours in academia. However, as we are interested in examining typical working hours for full-time employees only, it is important to minimize the influence of outliers at the upper end of the measure. Therefore, we place an upper limit of weekly working time at 70 hours and recode outliers accordingly.

The second methodological problem is the overlapping nature of academic duties. Background reading is often undertaken without knowing whether it will ultimately contribute predominantly to teaching or research. Time spent advising students is defined as a teaching duty in the CAP survey, but Kyvik and Smeby (1994) found that close to 50 percent of faculty members regarded supervision of PhD students as benefiting their own research “to a great extent”, though this varied between approximately 20 percent in the humanities and social sciences and about 60 percent in the natural sciences, medicine and technology. This indicates that academics from different fields may define the same tasks differently. Research funding applications and the administration of research projects also overlap research or administration. The problem of separating different work activities into the specific categories of tasks given in the questionnaire is a methodological challenge. Still, we assume that there is some general understanding across countries of what is meant

by teaching, research and administration, which are the central activities. However, the notion of “service” to society is a fundamentally North-American concept (Ward 2003) and may be confused with service to the government of the nation state in countries with traditions of nationalized universities (Scott 2006). Even though “service” was defined in the questionnaire, respondents may differ in which activities they include in this category.

A third methodological problem is generalizing typical weekly hours for teaching and non-teaching periods, and across the entire year. A frequently stated barrier to research is a lack of uninterrupted time. Flexible practices allow the faculty to focus teaching loads in parts of the academic year, while freeing up time for concentrated research in others. The number of teaching semesters can also vary between universities. For example, most American universities conform to the standard two 14 to 17 week teaching semesters, but others use three 10 week “quarters” for teaching. Therefore, while teaching periods roughly cover 30 of the 46 to 47 weeks of a working year, some faculty members will negotiate longer non-teaching periods by concentrating teaching in certain teaching periods. Teaching loads can also vary across years, as academics may benefit from sabbatical or other leave entitlements from teaching duties. We annualize weekly hours by combining estimates for teaching and non-teaching periods, assuming classes are in session for two thirds of the academic year.

Finally, the CAP survey uses an inclusive definition of working time, including tasks which go beyond what would be considered working time in broader labor force surveys. For example, unpaid voluntary service to the community may be strictly at the discretion of the individual and not included as working time in other professions. Bellas and Toutkoushian (1999) show evidence that the often reported 50 hour average working week in academia is partly due to the inclusion of unpaid overtime or professional commitments outside the institution. Norwegian surveys indicate that academic staff use about 5 hours per week for unpaid or paid work external to the university (Kyvik 2000). Massy and Zemsky (1994) argue that the American faculty have increased their discretionary time available for research

and the pursuit of personal goals, and loosened their institutional responsibilities to teaching. However, Jacobs and Winslow (2004) emphasize that American faculty across all institutional types (teaching or research-focused) face pressures to keep up to date with disciplinary research outside regular and paid working hours. Overall, faculty will differ in the extent that their working time is discretionary and this could have implications for comparisons across institutions, academic ranks and countries.

Tests of significance and regional weightings

When making pairwise comparisons, such as between professors and lower ranked staff, we adopt an independent samples *t*-test with a 95 percent significance level. For multiple pairwise comparisons, comparisons between each of the 13 countries, we use a one-way ANOVA Games-Howell multiple comparisons test with a 95 percent significance level. This choice is justified based on the unequal group sizes and variances in working hours. The Games-Howell test is preferable under such sub-optimal conditions as it maintains robust significance levels (Jaccard et al. 1984). Given the differences in country sample sizes, countries are weighted equally in regional and total (all countries) mean and standard deviation calculations.

2.3 Results

Full-time faculty at universities across all countries worked 48.4 hours per week during the teaching semester. The working week during the teaching semester was longest in the English-speaking countries (50.1), followed by Asia (49.7), Western Europe (48.3) and Latin America (45.4). Roughly one fifth of the faculty reported 60 hours or more per week during the teaching semester. Total working hours were significantly longer in Hong Kong (52.8), USA (51.4), Canada (51.1) and Germany (50.2), compared to Finland (47.2), Italy (46.9), Malaysia (46.3), Brazil (45.7) and Argentina (45.2). Our less restrictive definition of full-time faculty (minimum 30 hours per week) and

maximum limit of 70 hours per week, gives a slightly shorter average working week than some previous studies of the academic profession (Jacobs and Winslow 2004). However, when using comparable restrictions (minimum 35 hours per week, no maximum hours), our results indicate a working week of 50.5 hours across all countries. Table 2-3 shows the typical weekly working hours of faculty during the teaching semester across the 13 countries.

Table 2-3 Mean weekly hours on academic activities when classes are in session, by country and region.

Country/Region	Teaching	Research	Admin.	Service	Other	Total	N
English-speaking	20.4*	14.3*	9.1*	3.2*	3.2*	50.1*	2484
Australia	19.7	13.7*	9.7*	3.0*	3.0	49.2*	526
Canada	21.0	16.1*	7.7*	3.5*	2.9	51.1*	702
UK	20.0	12.6*	11.1*	1.4*	3.6	48.8*	569
USA	20.7	14.6	8.0*	5.0*	3.1	51.4*	687
Western Europe	20.1*	16.3*	5.7*	3.3	2.9*	48.3*	2729
Finland	23.4*	12.6*	6.0*	2.6*	2.6	47.2*	393
Germany	15.5*	20.1*	5.0*	6.1*	3.4*	50.2*	612
Italy	19.4*	18.1*	4.5*	2.5*	2.4*	46.9*	1358
Norway	22.0*	14.3*	7.3*	2.1*	3.3*	48.9	366
Asia	20.7*	14.9*	7.8*	3.4*	3.0	49.7*	1272
China	20.6	18.8*	5.4*	2.9	2.2*	49.9*	429
Hong Kong	21.7	15.9*	8.3*	3.6	3.4*	52.8*	527
Malaysia	19.7	10.0*	9.7*	3.7	3.3*	46.3*	316
Latin America	17.2*	17.5*	5.4*	2.7*	2.6*	45.4*	632
Argentina	14.8*	20.7*	4.6	2.9	2.2	45.2	371
Brazil	19.6*	14.4*	6.3	2.5	3.0	45.7	261
All countries	19.6	15.7	7.0	3.2	2.9	48.4	7117

* ANOVA significant difference in means between given country and at least one other country within the same region, or significant difference between given region and at least one other region, $p > 0.05$.

When classes are in session, working time across all countries was divided between duties as follows: teaching (40 percent), research (32 percent), administration (14 percent), service (7 percent), and other academic activities (6 percent). However, there are significant

differences between countries in the time spent on each of the five academic activities. The number of hours spent on research differs significantly across most countries and is particularly low in Malaysia, while teaching hours are somewhat more common. Working time patterns in Western Europe and Latin America are remarkably diverse during the teaching period, suggesting that faculty members share little in common with their geographical counterparts in their teaching, research and administrative workloads.

During the non-teaching period, faculty reduce their working time, on average, by 3.7 hours per week and divide their time between duties as follows: teaching (17 percent), research (53 percent), administration (15 percent), service (8 percent), and other academic activities (7 percent). As a proportion of total hours, they continue to spend about 70 percent of their time on teaching and research, but time allocations shift away from teaching and towards research. Teaching consumes less than half as much time while classes are not in session, while research increases to a majority of all working hours. However, even during the non-teaching periods there are significant differences across countries and regions in working time allocations. Faculty members in Brazil increase their already modest research hours during the teaching period only marginally when classes are not in session, while in Malaysia they continue to spend the fewest hours on research. This is in contrast to countries such as Finland, Norway, Canada and Hong Kong, where comparably high teaching hours during the teaching period are substituted for research during the non-teaching period. Table 2-4 shows the typical weekly working hours of faculty across the 13 countries when classes are not in session.

Table 2-4 Mean weekly hours on academic activities when classes are not in session, by country and region.

Country / Region	Teaching	Research	Admin.	Service	Other	Total	N
English-speaking	7.2*	24.7*	8.1*	3.5*	3.6*	47.0*	2484
Australia	8.4*	22.0*	9.6*	3.2*	4.1*	47.2	526
Canada	5.6*	29.1*	6.6*	3.7*	2.8*	47.9*	702
UK	8.3*	24.1*	9.6*	1.6*	4.1*	47.7*	569
USA	6.3*	23.6*	6.4*	5.5*	3.2*	45.1*	687
Western Europe	8.0*	26.2*	5.2*	3.5*	3.3*	46.2*	2729
Finland	8.8*	24.6*	5.4	2.7*	2.9*	44.4*	393
Germany	7.1*	27.2*	4.0*	6.4*	3.7*	48.5*	612
Italy	7.7	28.7*	4.7*	2.7*	2.6*	46.4*	1358
Norway	8.5	24.2*	6.7*	2.2*	3.9*	45.5*	366
Asia	8.1*	23.7*	8.4*	3.9*	3.4*	47.5*	1272
China	7.5	27.4*	5.9*	3.5	2.5*	46.8*	429
Hong Kong	7.4*	27.2*	8.4*	4.1	3.8*	50.8*	527
Malaysia	9.5*	16.5*	10.9*	4.2	3.9*	45.1*	316
Latin America	7.2*	21.2*	4.5*	2.7*	2.5*	38.1*	632
Argentina	6.3*	24.3*	4.6	3.0	2.3	40.4*	371
Brazil	8.1*	18.2*	4.5	2.4	2.7	35.9*	261
All countries	7.6	23.9	6.6	3.4	3.2	44.7	7117

* ANOVA significant difference in means between given country and at least one other country within the same region, or significant difference between given region and at least one other region, $p > 0.05$.

Assuming classes are in session for two thirds of a year, full-time academics across all countries worked roughly 47 hours per week across the entire year. Longest hours are found in the English speaking countries (49.1) and Asia (49.0), followed by Western

European (47.6) and Latin American countries (43.0). The faculty in Hong Kong worked the longest hours per week (52.2), significantly more than all other countries. By contrast, in Brazil they worked the fewest hours (42.4), significantly fewer than all other countries except Argentina. Across the entire year, working time across all countries was divided between duties as follows: teaching (33 percent), research (39 percent), administration (15 percent), service (7 percent), and other academic activities (6 percent). The annualized working time patterns of faculty across the 13 countries are indicated in Table 2-5.

Table 2-5 Annualized weekly hours on academic activities, mean and standard deviation, by country and region

Country / Region		Teach.	Research	Admin.	Serv.	Other	Total	n
English-speaking	Mean	16.0*	17.7*	8.8*	3.3*	3.3*	49.1*	2484
	S.D.	8.3	10.2	7.6	4.5	3.9	9.5	2484
Australia	Mean	15.9	16.5*	9.7*	3.0*	3.4	48.5	526
	S.D.	8.4	10.2	7.5	4.2	3.5	9.3	526
Canada	Mean	15.9	20.4*	7.3*	3.5*	2.9*	50.0	702
	S.D.	7.4	9.2	6.6	5.2	4.0	9.3	702
UK	Mean	16.1	16.5*	10.6*	1.5*	3.8*	48.4	569
	S.D.	9.3	10.2	8.7	3.1	4.1	9.2	569
USA	Mean	15.9	17.6*	7.4*	5.2*	3.1	49.3	687
	S.D.	8.0	11.0	7.5	5.5	3.8	10.2	687
Western	Mean	16.1*	19.6*	5.6*	3.4	3.0*	47.6*	2729
Europe	S.D.	8.2	9.8	5.3	6.4	4.1	8.9	2729
Finland	Mean	18.5*	16.6*	5.8*	2.6*	2.7	46.3*	393
	S.D.	9.0	9.0	5.6	4.3	3.2	8.3	393
Germany	Mean	12.7*	22.5*	4.7*	6.2*	3.5*	49.6*	612
	S.D.	9.2	11.5	5.6	10.9	5.0	9.1	612
Italy	Mean	15.5*	21.6*	4.6*	2.6*	2.5*	46.7*	1358
	S.D.	7.3	9.6	4.6	6.7	4.0	9.5	1358
Norway	Mean	17.5*	17.6*	7.1*	2.1*	3.5*	47.8	366
	S.D.	7.2	8.9	5.6	3.5	4.0	8.7	366

* ANOVA significant difference in means between given country and at least one other country within the same region, or significant difference between given region and at least one other region, $p > 0.05$.

Table 2-5 Annualized weekly hours on academic activities, mean and standard deviation, by country and region (cont.)

Country / Region		Teach.	Research	Admin.	Serv.	Other	Total	n
Asia	Mean	16.5*	17.8*	8.0*	3.6*	3.1*	49.0*	1272
	S.D.	8.6	9.8	7.8	5.0	3.7	11.1	1272
China	Mean	16.3	21.6*	5.6*	3.1	2.3*	48.9*	429
	S.D.	8.9	11.6	7.7	5.3	3.3	12.4	429
Hong Kong	Mean	16.9	19.6*	8.3*	3.7	3.6*	52.2*	527
	S.D.	9.2	10.9	8.0	4.3	4.3	9.9	527
Malaysia	Mean	16.3	12.2*	10.1*	3.9	3.5*	45.9*	316
	S.D.	7.7	6.8	7.8	5.4	3.5	11.0	316
Latin America	Mean	13.8*	18.8*	5.1*	2.7*	2.6*	43.0*	632
	S.D.	6.1	8.5	5.9	4.2	3.6	8.1	632
Argentina	Mean	11.9*	21.9*	4.6	2.9	2.2	43.6	371
	S.D.	4.9	8.3	6.0	4.1	3.4	7.2	371
Brazil	Mean	15.8*	15.6*	5.7	2.4	2.9	42.4	261
	S.D.	7.2	8.7	5.9	4.4	3.8	9.0	261
All	Mean	15.6	18.5	6.9	3.2	3.0	47.2	7117
Countries	S.D.	7.8	9.5	6.7	5.0	3.8	9.4	7117

* ANOVA significant difference in means between given country and at least one other country within the same region, or significant difference between given region and at least one other region, $p > 0.05$.

Annualizing the working time patterns across the entire year provides a more accurate representation of working hours across countries, but large differences remain evident across countries and within regions. Comparing the balance of working hours between the core duties of teaching and research, Finland and Malaysia are unique in their heavier dedication of time towards teaching. The faculty in Australia, UK, Norway and Brazil divide their time roughly equally between the

two activities. In Canada, USA and Hong Kong they spend more time on research than teaching, but research hours are greatest in China, Italy, Argentina and Germany, the countries with the shortest administration hours. Service is a relatively minor activity for faculty in most countries, but occupies a reasonably large share of working time in USA (11 percent) and Germany (13 percent). The longer hours dedicated to service is consistent with the deep historical significance of faculty service in both countries. However, faculty service has very different historical meanings. In an American context, faculty service traditionally involves “service to the public”, “civic engagement” and “democratization”, while in a German context, where academics are public sector employees, service has traditionally involved “service to the state” (Scott 2006).

Expansion of student numbers relative to staff is a global phenomenon, but the extremely short teaching hours in Argentina would suggest that this trend has affected the Argentine faculty differently. University student enrolment in Argentina approximately doubled from 1980 to 1990, and again from 1990 to 2000 (Marquina and Lamarra 2008, 365). While the Argentine faculty appear unique in their significantly fewer teaching hours (11.9), overall teaching loads within Argentine universities may not differ from countries as greatly as the data for full-time faculty suggests. Part-time teaching faculty are not included in the sample, but part-time employees influence the working time patterns of full-time faculty. Full-time faculty account for 13 percent of the teaching staff in Argentine universities and their extensive role as auxiliary teachers clearly reduces the teaching loads and interests of full-time faculty (Marquina and Lamarra 2008, 368). Variation in the use of part-time teachers across countries thus is a considerable problem in the interpretation of national differences between full-time faculty members.

The differences in working time patterns across countries are partly due to differences in the relative interests of the faculty towards research and teaching. Those who declared a relatively stronger interest in research, reported on average eight extra hours per week on research than those whose interests lied in teaching (21.7 vs 13.7),

and four fewer hours per week on teaching (14.5 vs 18.2). Faculty members most frequently reported a stronger interest in research in Italy (79 percent), Norway (79), Germany (74) and the UK (72), and least frequently in Malaysia (54), USA (54) and China (56). However, the strength of the relationship between declared interests and research hours is skewed by USA, UK and Australia, where working time patterns appear to be more flexible. Faculty members with research interests in these countries spend roughly twice as many hours on research and 25 percent fewer hours teaching. Research interests have the weakest relationship with research and teaching hours in Brazil, Italy and Malaysia. Faculty with declared research interests in these countries spend roughly a third more hours on research and just over ten percent fewer hours on teaching.

While faculty differ greatly across countries in their working time patterns and relative interests in teaching and research, full professors are relatively similar across most countries. Professors declared a stronger interest in research over teaching compared to other faculty members (78 vs. 65 percent) and the differences were significant in Australia (93 vs. 62), China (69 vs. 53), Finland (85 vs. 59), Germany (81 vs. 73), Hong Kong (83 vs. 63), Italy (82 vs. 77), Malaysia (69 vs. 52), Norway (89 vs. 68), UK (95 vs. 68) and USA (63 vs. 50). Brazil was the only country where professors were significantly less likely to report a stronger interest in research (48 vs. 66). The generally stronger interest in research amongst professors translates into shorter teaching hours than lower ranked staff, but only slightly longer research hours. The working time patterns for professors only are shown in Table 2-6.

Table 2-6 Annualized weekly hours on academic activities, mean and standard deviation, professors only, by country and region

Country / Region		Teach.	Research	Admin.	Serv.	Other	Total	N
English-speaking	Mean	12.4**	20.4**	10.3**	4.1**	3.6	50.8**	702
	S.D.	7.0	10.3	9.2	5.6	4.2	9.5	702
Australia	Mean	10.1**	21.0*	12.5*	4.6	4.2	52.4*	56
	S.D.	6.3	10.5	11.1	6.7	4.1	10.4	56
Canada	Mean	14.0**	20.1	8.7*	3.8	3.1	49.7	246
	S.D.	6.7	9.5	8.1	5.1	4.6	8.7	246
UK	Mean	11.6*	21.0*	11.3	2.6**	4.1	50.6*	125
	S.D.	7.6	10.4	8.8	4.5	4.5	9.1	125
USA	Mean	13.7**	19.4*	8.6*	5.5*	3.0	50.3	275
	S.D.	7.4	10.7	8.8	6.3	3.4	9.6	275
Western Europe	Mean	15.6*	19.7*	8.1**	3.2**	4.0*	50.5**	912
	S.D.	7.1	9.1	6.2	5.1	4.7	8.9	912
Finland	Mean	15.8*	17.5*	8.9**	2.9	3.9*	48.9**	151
	S.D.	7.0	9.6	6.6	3.9	3.6	8.4	151
Germany	Mean	15.3*	19.8	9.1**	5.2**	5.6*	54.9**	159
	S.D.	7.3	8.1	6.5	7.4	6.6	8.8	159
Italy	Mean	15.0	21.6*	6.3**	2.1*	2.7*	47.7**	400
	S.D.	7.4	10.3	6.0	5.6	4.3	9.2	400
Norway	Mean	16.1*	19.7*	8.0*	2.7*	3.9	50.4**	202
	S.D.	6.5	8.6	5.9	3.6	4.3	9.0	202

* ANOVA significant difference in means between given country and at least one other country within the same region, or significant difference between given region and another region, $p < 0.05$.

+ Independent samples t-test significant difference between professors and lower ranked academics within country/region, $p < 0.05$.

Table 2-6 Annualized weekly hours on academic activities, mean and standard deviation, professors only, by country and region (cont.)

Country / Region		Teach.	Research	Admin.	Serv.	Other	Total	N
Asia	Mean	12.9*+	19.1*+	10.8*+	3.7	4.1+	50.5*+	302
	S.D.	7.5	9.7	9.6	5.7	4.1	10.5	302
China	Mean	14.1+	24.9*+	6.8*	2.4	2.4*	50.5	146
	S.D.	8.2	12.6	7.5	4.7	3.3	12.6	146
Hong Kong	Mean	11.9+	20.4*	12.2*+	4.0	4.7+	53.2	127
	S.D.	6.2	9.3	9.8	4.4	5.3	9.2	127
Malaysia	Mean	12.6+	11.9*	13.5	4.8	5.1*+	47.9	29
	S.D.	8.0	7.4	11.5	7.9	3.8	9.6	29
Latin America	Mean	13.9*	16.3*+	7.2*+	3.0*	2.8	43.1*	159
	S.D.	6.5	7.9	7.3	4.2	3.7	8.1	159
Argentina	Mean	11.9	19.1*+	7.3+	3.4	2.6	44.3	111
	S.D.	4.7	7.5	7.7	3.9	3.7	7.2	111
Brazil	Mean	15.9	13.5*+	7.1	2.5	2.9	41.9	48
	S.D.	8.2	8.3	6.9	4.5	3.8	9.1	48
All	Mean	13.7	19.2	9.2	3.6	3.7	49.4	2075
Countries	S.D.	7.1	9.4	8.1	5.3	4.2	9.3	2075

* ANOVA significant difference in means between given country and at least one other country within the same region, or significant difference between given region and another region, $p < 0.05$.

+ Independent samples t-test significant difference between professors and lower ranked academics within country/region, $p < 0.05$.

Professors reported 49.4 hours per week across the entire year and divided their time between duties as follows: teaching (28 percent), research (39 percent), administration (19 percent), service (7 percent), and other academic activities (7 percent). Compared to other faculty

members within their country, professors spent significantly fewer hours on teaching in all English-speaking and Asian countries, plus Finland and Norway. No significant differences between professors and other staff in teaching hours are found in Latin America or Italy. German professors were unique in reporting significantly more hours teaching than lower ranked staff.

The relationship between higher academic rank and teaching hours appears to be negative in most countries, but professor teaching hours vary significantly across countries and within the English-speaking region. The standard deviations in teaching hours are high relative to their means, particularly in Australia, UK and Malaysia where teaching appears to be a comparably minor duty for professors. Comparably less variation in teaching hours is found amongst professors in Norway, where professor teaching hours are longest. Professors in Western Europe appear to share common teaching loads of between 15 and 16 hours per week, but the differences in total working hours indicate that the relative requirements of teaching compared to other duties varies within this region.

The generally fewer teaching hours of professors does not necessarily translate directly into significantly longer research hours for professors compared to lower ranked colleagues. Professors report significantly more research hours than lower ranked academics in Australia, UK, USA, Norway and China, but the opposite is the case for professors in Argentina and Brazil where professors report significantly fewer hours on research. Differences are insignificant in the remaining countries. Tests of significance between professors and lower ranked academics within each country are affected by the smaller sample size of professors, but Italy is a particularly interesting case. Despite a very large sample size, there are no significant differences between Italian professors and other Italian faculty members in teaching or research hours.

Despite the generally stronger interests of professors towards research, we can safely reject the null hypothesis that there are no

differences across countries. However, this does not mean that differences are significant between all 13 countries; research hours are clustered around 20 hours per week in most countries. If we exclude the three countries in which professors differ most greatly from the others – Malaysia, Brazil and China – many of the differences in research hours amongst professors in the remaining 10 countries are insignificant.

Administration is perhaps the key activity that distinguishes professors from other academics in their working time patterns. Professors dedicated significantly more hours towards administration than lower ranked colleagues in all countries except UK, Malaysia and Brazil, where the relationship was positive but not significant. While there are numerous significant differences across countries in the mean administration hours of professors, this may be related to differences in teaching hours. Administration hours are longest for professors in the countries where teaching hours tend to be shortest, such as Australia, Hong Kong, UK and Malaysia. Hours dedicated to teaching and administration are perhaps less likely to be at the discretion of individual professors, resulting in a trade-off between the two institutionally directed activities.

Differences across countries in academic time use can also be attributed to national differences in the proportion of staff across academic field. To examine whether national differences in working time patterns remain after controlling for academic field, Table 2-7 lists the results of linear multiple regression for the working time variables, using the USA and social sciences as the reference categories (due to their median levels on most working time variables). Academic rank is not included as an independent variable as the proportion of full professors predominantly affects distribution of working time within countries, not between them. The regression results show that academic field, particularly being located in medicine, strongly affects on the number of hours spent on each of the academic duties. For example, after controlling for country, academics in medicine typically report 5.6 extra hours per week on service, 3.5 fewer hours on teaching and 1.4 fewer hours on research, compared to

academics in the social sciences. Research hours are also greater in the natural sciences, while teaching hours are greater in the humanities.

Table 2-7 Linear multiple regression unstandardized beta weights for effect of country and academic field on annualized weekly hours on academic activities

	Teaching	Research	Admin	Service	Other	Total
Constant	16.37*	17.10*	7.62*	4.84*	3.33*	49.26*
Australia	0.28	-1.05	2.24*	-2.42*	0.25	-0.70
Canada	0.17	2.73*	-0.12	-1.70*	-0.25	0.82
UK	0.38	-1.07	3.16*	-3.96*	0.65*	-0.84
Finland	2.71*	-0.95	-1.64*	-2.59*	-0.46	-2.94*
Germany	-2.62*	4.49*	-2.65*	1.03*	0.39	0.63
Italy	0.15	3.26*	-2.69*	-2.34*	-0.59*	-2.21*
Norway	1.91*	-0.18	-0.29	-3.23*	0.39	-1.39*
China	0.74	3.49*	-1.77*	-1.54*	-0.93*	-0.01
Hong Kong	0.87	2.20*	0.81	-1.42*	0.41	2.87*
Malaysia	0.85	-5.63*	2.68*	-1.14*	0.23	-3.01*
Argentina	-3.41*	3.60*	-2.73*	-1.98*	-0.85*	-5.37*
Brazil	0.42	-2.04*	-1.71*	-3.21*	-0.19	-6.73*
Humanities	1.82*	0.10	0.04	-0.66*	-0.40*	0.89*
Natural Sciences	-1.46*	3.21*	-0.68*	-1.02*	-0.63*	-0.57
Technology	-1.78*	0.68	-0.26	-0.15	0.38*	-1.13*
Medicine	-3.47*	-1.35*	-0.27	5.58*	-0.35*	0.13
Adjusted R-Square	0.06	0.09	0.08	0.15	0.20	0.05

Despite the strong academic field differences, the regression results also indicate that most of the national and regional differences remain

consistent and strong in their effects on time use. After controlling for academic field, total working hours and teaching hours do not differ significantly within the English-language region. Faculty in Germany and China also do not differ in the total working hours from their USA colleagues in similar academic fields, but the distribution of working hours more heavily favors research in these countries, along with Italy, Argentina and Canada. Administration hours remain significantly longer in the UK, Malaysia and Australia, compared to China, Brazil, Argentina and most Western European countries. Compared to the USA, service hours remain significantly shorter in all other countries, except Germany where academics typically report one extra hour per week than their American colleagues on this duty. Therefore, the greater service orientation of academics in Germany and the USA can not be attributed to national differences in the proportion of academics in fields of science where professional service is more common, such as medicine. Overall, the regression results confirm that national differences in total working hours and the distribution of time between tasks are significant, with very large differences in working time patterns between the USA and Germany, China and Argentina.

2.4 Discussion

According to Meyer et al. (2007), universities are no longer shaped by nationalist agendas, “we are once again in a transnational or global era and this should lead to a narrowing of organizational differences across universities within and between countries” (Meyer et al. 2007, 211). The world dominance of the twentieth century American multifunctional university or “multiversity” is now being replaced by an internationalization model for competing in the global market and serve world-wide-stakeholders (Scott 2006). Academic credibility is increasingly defined in global terms through standardized university rankings, which promote vertical segregation and discourage specialization or diversity in university mission (Marginson 2000, 2007).

The first objective of this study was to investigate whether the spread of these images translates into similar day-to-day academic duties. We hypothesized that institutional isomorphism would underpin increasingly common working time patterns of full-time faculty at research universities in our 13 country sample, with few differences between faculty in the USA and other countries due to the hegemonic position of American research universities. Overall, our data does not support such conclusions. Faculty vary greatly within and between countries in their total working hours and distribution across tasks. On each of the three core academic duties – teaching, research and administration – we noticed large differences in the mean number of hours faculty members dedicate to each activity. Teaching hours varied least across countries, with full-time faculty reporting 16 to 17 hours per week on teaching in 10 of the 13 countries. With the exception of Germany and Argentina, where research received a clear precedence over teaching, research universities in most countries share a common engagement in teaching from their full-time faculty in similar academic fields. However, the large variation in research and administration hours indicated significant national diversity in working hours, with weak support for convergence across countries towards a common working time practice.

National differences in working time patterns are likely due to a combination of differences in institutional expectations, professional norms and the proportion of faculty by academic field. For example, the proportion of faculty within the natural sciences was highest in China, Argentina, Italy and Germany, the countries where research hours were longest. However, after controlling for academic field in our regression analyses, the effect of being located in such countries remained positive and significant as a predictor of research hours (see Table 2-7). This suggests that national differences extend beyond traditional disciplinary differences in research expectations. The greater time dedicated to research in these countries is probably also related to a substitution of working hours towards research due to lighter administrative loads or stronger resistance of administrative oversight, rather than a greater preference towards research over

teaching or university policies promoting the recruitment of research focused staff.

The cultural hegemony of universities in the English-speaking region in the spread of ideas for best practices underpinned our second hypothesis, that working time patterns would be most similar within the English-speaking region and between other countries culturally close to the English-speaking world. There was some support for this in the data, but many conflicting results.

The faculty in English-speaking countries differed less from each other than from most countries in other regions. After controlling for the relatively small differences in the proportion of staff by academic field between English-speaking countries, total working hours and teaching hours were roughly comparable. Another distinguishing feature of the English-speaking region was the relatively heavy administrative load. However, the balance between research, administration and service duties suggested greater commonality between two pairs of countries, Australia and UK, and to a lesser extent, USA and Canada. Administrative hours were significantly longer in Australia and UK, which partly accounted for the shorter research hours compared to Canada and service hours in the USA. This diversity may be due to the different traditions of higher education governance within the English-speaking region.

Higher education in all countries has expanded with increasing student numbers and pressures to redefine the relationship between universities, the state, and the market. Research universities occupying the top stratum of research reputation, characterized by Morhman et al. (2008) as the carriers of an Emerging Global Model, are inherently expensive to fund. Universities have traditionally looked to the state for funding, but the restructuring of universities, particularly within the English-speaking region, has been in accordance with broader neo-liberal arguments for efficiency, public accountability and organizational best practices. Hood (1995, 99-100) identified the UK, Australia, Canada and Hong Kong, and to a lesser extent USA and Norway, as countries where new public management

was more eagerly adopted. Australian and British universities have implemented such principles extensively in response to calls for greater accountability from both the state and university administration (Barry et al. 2003; Lafferty and Fleming 2000), which is probably reflected in their extremely long administration hours even compared to the USA.

Faculty in Hong Kong and Norway share the most in common with their counterparts in the English-speaking region. Compared to faculty in similar academic fields in the USA, Norwegian faculty spent significantly more hours on teaching and Hong Kong faculty spent significantly more hours on research, but both countries share an equally high level of administration hours. Hong Kong, a British colony until 1997, has also extensively rationalized its higher education funding system by introducing research assessment exercises based upon the British model of linking university funding with research quality and quantity (Mok 1999). Norway was also an early adopter of new public management (Hood 1995). The deeper implementation of government systems for accountability in these countries may be reflected in the relatively long hours spent on administration.

By contrast, new public management was not eagerly adopted in Germany (Hood 1995). Italian universities have also successfully resisted outside influence and calls for greater accountability (Rostan 2008). The autonomy of universities in these countries from government and the market may partly explain the very low levels of administration and their associated impacts on research time. However, Malaysia also differed significantly from the USA with high levels of administration, matching those found in the UK and Australia. Malaysia was a particularly unique case, with extremely low levels of research time, which can not be easily explained by university restructuring based on neoliberal policies and call for increased accountability. Lee (2004) argues that Malaysian higher education is an example of relative autonomy within a globalised context, challenging the notions of cultural diffusion and institutional isomorphism.

The more similar working time patterns and heavier administration burdens of faculty in countries with stronger traditions of new public management (controlling for academic field), provides conflicting evidence regarding the appropriateness of the institutionalism framework offered by Meyer et al. (2007). While research universities in different countries face similar pressures to diversify their funding bases, even within the English-speaking region universities differ in the extent to which they are reliant on government funding and have ties with industry partners. In other words, we contend that the role of national government and governance practices affects faculty time use, in addition to professional norms regarding faculty work which may be more global in orientation.

For example, governments around the world have encouraged collaborative partnerships between universities, industry and the state. Such practices have been conceptualized as a “triple helix” approach to innovation, but national traditions shape innovation policy and its effect on universities (Etzkowitz et al. 2007). China and some countries in Europe and Latin America maintain a statist-driven “Triple Helix I” model, whereby the state encompasses and directs universities and industry. English-speaking countries are typically considered *laissez-faire* or “Triple Helix II” in their approach, whereby cooperation and competition are linked through the market. However, even within the English-speaking region the level of government centralization is greater in the UK and Australia, where national competitive research funding can be implemented through market mechanisms. This is a considerable problem when interpreting our results because the boundaries between time spent on research funding applications, administration duties associated with government funding accountability or service to funding providers, may be shaped by national culture. Therefore, the university practices for shaping faculty working time in the USA, where service occupies a significant proportion of faculty time, may reflect historical traditions of applied research and private donations, and such traditions may influence how faculty categorize their working time.

While we find significant diversity amongst full-time faculty, Meyer et al. (2007) argue that the meaning of the category “professor” has a very substantial historical and global standing, and may be shaped locally in only minor ways. The professionalized structure of the academic career involves socialization of codes of conduct and patterns of working time, which are then mimicked and reinforced through the academic reward system (Milem et al. 2000). If universities compete vis-à-vis all others on standardized global scales and universities are purposefully managed, professors likely reflect and project the desired behaviors of their institution, supporting “normative isomorphism” at the highest rank (DiMaggio and Powell 1983). Therefore, our third hypothesis was that the working time patterns of full professors are relatively similar across countries.

The results for professors indicated that similar working time patterns existed within the English-speaking region, and to a lesser extent in Western Europe, but Asia and Latin America were characterized by significant variation. Research is the key activity that unites professors across most countries. Compared to the broader category of full-time academics, professors are distinguished by a significantly stronger interest in research over teaching, particularly in the English-speaking region. While Western European professors also declared stronger research interests, professorial teaching hours were comparably longer in this region. Unique to Germany, professors reported significantly longer teaching hours than lower ranked academics. Professors in the two Latin American countries shared little in common with each other. Professors in Argentina shared similar working time patterns to professors in the English-speaking region, but research interests and hours were very low among professors in Brazil.

However, a mutual dedication by professors towards research does not imply common institutional expectations for the role of teacher or administrative leader. The comparably heavy administration burden and short teaching hours for professors in the English-speaking region is related to the relative number of full professors and academic hierarchy. Professors comprise roughly 10 percent of all full-time

faculty members in Australia, UK, Hong Kong and Malaysia. The hierarchy is also reflected in the perceived top-down management style, with a large majority of academics in Australia (78 percent), Hong Kong (76), UK (73) and USA (65) agreeing with the statement: "At my institution there is a top-down management style". In Australia and USA, where faculty numbers have grown at the "margins", the requirements of faculty governance and curriculum development fall increasingly to the existing base of full-time staff (Jacobs 2004; Marginson 2000). A steeper hierarchy may allow professors to delegate teaching duties and maintain their research focus, but administrative hours typically grow where professors are relative scarce due to the fact that fewer professors have to share duties as academic managers.

By comparison, in Norway only a minority (30 percent) agreed that the management style was top-down. Barriers to promotion are also minor, with associate professors entitled to become full professors provided they are found competent (Olsen, Kyvik, and Hovdhaugen 2005). Consequently, close to 50 percent of the Norwegian faculty are full professors. However, being a full professor in Norway does not entail the very few teaching hours or heavy administration loads of the English speaking region because duties are distributed more equitably across ranks and responsibilities of faculty governance can be divided among a greater number of professors.

Higher education systems around the world have undergone transformations away from publicly-funded collegial communities and towards more privately-funded and managed enterprises (Enders and Musselin 2008). The strong commitment of professors towards research in most countries indicates relative consistency in working time patterns at higher ranks, with teaching responsibilities typically giving way to administration in countries with more hierarchic career structures. However, the results do not suggest that marketization and internationalization of the academic profession has led towards convergence in working time patterns across countries for non-professorial faculty. Our results show significant differences across countries which suggest conditions of academic work remain heavily

dependent on national higher education traditions and patterns of workplace relations. Internationalization may quicken the transfer of successful higher education models, but implementation generally involves adaptation to the practicalities of local circumstances and traditions (Jones 1992). Even within the English-speaking world the spread of managerial practices has been implemented partially and unevenly, with core full-time faculty being in stronger position to resist intervention compared to lower ranked, part-time and newly hired faculty (Lafferty and Fleming 2000, Marginson 2000). Therefore, institutional isomorphism in how universities strategically manage faculty working time likely occurs in conjunction with diversification and specialization, with increasingly fewer faculty engaged equally in teaching and research.

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3. Individual differences in faculty research time allocations across 13 countries

Peter James Bentley & Svein Kyvik

Abstract

In research universities, research time is often too scarce to satiate the wishes of all faculty and must be allocated according to guidelines and principles. We examine self-reported research hours for full-time faculty at research universities in 13 countries (Argentina, Australia, Brazil, Canada, China, Finland, Germany, Italy, Malaysia, Norway, UK, USA, and Hong Kong, a semi-autonomous special administrative region of China). We examine the level of variation in individual faculty research time and the factors associated with individual differences, including differences in: (a) university policy regarding the allocation of working time for research between individual faculty members, (b) individual motivation towards research, and (c) family commitments. Our results suggest that the factors associated with additional research time vary across countries, but individual motivation towards research (relative to teaching) is a significant in all countries. University policies towards research and the research status of individual faculty, are relatively weak predictors of individual research time, though stronger effects are generally found in English-speaking countries. Research hours typically decrease with age, but plateau or increase in the oldest cohorts. Family and gender are weak predictors of research time amongst full-time faculty.

Keywords: Research time, research motivation, resource allocation, faculty work.²

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3.1 Introduction

University faculty perform a variety of work tasks with levels of autonomy rarely seen in other professions. However, professors do not have complete discretion over working time decisions as, amongst other institutionally regulated activities, professors are typically required to teach a minimum number of classes, supervise doctoral students and partake in administrative work. In line with general public sector reforms under the auspices of new public management (Hood 1995), managerial reforms have required universities to further justify the public investment of resources through greater transparency, accountability and efficiency. Faculty time is a core and valuable institutional resource. In research universities – where tenure, promotion, salary and prestige are closely related to research output – research time is scarce and must be carefully managed.

Through the regulation of weekly teaching hours, yearly supervision hours, and other duties, universities control the availability of time remaining for research. However, faculty also differ in their research interest and non-work commitments. This affects their propensity to trade off discretionary research hours for non-work time. Therefore, research time is partly a residual category, based on time available after all other formally regulated contact hours, and partly discretionary, based on work and leisure trade-offs.

Academic workload studies typically examine the trade-offs in time use across activities and most former studies are single-country. Drawing international generalizations from national level studies is fraught with conceptual and theoretical complexities. Virtually all studies define faculty tasks and roles differently, or use different methods of data collection (Rosser and Tabata 2010; Meyer 1998). International studies indicate that the proportion and number of hours spent on research, teaching and other activities differs greatly across countries and between universities (Enders and Teicher 1997; Gottlieb and Keith 1997; Bentley and Kyvik 2012). While there are many reasons why faculty differ in their time use, most comparative

studies are descriptive and do not analyze factors associated with working time patterns.

One exception is Gottlieb and Keith's (1997) international study of research hours in Australia, Israel, South Korea, Sweden, West Germany, UK, Japan and USA. Through OLS regression, they analyzed the correlation between research hours and published articles, research/teaching orientation, total enrolment, total courses taught, academic rank, sex and teaching hours. The strongest factor associated with research hours was research orientation, followed by publications. Research oriented faculty spent one-third to two-thirds more hours on research compared to teaching orientated, while five additional publications (in the previous three years) were associated with one extra research hours per week.

The purpose of this study is to examine, from an international comparative perspective, the level of variation in individual faculty research time in research universities, and the factors associated with individual differences. Data on working time patterns of individual faculty members have been drawn from universities across 13 countries (Argentina, Australia, Brazil, Canada, China, Finland, Germany, Italy, Malaysia, Norway, UK, USA, and Hong Kong, a semi-autonomous special administrative region of China). Former multivariate studies from the United States and Australia indicate that research time is predominantly shaped by a combination of personal, family, career and institutional characteristics (Link et al. 2008; Singell et al. 1996; Guest and Duhurs 2002). Based on these studies and other former literature in this field, we propose three different groups of explanations for skewed patterns of research time, including differences in: (a) university policy regarding the allocation of working time for research between individual faculty members, (b) individual motivation towards research, and (c) family commitments. The international comparative dimension allows us to examine whether country specific results, such as those found previously in the USA and Australia, apply to a wider range of countries.

Differences in university time allocation policy

When organizational resources are too scarce to satiate the wishes of all recipients, limited resources must be allocated according to guidelines and principles. Previous studies of allocation of research time suggest that distributional allocation may be motivated by *strategic* and *practical* reasons, as well as by considerations on *fairness* (Kyvik, 2009). The strategic objectives of universities — which include multiple missions of research, teaching and service to the community — underpin the rationale for discretionary management of research time. If universities can identify individual faculty with the greatest potential for contributing towards institutional research goals, management can introduce policies and incentives that skew research time towards preferred recipients. Management can also indirectly shape research time allocation by linking human resource decisions with performance. This could include determining research funding and resource allocations based on research performance, or alternatively, encouraging some faculty to pursue non-research activities, such as entrepreneurial services.

However, strategic management of research time also involves transaction costs associated with evaluating research goals and negotiating individual work agreements. There are also considerations of fairness. Equal access to research time may be the fairest and least costly method, but fails to efficiently distribute the resource for greatest effect. Fairness and practical considerations tend to encourage research time allocation policies based on fixed standards, rather than managerial discretion. In practice, this can mean fixed standards for all faculty within certain easily perceptible status criteria. For example, it may be practical, fair and reasonably efficient to allocate greater research time to full professors, given that attaining professorship usually entails a strong prior research record. Regardless, such fixed standards may also be contentious, particularly if taken to an extreme where stratification across rank leaves inadequate access to research time in lower ranks and opportunities to demonstrate research competence.

As noted by Elster (1992), actual allocation systems can rarely be reduced to a single allocation principle or procedure. Allocation systems typically entail a combination of discretion, negotiation and fixed standards based on recipient status. We examine three resource allocation practices within the discretion of university management for steering research time towards strategic objectives: research funding, linking research quality to personnel decisions; and encouraging service/entrepreneurial activities. We also examine three easily perceptible status criteria: academic rank; doctoral qualifications; and research publishing record.

Strategic objectives

Across the world, decreases in guaranteed institutional and governmental funding for research make faculty increasingly dependent upon external research funding for “buying” research time. Strategic objectives of universities may not be directly aligned with external stakeholders, but faculty successful in gaining external funding wield disproportionate influence over university councils, often reshaping institutional missions in line with their funded objectives (Massy 2004). The ability to raise research funding stratifies faculty across disciplines and universities (Slaughter and Leslie 1997), with clear impacts on research performance. In an international study of factors associated with individual faculty research output across ten countries, level of research funding was one of the strongest and most frequently significant predictors of individual research output (Teodorescu 2000). Its impact was particularly strong in the English-speaking countries, where new public management and marketization have longer traditions. With research becoming increasingly tied to relevance and external stakeholders, a coping mechanism and unintended consequence of new public management has been increased specialization in teaching, research or administrative roles (Barry et al. 2003). In such circumstances, the signaling effect of research funding likely leads to a cumulative advantage for the recipients, further increasing their chances for blocks of research time in the future. The growing importance of external research funding leads us to expect faculty receiving most of their research funding

from non-institutional sources, and those satisfied with their research funding, will spend more hours on research. We also expect the importance of research funding to be stronger in countries where marketization is more deeply embedded in research allocation systems, such as the English-speaking countries.

Not all universities place similar emphasis on a research mission or expect all faculty to engage primarily in research and teaching. The type of university to which one is employed (based on the Carnegie classifications) was the strongest predictor of time spent on research and service activities in the USA (Bellas and Toutkoushian 1999). Service-based and entrepreneurial activities, such as business ventures, professional lectures, and service or consulting for governments (local and worldwide), have varying degrees of value to the individual and the university. These activities encourage practical application of university research, raise additional revenue and legitimize the university's position in the stakeholder community. However, their engagement leaves less time for research, and if actively encouraged by the university, provide fewer incentives to engage in traditional, campus-based activities (Zemsky et al. 2006). Therefore, we expect that faculty in institutions emphasizing entrepreneurial activities will spend fewer hours on research.

Fixed standards

Allocating resources based on strategic objectives requires clearly defined allocation principles and implementation procedures. These procedures are typically more costly, complicated and time consuming than simply providing equal access to all. Differential treatment can also be controversial by conflicting with the normative ideals of a homogenous faculty workforce in equal pursuit of research and scholarship. Such norms are often reflected in union-negotiated collective agreements or laws governing faculty work. For example, in three of Australia's Group of Eight research intensive universities (Adelaide, Monash and Sydney), collective agreements prescribe a standard 40-40-20 ratio for workload divisions between research,

teaching and other duties. Applying equal apportionment of research time to all faculty, irrespective of individual status, can be partly justified because it avoids conflict and minimizes cost in the allocation process (Kyvik 2009). However, treating the faculty workforce as homogenous is clearly inconsistent with the strategic allocation that differentiates between individuals.

A compromise is to allocate resources based on fixed standards. Fixed standards differentiate between groups of faculty members by providing standard apportionment to all individuals with easily perceptible features. Access to research sabbaticals may also be available only to full professors or those with research qualifications or faculty with demonstrated research competence. Combined with a promotional system that directly (or indirectly) rewards research performance, such policies skew research time towards groups of recipients most likely to utilize the resources. However, given that allocation is group-based, fixed standards do not direct resources to preferred individuals. Professors may have greater research competence, but individual professors often have different motivations to conduct research aligned with the strategic objectives.

Multiple fixed standards, such as equal research time for all research-active faculty in professorial positions adds further specificity, but in turn leads to greater complexity and potential conflicts when implementing the criteria. Given the reciprocal relationship between rank, research competence, research qualifications and research funding, it is difficult to examine fixed standards in isolation to other factors. However, we may expect that fixed standards criteria which differentiate access to research time will be weaker in countries where the academic hierarchy is flatter. For example, in Norwegian universities, all ranks have equal job security and institutional expectations of research (Kyvik 2012). Opportunities to gain research qualifications are also comparably strong with doctoral research positions receiving salaries and conditions commensurate to public sector positions. This is in contrast to the USA where the tenure-track differentiates faculty and an “underclass” of part-timers who struggle to receive minimum wage (Jacobs 2004). A steep hierarchy also

operates in Australia, where low ranked positions face increased managerial oversight (Lafferty and Fleming 2000), and many faculty are unable to gain the necessary research qualifications for further advancement (White 2004). Based on national differences in steepness of the hierarchy, we may expect a stronger relationship between research publications, rank, qualifications and research time, in countries with steeper academic hierarchies.

Differences in research motivation

It is common knowledge that individual interest and motivation towards conducting research varies among faculty and can also change with career stage (Rosser and Tabata 2010). While the sources for motivational differences are numerous, we put forward two possible explanations: the “sacred spark” theory, and the theory of utility maximization.

The “sacred spark” theory

Some faculty may be more strongly motivated than others to dedicate time to research simply because they have an inner compulsion to do so. This explanation has been referred to as the “sacred spark” theory (Cole and Cole 1973). Research typically requires long periods of unpaid working time, but such activities can be extremely absorbing for those who find the activity satisfying. The level of autonomy faculty possess over their working time beyond relatively short classroom teaching and administrative hours provides the freedom to seek out activities of professional and personal attachment (Enders 2001).

While it may be tempting to generalize a natural affinity of faculty towards research, not all academics were drawn to the profession out of research interests. In Australia and other countries, the unification of former vocational and teaching oriented colleges into the university

sector required teaching-focused faculty, who lacked both research qualifications and research interests, to become research active (White 2001). However, Enders and Teichler (1997) found that in many countries a significant minority of faculty held stronger interests in teaching compared to research, and differences in research interest partly explained the proportion of time spent by faculty on research.

Gottlieb and Keith (1997) also found research oriented faculty were more likely than teaching oriented faculty to view their research as complimentary to their teaching. This may be because they seek out different teaching assignments. Research oriented faculty taught courses with fewer student assessment requirements and more frequently at a graduate level, utilizing major papers and oral presentations as the main forms of assessment. These former studies lead us to expect a positive relationship between research interest, graduate teaching and total research hours.

The utility maximization theory

According to this theory, faculty will seek to maximize the utility of their time in terms of income, prestige or intrinsic outcomes (Stephan and Levin 1992). As promotion at universities, visibility and prestige in the scientific community are first and foremost dependent on published output, faculty will use as much time as possible for research. However, this will hold only as long as they believe that this activity will result in the expected status achievement. Therefore, differences in research hours partly reflect differences in the perceived utility of additional research hours. For example, eminent researchers may experience diminishing marginal returns for additional research, given their already strong record. Well established researchers may perceive greater career or intrinsic benefits from other activities, such as consulting, external service and administrative leadership. Accordingly, it can be expected that older academics will use less time for research (Kyvik and Olsen 2008).

The perceived utility of additional research also depends upon the belief that research is valued at one's institution. Most research universities could be expected to include research quality in their personnel decisions, but the extent to which this is perceived to be the case will vary across institutions and countries. For example, in the United States the tenure process explicitly requires early-career faculty to exert a strong emphasis on research, while mid- and late-career faculty generally receive fewer research incentives. Link and colleagues (2008) found that tenure was significantly associated with individual research hours. Assistant professors in their first two years spent the greatest number of hours on research, while gaining tenure was associated with significantly fewer research hours. Importantly, the tenure process also fragmented the faculty below the full-professor rank. Faculty who had spent more than seven years as associate professor spent increasingly fewer hours on research. The perceived heavy workload requirements and minimal chances for successful tenure in top-tier American research universities, also discourages some capable researchers from the tenure track (Jacobs 2004). This results in an increasingly selective and research focused tenure-track professoriate. Overall, we expect that faculty who strongly believe that research is critical to human resource decisions will spend greater time on this activity.

Differences in family commitments

Caring responsibilities limit total working hours (Bellas and Toutkoushian 1999), particularly for female primary caregivers (Probert 2005). The self-directed nature of research time should be relatively compatible with domestic responsibilities because some work can be completed from home. For example, women at English universities are more likely than men to accommodate unpaid working hours by taking work home (Barry, et al. 2003). However, it may be difficult for women to maintain a research focus when interrupted with domestic responsibilities. Previous studies indicate that the impact of children on research publications is mixed (Creamer 1998) or minor (Sax et al. 2002). A stronger negative effect has been found for women with young children (Kyvik and Teigen 1996) and

increasing with the number of children (Long 1990). The greater effect for female faculty is likely due to reduced total hours. When faced with competing demands, research often receives lowest priority for primary caregivers (Barry, et al. 2003; Probert 2005). Therefore, we expect the number of children in the home to be negatively associated with research hours.

3.2 Data

The data for this study comes from the Changing Academic Profession (CAP) international survey conducted in 2007/2008 among university faculty in 18 countries. This study is restricted to a subsample of full-time faculty in combined research and teaching positions at research universities. Therefore, all faculty with part-time contracts, less than 30 hour per week, or less than one hour per week on both teaching and research activities, were removed from the subsample. Institutional restrictions differed according to national classifications, but in most cases research universities were universities that offer post-graduate qualifications. However, there may be great differences in research capacity between research universities, particularly in unified higher education systems, such as Australia and the UK. Individual faculty were classified into five academic fields (social science, humanities, natural sciences, technology and medicine) based on the UNESCO (1978) guidelines. Five countries were removed from the subsample due to low response rates (below 10 percent in Korea and Portugal), unavailability of working time data (Mexico), incomplete sampling details (South Africa) and small sample of research university faculty (Japan). Prior to the weighting procedure, this left a sample of 7,117 faculty from 13 countries: Argentina, Australia, Brazil, Canada, China, Finland, Germany, Hong Kong, Italy, Malaysia, Norway, UK and USA.

National samples were considered representative of their respective populations on strata such as gender and institutional type, but full professors were over-represented in 10 countries (the exceptions being Italy and Malaysia, while no suitable population data was available

on this stratum in Brazil). Given the consistency across countries, national samples were weighted based on academic rank for the 12 countries with suitable population data. The weighting was applied to the national samples, prior to subsample restrictions. Faculty excluded from the subsample were more likely to be of lower rank, and because lower ranked faculty were typically allocated a weighting of greater than one (due to over representation of full-professors in most national samples), the weighted sub-samples (n_w) were generally smaller than the unweighted sub-samples (n). Response rates, the size of the national subsamples and the weighted subsamples are shown in Table 3-1.

Table 3-1. Number of survey invitations to university faculty members; number of surveys returned; response rate, subsample (n) and subsample weighted for academic rank (n_w)

	Surveys sent	Surveys returned	Response rate	n	n _w
Argentina	2,400	826	34%	371	328
Australia	5,496	1,381	25%	526	514
Brazil	4,702	1,200	26%	229	229
Canada	6,693	1,152	17%	702	705
China	4,200	3,612	86% ^a	429	395
Finland	3,902	1,115	29%	393	336
Germany	3,891	1,246	32% ^a	612	521
Hong Kong	6,219	811	13%	527	365
Italy	4,797	1,701	35%	1,358	1,366
Malaysia	4,114	1,226	30% ^a	316	318
Norway	2,883	1,035	36%	366	276
UK	11,000	1,663	15% ^a	569	426
USA	3,732	848	23%	687	647
All countries	64,029	17,816	28%	7,117	6,459

^a Response rate includes a small number of universities without combined teaching and research missions, excluded from the subsample.

The relatively low response rates of the CAP survey in many countries may reflect the general increase in the number of surveys academics receive, combined with other accountability procedures academics must respond to. It is difficult to estimate any potential biases in the CAP samples resulting from low response rate. Intuitively it may be reasonable to assume that academics most pressed for time and working the longest hours would more likely be non-respondents (thus underestimating overall working hours). However, there is less reason to assume that the relative time spent on research would be related to survey response.

The differences across countries in response rate to the CAP survey are probably due to combination of factors related to the sampling and distribution. Response rates were typically higher in those countries where both paper and online surveys were delivered to respondents (Finland, Germany, Italy, Norway, USA), compared to online-only (Argentina, Australia, Brazil, Canada, UK) or paper-only surveys (China, Malaysia, Hong Kong). Multiple formats for survey delivery increase the likelihood that the respondents receive the survey invitation and allow choice of preferred completion method. Online surveys may be particularly problematic in this regard due to the potential for unsolicited email invitations to be filtered (spammed) into the junk email folders. The exceptionally high response of the CAP survey in China is probably due to the high level of coordination in its survey distribution. The Chinese team also used gifts for university human resource officials assigned to deliver the survey, and for individual respondents.

3.3 Methodology and variable summary

Our dependent variable is the weighted average of self-reported individual weekly research hours in the teaching and non-teaching periods. The CAP survey categorized faculty workloads across five activities: *teaching* (preparation of instructional materials and lesson plans, classroom instruction, advising students, reading and evaluating student work), *research* (reading literature, writing, conducting experiments, fieldwork), *service* (service to clients and/or patients, unpaid consulting, public or voluntary services), *administration* (committees, department meetings, paperwork), and *other* academic activities (professional activities not clearly attributable to any of the categories above). Faculty reported typical weekly hours for two separate time periods: when classes are in session and when classes are not in session.

We annualize research hours by combining the two separate periods and weight the teaching period as twice the duration of the non-teaching period. Therefore, if one reports 15 research hours per week

when classes were in session, and 30 research hours per week when classes were not in session, the weighted average for this individual is 20 research hours $((15 \text{ hours} * 2) + 30 \text{ hours}) / 3$. To minimize outlier effects, total working hours are capped at 70 hours and research hours are reduced proportionally (further details on this approach: Bentley and Kyvik 2012).

Self-reported working hours have some clear limitations. Firstly, there may be errors of recall. Secondly, distinguishing between work and non-work time may be particularly challenging for faculty due to the highly flexible and autonomous substance of their work and daily schedules (Jacobs and Winslow 2004b). Thirdly, self-reports might lead to over-report of working time (Robinson and Bostrom 1994). In addition, there are often no clear-cut division between research and other tasks, like supervision of postgraduate students which contains elements of both teaching and own research. However, Jacobs (1998) found no systemic bias between self-reports and documented arrival and departure times. The aforementioned methodological problems are also of less concern in this study because we examine relative differences in research time between individuals.

Differences across countries in mean research hours were statistically significant (ANOVA, $p < 0.05$). Therefore, we also applied post-hoc tests for significant differences between individual countries (Games-Howell ANOVA, $p < 0.05$). Our choice of a Games-Howell post-hoc test was based on unequal group sizes and variances (Jaccard et al. 1984).

Research hours were then modeled using OLS linear multiple regression. To help normalize the distribution, we used a log transformation. We checked for multicollinearity between independent variables by examining the variance inflation factors (VIF) for all 13 countries. Multicollinearity does not appear to be a problem as VIF values for the independent variables rarely reached 4, except in

certain academic fields in China and Malaysia.³ To avoid multicollinearity between our two age-based variables, we centered age around the sample mean (by subtracting 48 years from an individual's age). Our independent variables were categorized and operationalized in the following way:

Differences in research time allocation policy: *Strategic objectives*

- a) Research funding satisfaction: A five point scale career variable is constructed from ordinal responses to satisfaction with research funding (poor=1; excellent=5).
- b) External research funding: A categorical variable for those who receive the majority of their research funding from outside their own university (no=0; yes=1).
- c) Entrepreneurialism: A five point scale variable based on the extent to which one's institution emphasizes "... academics to adopt service activities/entrepreneurial activities outside the institution" (not at all=0; very much=5).

Differences in research time allocation policy: *Fixed standards*

- d) *Professor*: A categorical variable based on holding the highest national academic rank (no=0; yes=1).
- e) *PhD*: (no=0; yes=1).
- f) *Publications*: Three categorical variables based on a weighted sum of self-reported authored books (4 points), edited books (1 point) and journal articles or book chapters (1 point) during the three years prior to the survey. Faculty were ranked and categorized as: highly publishing (top quartile); moderate publishing (middle two quartiles); or low publishing (bottom quartile).

³ China for Social Sciences (VIF=4.46), Natural sciences (VIF=5.92), and Technology (VIF=5.31); Malaysia for Social sciences (VIF=4.64), Natural sciences (VIF=5.78) and Technology (VIF=6.65).

Differences in research motivation: *Sacred spark theory*

- a) *Research interest*: A categorical variable based on a Likert scale response for interest in research relative to teaching (Primarily in teaching = 1; In both, but leaning towards teaching = 2, In both, but leaning towards research = 3; Primarily in research = 4).
- b) *Doctoral Teaching*: A scale variable based on the proportion of teaching responsibilities devoted to doctoral programs.

Differences in research motivation: *Utility maximizing theory*

- a) *Age*: A scale variable centered around the sample mean (age-48 years).
- b) *Age squared*
- c) *Research quality in personnel decisions*: A five point scale variable based on the extent to which one's institution emphasizes "... research quality when making personnel decisions" (not at all=0; very much=5).
- d) *Tenure*: (permanent contract of employment=1; non-permanent=0).

Differences in family commitments

- a) *Sex*: (female=0; male=1).
- b) *Children at home*: Four categorical variables based on the number of children living at home: no children; one child; two children; three or more children (no=0; yes=1).

3.4 Results

The results summarized in Table 3-2 show individual faculty across the 13 country sample spent, on average, 18.5 hours per week on research or 39 percent of their total working hours on this activity. A

relatively high standard deviation of 9.7 hours, indicated that individual research hours varied considerably between individuals. Consistent across all countries, most faculty reported research hours below the mean, as indicated by the relatively lower median research hours. Such a pattern is indicative of the skewed nature of research time, whereby a minority of faculty reported a large number of research hours. Differences in mean research hours between individual countries were statistically significant in most cases. Even the USA, the median country with an average of 17.6 research hours per week, differed significantly from six of the twelve other countries (ANOVA Games-Howell multiple comparisons *t*-test, $p < 0.05$).

Table 3-2. Research hours per week: mean, median, standard deviation and as a percent of total hours, by country

Country	Mean	Median	SD	%	n	n _w
Argentina	21.8	20.7	8.3	50.3	371	328
Australia	16.5	14.0	10.2	33.9	526	514
Brazil	16.3	15.0	8.6	38.2	229	229
Canada	20.4	18.7	9.2	40.8	702	705
China	21.6	20.0	11.6	44.3	429	395
Finland	16.6	14.7	9.0	35.9	393	336
Germany	22.5	21.7	11.5	45.3	612	521
Hong Kong	19.6	18.3	10.9	37.6	527	365
Italy	21.6	20.0	9.6	46.3	1,358	1,366
Malaysia	12.2	11.6	6.8	26.5	316	318
Norway	17.6	16.7	8.9	36.8	366	276
UK	16.5	14.1	10.2	34.0	569	426
USA	17.6	16.0	11.0	35.8	687	647
Total (weighted mean)	18.5	17.0	9.7	38.9	7,085	6,426

Based on former academic workload studies, we hypothesized that individual differences in research hours may be due to three factors: university policies on the allocation of research time, individual motivation and family commitments. We also controlled for the effect of academic field. Our regression results in Table 3-3 show the relative effect of each independent variable in explaining variation in (log

transformed) research hours among individual faculty members, with the humanities and childless faculty as the reference categories. We report both the unstandardized beta (B) and the standardized beta (Beta) coefficients. Based on the adjusted R-square, the model explained 34 percent of the variation in individual research hours in the Argentina and USA samples, with similar results in Australia (30 percent), the UK (29 percent), Germany (24 percent), and Canada (23 percent). However, substantially less variation was explained in Brazil (18 percent) Finland (17 percent), China (16 percent), Italy (15 percent) and Malaysia (12 percent).

Table 3-3 OLS linear regression model explaining (log transformed) research hours

	ARG		AU		BRA	
	B	Beta	B	Beta	B	Beta
(Constant)	2.29***		1.63***		2.70***	
<i>Strategic objectives</i>						
Research funding sat.	0.04**	0.10**	0.05**	0.10**	0.00	0.01
External res. funding	0.03	0.03	0.16***	0.13***	-0.11	-0.06
Entrepreneurialism	-0.02	-0.05	0.01	0.01	-0.06	-0.11
<i>Fixed standards</i>						
Professors	-0.07	-0.06	-0.12	-0.06	0.04	0.02
PhD	0.12**	0.15**	0.14*	0.09*	-0.19	-0.10
Low publishing	0.05	0.06	-0.12*	-0.09*	-0.28**	-0.22**
High publishing	-0.05	-0.05	0.27***	0.17***	-0.06	-0.05
<i>Sacred-spark theory</i>						
Research interest	0.26***	0.38***	0.23***	0.28***	0.15***	0.17***
Doctoral teaching	0.00**	0.13**	0.00*	0.10*	0.01***	0.23***
<i>Utility maximizing</i>						
Age	-0.01**	-0.12**	0.00	-0.07	0.00	-0.02
Age squared	0.00**	0.11**	0.00	0.03	0.00	0.08
Research quality	-0.05***	-0.14***	0.00	-0.01	-0.05	-0.11
Tenured ^a	-0.15*	-0.08*	-0.15**	-0.12**	-0.02	-0.01
<i>Family commitments</i>						
Male	-0.05	-0.06	0.10*	0.08*	-0.05	-0.04
One child	0.05	0.05	0.03	0.02	-0.02	-0.02
Two children ^b	0.04	0.04	-0.03	-0.02	0.07	0.06
Three children ^b	-0.02	-0.02	-0.12	-0.06	-0.14	-0.06
<i>Academic field</i>						
Social sciences	-0.13*	-0.12*	-0.01	0.00	0.14	0.10
Natural sciences	-0.06	-0.06	0.06	0.02	0.09	0.04
Technology	0.03	0.03	0.10	0.06	0.25**	0.20**
Medicine	-0.15*	-0.10*	0.03	0.02	-0.10	-0.07
R-Square	0.38		0.34		0.26	
Adjusted R-Square	0.34		0.30		0.18	
n (weighted)	306		375		197	
n	348		386		197	

***p<0.01; **p<0.05; *p<0.10

^a All Italian faculty members are tenured. ^b All Chinese faculty with children were merged into the 'One child' category

Reference categories: No children and Humanities

Table 3-3 OLS linear regression model explaining (log transformed) research hours (cont.)

	CAN		CHI		FIN	
	B	Beta	B	Beta	B	Beta
(Constant)	1.87***		2.56***		1.81***	
<i>Strategic objectives</i>						
Research funding sat.	0.03*	0.07*	0.04	0.07	-0.01	-0.01
External res. funding	-0.01	-0.01	0.11	0.09	-0.13	-0.11
Entrepreneurialism	0.01	0.01	-0.01	-0.03	-0.01	-0.02
<i>Fixed standards</i>						
Professors	0.08	0.07	-0.09	-0.08	-0.06	-0.05
PhD	0.39***	0.18***	0.07	0.07	-0.07	-0.05
Low publishing	-0.10**	-0.10**	-0.28**	-0.16**	-0.06	-0.04
High publishing	0.03	0.02	0.11	0.10	0.14	0.10
<i>Sacred-spark theory</i>						
Research interest	0.19***	0.28***	0.18**	0.22**	0.29***	0.35***
Doctoral teaching	0.00	-0.04	0.00	-0.03	0.00*	0.13*
<i>Utility maximizing</i>						
Age	-0.01***	-0.16***	0.01	0.09	0.00	-0.02
Age squared	0.00	-0.07	0.00	0.01	0.00	0.11
Research quality	0.01	0.02	0.02	0.05	0.06	0.10
Tenured ^a	-0.09*	-0.09*	-0.10	-0.07	-0.01	-0.01
<i>Family commitments</i>						
Male	0.06	0.06	0.13	0.11	-0.08	-0.06
One child	-0.03	-0.02	-0.18*	-0.16*	-0.17	-0.10
Two children ^b	0.03	0.02	N/A	N/A	-0.01	-0.01
Three children ^b	0.07	0.04	N/A	N/A	-0.11	-0.06
<i>Academic field</i>						
Social sciences	0.09*	0.09*	-0.34**	-0.25**	-0.04	-0.03
Natural sciences	0.02	0.01	-0.15	-0.13	-0.14	-0.07
Technology	0.13**	0.11**	-0.10	-0.08	0.05	0.03
Medicine	0.01	0.01	-0.14	-0.05	-0.07	-0.04
R-Square	0.26		0.25		0.25	
Adjusted R-Square	0.23		0.16		0.17	
n (weighted)	531		176		227	
n	533		209		272	

***p<0.01; **p<0.05; *p<0.10

^a All Italian faculty members are tenured. ^b All Chinese faculty with children were merged into the 'One child' category

Reference categories: No children and Humanities

Table 3-3 OLS linear regression model explaining (log transformed) research hours (cont.)

	GER		HK		ITA	
	B	Beta	B	Beta	B	Beta
(Constant)	1.95***		1.91***		2.57***	
<i>Strategic objectives</i>						
Research funding sat.	0.06**	0.11**	0.00	0.00	0.01	0.01
External res. funding	0.02	0.02	0.08	0.06	-0.07**	-0.06**
Entrepreneurialism	0.01	0.02	-0.05	-0.08	-0.01	-0.01
<i>Fixed standards</i>						
Professors	-0.04	-0.02	-0.09	-0.06	-0.02	-0.02
PhD	-0.06	-0.04	0.08	0.03	0.00	0.00
Low publishing	-0.09	-0.07	-0.36***	-0.26***	-0.08*	-0.05*
High publishing	0.00	0.00	0.09	0.06	0.03	0.03
<i>Sacred-spark theory</i>						
Research interest	0.26***	0.32***	0.24***	0.27***	0.19***	0.23***
Doctoral teaching	0.00*	0.10*	0.00	0.06	0.00	-0.03
<i>Utility maximizing</i>						
Age	0.00	0.01	-0.01	-0.09	0.00	-0.06
Age squared	0.00	0.00	0.00**	0.14**	0.00***	0.10***
Research quality	0.03	0.05	0.03	0.05	-0.04***	-0.09***
Tenured ^a	-0.02	-0.02	-0.10	-0.08	N/A	N/A
<i>Family commitments</i>						
Male	0.02	0.01	0.13	0.09	-0.01	-0.01
One child	-0.10	-0.06	0.01	0.01	-0.03	-0.02
Two children ^b	-0.22***	-0.14***	0.00	0.00	-0.02	-0.02
Three children ^b	0.02	0.01	0.06	0.02	0.00	0.00
<i>Academic field</i>						
Social sciences	0.02	0.02	0.17*	0.13*	-0.10*	-0.08*
Natural sciences	-0.08	-0.05	0.13	0.06	-0.07	-0.05
Technology	0.29***	0.21***	0.20	0.12	0.04	0.04
Medicine	-0.09	-0.05	0.07	0.04	-0.40***	-0.25***
R-Square	0.28		0.26		0.17	
Adjusted R-Square	0.24		0.19		0.15	
n (weighted)	362		245		1094	
n	450		373		1087	

***p<0.01; **p<0.05; *p<0.10

^a All Italian faculty members are tenured. ^b All Chinese faculty with children were merged into the 'One child' category

Reference categories: No children and Humanities

Table 3-3 OLS linear regression model explaining (log transformed) research hours (cont.)

	MAL		NOR		UK	
	B	Beta	B	Beta	B	Beta
(Constant)	2.00***		1.96***		1.29***	
<i>Strategic objectives</i>						
Research funding sat.	-0.04	-0.07	0.02	0.05	0.03	0.04
External res. funding	-0.01	-0.01	-0.03	-0.03	0.02	0.02
Entrepreneurialism	-0.07	-0.11	-0.05*	-0.10*	0.02	0.03
<i>Fixed standards</i>						
Professors	-0.30**	-0.15**	0.15*	0.14*	0.05	0.03
PhD	0.15	0.12	0.03	0.02	0.12	0.06
Low publishing	0.02	0.01	-0.10	-0.09	-0.16*	-0.11*
High publishing	0.00	0.00	0.13	0.11	0.33***	0.20***
<i>Sacred-spark theory</i>						
Research interest	0.31***	0.31***	0.21***	0.27***	0.32***	0.34***
Doctoral teaching	0.00	-0.09	N/A	N/A	0.00	-0.02
<i>Utility maximizing</i>						
Age	0.01	0.20	0.00	-0.04	-0.01**	-0.16**
Age squared	0.00	0.07	0.00	0.05	0.00*	0.10*
Research quality	0.02	0.04	-0.02	-0.04	0.04	0.07
Tenured ^a	-0.21	-0.11	0.08	0.04	-0.12	-0.06
<i>Family commitments</i>						
Male	0.20**	0.16**	0.04	0.03	0.13	0.10
One child	-0.09	-0.06	0.02	0.01	0.03	0.02
Two children ^b	-0.08	-0.06	-0.13	-0.10	-0.05	-0.03
Three children ^b	-0.02	-0.01	-0.24*	-0.13*	0.22	0.08
<i>Academic field</i>						
Social sciences	-0.01	0.00	0.12	0.10	0.08	0.06
Natural sciences	-0.16	-0.12	-0.01	-0.01	0.13	0.06
Technology	0.00	0.00	0.19**	0.16**	-0.03	-0.02
Medicine	-0.35**	-0.17**	0.11	0.08	-0.16	-0.09
R-Square	0.22		0.27		0.35	
Adjusted R-Square	0.12		0.20		0.29	
n (weighted)	186		233		241	
n	184		317		339	

***p<0.01; **p<0.05; *p<0.10

^a All Italian faculty members are tenured. ^b All Chinese faculty with children were merged into the 'One child' category

Reference categories: No children and Humanities

Table 3-3 OLS linear regression model explaining (log transformed) research hours (cont.)

	USA	
	B	Beta
(Constant)	1.80***	
<i>Strategic objectives</i>		
Research funding sat.	0.02	0.04
External res. funding	0.09	0.07
Entrepreneurialism	0.01	0.01
<i>Fixed standards</i>		
Professors	0.04	0.03
PhD	0.12	0.05
Low publishing	-0.18***	-0.15***
High publishing	0.02	0.01
<i>Sacred-spark theory</i>		
Research interest	0.32***	0.39***
Doctoral teaching	0.00	-0.03
<i>Utility maximizing</i>		
Age	-0.01***	-0.19***
Age squared	0.00***	0.17***
Research quality	-0.01	-0.02
Tenured ^a	-0.07	-0.06
<i>Family commitments</i>		
Male	0.00	0.00
One child	0.10	0.06
Two children ^b	-0.02	-0.01
Three children ^b	0.18	0.06
<i>Academic field</i>		
Social sciences	-0.06	-0.05
Natural sciences	0.10	0.05
Technology	0.16*	0.10*
Medicine	-0.17*	-0.09*
R-Square	0.37	
Adjusted R-Square	0.34	
n (weighted)	415	
n	471	

***p<0.01; **p<0.05; *p<0.10

^a All Italian faculty members are tenured. ^b All Chinese faculty with children were merged into the 'One child' category

Reference categories: No children and Humanities

Results for Allocation based on Strategic objectives

The independent variables addressing different institutional strategies for allocating resources generally did not explain a significant proportion of variation in individual research hours in most countries. However, there were some significant results in certain countries. The extent to which one was satisfied with research funding was positively associated with research hours in Australia, Argentina, Germany and Canada, but its relationship is relatively weak. For example, in Germany, a one-unit increase in satisfaction with research funding corresponded with a 6 percent increase in research hours. External research funding had little relationship with research hours, except in Australia where this was the third-strongest predictor of research time. Australian faculty who received most of their research funding from outside their own institution reported 16 percent more research hours. A small but significant negative relationship was also found in the Italian sample. The extent to which one's university encouraged service and entrepreneurial activities had negligible relationship with research hours.

Results for Allocation based on Fixed standards

Our model included three easily perceptible status criteria for which universities may use to allocate additional research time: academic rank (full professorship); research qualifications (PhD) and recent publishing record (low, moderate and highly publishing). Professorship was a very weak predictor of research time, which may be surprising considering in most countries professors report more hours on research than lower ranked staff (Bentley and Kyvik, 2012). Strikingly, Malaysian full professors spent significantly fewer hours on research (30 percent) than lower ranked staff. Holding a PhD was also a weak predictor of additional research hours, except in Canada where it was the second-strongest variable and associated with a 39 percent increase in research hours. Statistically significant positive effects were also found in Argentina and Australia.

The status criterion with the strongest relationship with research hours was one's relative level of publication performance. A high level of publishing (in the top quartile of faculty) was associated with significant increases in research hours in the UK (33 percent) and Australia (27 percent). However, a low level of publishing (bottom quartile) had a stronger association with research hours, with significant negative relationships found in Hong Kong, Brazil, USA, China and Canada, and to a lesser extent in Australia, UK and Italy. We can not imply from these results that status criteria have a strong role in university research time allocations, but it does appear that individual faculty with demonstrated research competence do manage to find additional hours for this activity.

Results for Sacred spark theory

The greater inner compulsion that some faculty have towards research, referred to as the "sacred spark" theory (Cole and Cole 1973), received the strongest support from our result in explaining why some faculty dedicate more time to research than others. Across all thirteen countries, faculty who reported a stronger interest in research (relative to teaching) spent significantly more hours on research. A one-unit increase in research interest relative to teaching, was associated with roughly 25 percent more research hours in most countries. These results are similar to Gottlieb and Keith (1997) who found research interest was associated with five extra hours of research. Although clearly the variable with the most consistent relationship with research hours, academic field had a stronger relationship in China, Italy and Brazil.

The proportion of one's teaching load dedicated to teaching doctoral researchers (as opposed to undergraduate, masters or other teaching programs) was not a strong predictor of research hours, but was significant in Brazil and Argentina, and to a lesser extent in Australia, Finland and Germany. In the case of Brazil, it was the strongest variable associated with research hours. In all cases, doctoral teaching was positively related to research hours.

Results for Utility maximizing theory

The utility maximizing theory suggests that individual faculty research time partly reflects rational choices seeking greater income, prestige or intrinsic outcomes (Stephan and Levin 1992). Three variables were operationalized to investigate this theory: age; age squared; the extent to which one's institution emphasizes research quality when making personnel decisions; and permanency/tenure.

Before discussing the regression results, it is worth briefly discussing the interaction between age (or career stage) and academic field. As noted by Becher (1989), mid-career 'burn out' and inertia is more common in scientific disciplines with cumulative knowledge-bases, while 'late-bloomers' may be more common in softer disciplines of the humanities and social sciences where knowledge is contested. Figure 3-1 illustrates the bi-variate relationship between research hours and age in the five academic fields. Although age has a broadly negative and linear relationship with research hours in most academic fields, there is no such relationship in the humanities. The second noticeable trend is that research hours generally increase in the oldest age group (over 60 years), particularly in the humanities where this age group has the highest mean research hours.

Figure 3-1. Mean Research Hours by Age Group and Academic Field

In Figure 3-1, the uniqueness of humanities may reflect its non-cumulative knowledge structure. We investigated this further by adding interaction variables for academic field and age, and academic field and age squared. We recomputed all OLS regressions and included the eight interaction variables, taking social sciences as the reference group. The interactions were mostly insignificant ($p > 0.05$) or were very weak. The exception was Norway where, and to a lesser extent in the USA, where the interaction between age and humanities was significant and positive (but not age squared). This implied that the generally negative linear relationship between age and research hours did not apply in the humanities in these countries. Other smaller but statistically significant ($p < 0.05$) and negative interactions were found for age and natural sciences in Italy and Australia, age and medicine in Italy, and age squared and natural sciences and Canada. Overall, the weak results suggested that faculty in the natural sciences were not unique in being 'burnt-out' or seeing research decline in older age cohorts, but 'late bloomers' in humanities received support in Norway.

Returning to our regression results in Table 3-3, we found that age exhibited a significant relationship with research hours in six countries. One additional year was associated with one percent fewer research hours in Argentina, Canada, UK and USA. The positive and significant beta coefficients for age squared in Argentina, Hong Kong, Italy, UK and USA, indicate that the decline in research hours with age may be alleviated by a late-career increase amongst the oldest age groups. The influence of a continuous employment contract (tenure) was not significant, except in Australia, and to a lesser extent Argentina and Canada, all of which suggested a negative relationship with research hours. Utility maximization theory would suggest that when research quality is included in university personnel decisions, individual faculty would have a stronger incentive to dedicate time to this activity. However, in most countries this variable was weak and insignificant, with the notable exceptions of Argentina and Italy where, contrary to expectations, agreement was associated with fewer research hours.

Results for Differences in family commitments

Gender was insignificant in all countries other than Malaysia, where males spent roughly 20 percent more hours on research. and in Australia where the results were very weak. The presence of children in the home had minimal relationship with research hours, with no discernible pattern emerging. We also tested for interactions between gender and children in the home, with the expectation that females with children may exhibit a stronger negative relationship with research hours, but the OLS regression results for the interaction variables were overwhelmingly insignificant in each of the 13 countries.

Results for Academic field effects

When compared to faculty in the humanities, most of the academic field differences were insignificant. However, academic field was one

of the strongest predictors of research hours in Brazil, Italy and Malaysia, and faculty in technology disciplines tended to spend more hours on research.

Discussion

Faculty have long been attracted to academic work for the relatively strong autonomy it provides to pursue one's research interests, communicate ideas to disciplinary colleagues and transfer knowledge to students and future researchers (Bellamy et al. 2003). While there are undeniable tensions between academic autonomy and managerial control over working time, our results suggest that an individual's level of interest in research is the strongest predictor of one's research time allocation. Consistently across all 13 countries, we found that faculty primarily or mostly interested in research spent significantly more hours on research than their teaching oriented colleagues. This was the case even after controlling for the effects of research qualifications, previous publications research funding and other factors one may associate with highly motivated researchers. In other words, some faculty have a stronger inner compulsion to do research and such faculty manage to find extra hours for this activity. This supports the "sacred spark" theory that individual faculty differ in their abilities and motivations towards research (Cole and Cole 1973) and is consistent with Gottlieb and Keith's (1997) earlier international study.

However, the statistical significance of research motivation was weaker in China. This may be due to the lingering effects of the traditional bureaucratic management of faculty work, which treated faculty uniformly regardless of research performance. According to Chen (2003), changes in the governance and management of Chinese universities since the 1990s have led to a transition from a highly bureaucratized "title system" of tenure based on length of service with minimal incentives to work hard, to a more flexible, individualistic and competitive system, drawing heavily on practices in the USA. Under the former system, many highly motivated and

talented researchers were enticed away from research into administrative positions which offered greater power and status.

The generally weak relationships between research time and most other independent variables suggest that research locations have little to do with university policies and status criteria. The exception was the Australian sample, where a consistent pattern amongst the independent variables emerged in the hypothesized directions. Australian faculty who received a large proportion of their research funding from non-institutional sources, found significantly more time for research. The same can be said for those faculty members who had the highest levels of publishing, while having a low level of publishing was likewise associated with significantly fewer research hours. Similar patterns were evident in the UK and to a lesser extent, Hong Kong. While we expected a stronger relationship between individual research time and these variables in other countries, the fact that these variables are most significant in Australia may be explained by the steep academic hierarchy and entrenched nature of managerial practices promoting individualism and stratification (Lafferty and Fleming 2000).

Declining government funding leave universities more dependent on external research funding, and while all faculty teach, external research funding is a key distinguisher between individual faculty members (Slaughter and Leslie 1997). When time pressures are particularly acute, external research funding can be the only method for faculty to “buy themselves out” of other duties and free up time for research (Barry, et al. 2003). The greater statistical significance of the university allocation variables in Australia is consistent with Slaughter and Leslie’s (1997) results, which showed market mechanisms for resource allocation more advanced in Australian universities compared to USA and the UK. By contrast, Canadian faculty were yet to experience managerial oversight to the same extent, which is also consistent with our results. Doctoral qualifications were more strongly associated with research hours in Canadian universities than other factors, such as publication productivity. The greater importance of external research funding and

publishing in Australian universities suggests that competitive performance-based processes are more important status criteria for research time allocations than qualifications.

Our results for gender and children responsibilities were insignificant in most countries, but one must also be cautious not to dismiss the indirect influence of these variables on research time. Our sample excluded part-time faculty and it is likely that women with caring responsibilities may opt out of full-time academic employment given the well-documented difficulties managing competing demands (Barry, et al. 2003; Jacobs and Winslow 2004a; 2004b; Probert 2005). Therefore, the remaining group of full-time female academics with young children may not be representative of the population of academics caring for children. Many of the fixed-standard variables also minimize the effect of these variables, as research publishing is affected by dependent children (Kyvik and Teigen 1996).

The data on American faculty warrants further scrutiny because USA is a country where we have previous multivariate studies of research time. Bellas and Toutkoushian (1999) examined time allocations between tasks and found full professorship positively associated with the proportion of time dedicated to research, while females and lecturers spent relatively more time on teaching. Link and colleagues' (2008) explored the role of tenure and promotion in determining the number of research hours, controlling for gender, ethnicity, citizenship and marriage. They found research hours declined with promotion to associate professor and with the number of years of tenure, particularly beyond 7 years of tenure.

Although we do not find a significant relationship between tenure and research hours in our regression results, we do find similar results for rank and length of time since promotion. Assistant professors and other junior faculty averaged 19.7 research hours per week (n=182) and full professors 20.3 hours, compared to 16.1 hours for associate professors. Associate professors with seven or more years at this rank spent fewer hours on research (13.5 hours, n=56) compared to other

associate professors (167 hours, $n=129$). This provides some support to Link and colleagues' (2008) assertions that tenure and length of time as an associate professor may be associated with fewer research hours. However, it is not clear if this is due to declining preferences towards research, the perceived utility of additional research or other factors.

3.5 Conclusion

Using data from a survey of university faculty across 13 different countries, our analysis showed significant variation in the number of hours devoted to research within and between countries. We examined three different groups of explanations for variation between individual faculty members, differences in: (a) university policy, (b) individual motivation, and (c) family commitments. While each of these three explanations can account for a significant proportion of the variation in research hours in Australia, in most countries the relationships are weak. A strong individual motivation towards research over teaching was the only variable which showed a significant and positive relationship with research hours in all 13 countries. This lent the strongest support for the "sacred spark" theory that certain faculty prioritize and have an inner compulsion to do research. The significance of this variable, compared to university allocation policies, may also be reassuring to those concerned about the state of faculty autonomy. However, research hours vary considerably within each of our national samples and our model generally explained only a small fraction of this variation. Even though this is similar to former studies of research time allocation (Gottlieb and Keith 1997, Bellas and Toutkoushian 1999, Link et al. 2008), much remains to be explained as to why research hours vary so dramatically between faculty.

One reason why university allocation policies did not explain much of the variation in research hours may be that unequal resource distribution conflicts with prevailing academic norms for formal equality amongst faculty staff. In addition to strategic objectives and practical considerations, resource allocation policies are also

influenced by considerations on distributional justice (Elster 1992; Kyvik 2009). Research time is also prerequisite for developing research competence, and concentrating research time allocations towards certain faculty may not maximize the research potential of the entire staff base. Such practices may also conflict with political objectives to extend research opportunities to historically underrepresented groups.

Another reason may be that university managers have weak power to implement policies. This could also account for some of the differences we noticed across countries. For example, in Brazil the top-tier universities have strong collegial power and been able to resist changing in response to government policy or administration objectives (Balbachevsky and Quinteiro 2003). By contrast, the Argentine Government's modernization agenda of the early 2000s required faculty to improve their research skills, which led to en mass enrolment in post-graduate degrees (Marquis 2003). In Argentina, faculty are highly stratified based on research qualifications and there are very few full-time faculty actively engaged in both research and teaching. The significance of the PhD as a factor associated with research hours in Argentina may reflect the relatively stronger role of a PhD in this system. By comparison, in the UK, Hong Kong and Australia, where the PhD is largely a pre-requisite for entry, government policies and research funding agencies have focused on assessing quality and quantity of research.

Finally, our results also suggest that academic field remains an important factor when understanding the diversity in faculty research hours. Generally, those employed within technology and engineering departments spent more hours on research, which may reflect the ability of such academics to bypass institutional constraints on research funding. Faculty within the medical sciences also tended to be less engaged with research, but this may be due to how universities accommodate external service into academic duties. The concept of "individual freedom" is broadly interpreted in Italian universities and research time is considerably less in medicine and other professional

fields where faculty are able to maintain full-time faculty appointment while actively engaging in external service (Moscato 2001).

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4. Cross-country differences in publishing productivity of academics in research universities

Peter James Bentley

Abstract

The main bibliometric databases indicate large differences in country-level scientific publishing productivity, with high growth in many East Asian countries. However, it is difficult to translate country-level publishing productivity to individual-level productivity due to cross-country differences in the size and composition of the research workforce, as well as limited coverage of publications in the social sciences and humanities. Alternative data sources, such as individual-level self-reported publication data, may capture a wider range of publication channels but potentially include non-peer reviewed output and research republished in different languages. Using individual-level academic survey data across 11 countries, this study finds large differences across countries in individual-level publishing productivity. However, when fractionalised for English-language and peer-reviewed publications, cross-country differences are relatively smaller. This suggests that publishing productivity in certain countries is inflated by a tendency to publish in non-peer reviewed outlets. Academics in large, non-English speaking countries also potentially benefit from a wider range of domestic publication channels. Demographic, motivational and institutional characteristics associated with high individual-level publishing productivity account for part of the publishing productivity differences within and between counties in English-language and peer-reviewed publishing productivity, but not in total publishing productivity where such workforce characteristics only account for within-country differences.

Keywords: Publication productivity, research, publishing, English-language publishing, double-publishing, peer-review ⁴

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4.1 Introduction

Since the early 1990s the balance in global research has shifted away from North America and other established systems in Western Europe and Japan, towards emerging Asian countries. At an aggregate national level, this can be demonstrated based on input factors, such as total R&D expenditure or the number of scientists, or in terms of research outputs based on the number of scientific publications and citations (Larsen et al. 2008). The spectacular growth of China and other Asian nations against a relative decline in the USA and Europe has received considerable attention (Leydesdorff and Wagner 2009). For example, the USA's share of all scientific articles within the Web of Science declined from 38% in the early 1990s (the period 1990-1994) to 29% in recent years (2008-2012), while mainland China's share increased from 1% to 12%. However, changes in national output do not directly reflect individual-level productivity of researchers. The exponential growth in China can be attributed in part to the sustained increases in funding, the tapping of an almost unlimited reservoir of highly-skilled human resources, and the return of overseas scholars (Zhou and Leydesdorff 2006).

Understanding how the relative output of countries reflects the productivity of individual academics is much more difficult to determine. Bibliometric databases, combined with national R&D statistics, may be used as a rough benchmark to compare individual-level productivity. For example a highly cited article published in *Nature* titled "The scientific impact of nations", showed that the UK published more scientific articles than Japan during 1997-2001, despite having fewer than one quarter the number of full-time researchers (King 2004). Thus on these aggregated metrics, the UK - along with USA, Canada, Italy, Germany and France - all dramatically outperformed Japan on a "publications per researcher" basis. However, the use of bibliometric databases for international comparisons of individual academic productivity has several limitations.

Firstly, the major scientific databases (Thomson-Reuters Web of Science or Scopus) lack coverage of publication channels in the humanities and social sciences (e.g. books and book chapters) and non-English language outlets (Harzing 2013). This means they are inappropriate for generalising the individual-level publishing productivity of academics outside the sciences. Therefore, international comparisons tend to be limited to a narrower range of scientific fields (Leydesdorff and Wagner 2009). Secondly, various types of researchers may be included in national-level personnel data, such as private sector R&D personnel and public research institute staff. These researchers will not always be engaged primarily (or on a full-time basis) in research leading to scientific publications, and unlike academics, will not have direct obligations to teach. Therefore, national differences in the structure of the R&D workforce will influence individual-level publication productivity derived from aggregated data. Finally, treating the number of full-time researchers as the primary input factor assumes homogeneity of researchers and institutional settings. This is clearly not the case within the higher education sector. Universities and colleges differ in their research profile, while academics within them differ in rank, qualifications, experience, and dedication to research relative to other duties.

The limited disciplinary and linguistic coverage of international databases mean that surveys of the academic profession may provide a more complete picture of scholarly publishing (Kyvik 2003). Although there are many single-country studies which account for differences between individual academics, international studies are rare (Teodorescu 2000). This is most likely due to the lack of detailed and comparable data on the characteristics shown to correlate with higher levels of productivity. Studies of individual research productivity in the USA and other countries suggest productivity is an outcome of a complex mix of individual background, behavioural and institutional factors (Fox 2005, 1983; Fox and Mohapatra 2007; Bland et al. 2005; Long 1992; Xie and Shauman 1998; Kyvik 1991). Given that national higher education systems and the profile of academics within them differ on each of these attributes, accounting

for cross-country differences in individual-level productivity requires data on these attributes.

International survey studies from the 1990s showed large national differences in individual-level research productivity (Altbach 1996; Enders and Teichler 1997). More recent studies based on 2007 survey data from the Changing Academic Profession (CAP) project, show USA academics publish around half the number of articles and book chapters as academics in some Western European and Asian countries (Bentley and Kyvik 2011; Cummings and Finkelstein 2012). It is, however, unclear whether publishing performance differs primarily due to the types of duties academics perform or their institution's support for research, rather than research effectiveness. In other words, countries may differ in the structure of their academic workforces with lower productivity countries containing a lower proportion of academics exhibiting characteristics generally associated with higher levels of research output. Secondly, publishing productivity be lower in USA and other English-speaking countries because academics within these countries publish exclusively in English, limiting their range of potential publication outlets and the possibility to publish their results in multiple languages. This article investigates this possibility by examining mean individual-publishing productivity in its totality, as well as those within English-language and peer-reviewed outlets.

This study will provide a comprehensive picture of scholarly publishing across a range of academic disciplines in 10 countries and Hong Kong (a special administrative region of China, but hereafter referred to as a country). The purpose is to examine country-level differences in the mean publishing productivity of university academics, and attempt to account for these differences based on the structure and attributes of the academic workforce. Additional analyses will investigate how total publishing productivity relates to the propensity to publish in English-language and peer-reviewed outlets. The selection of countries includes the three largest and most mature research systems (USA, UK and Germany), two of the world's fastest growing systems (China and Korea), as well as four well-

established medium-sized systems (Canada, Australia, Italy and Hong Kong) and two well-established smaller systems (Norway and Finland).

4.2 Determinants of publishing productivity

Rosser and Tabata (2010) comprehensively reviewed the conceptual and theoretical frameworks used to examine academic work and productivity. Many studies seeking to explain individual-level differences use a rather standard mix of variables, such as demographic characteristics, attributes or work habits, and organisational factors which reinforce behaviours (Fox 1983; Teodorescu 2000; Fox 1992). An abundance of studies show a persistent pattern of lower publishing productivity amongst women (Ward and Grant 1996; Creamer 1998). Various explanations have been given, including scientific ability, social selection (e.g. discrimination), self-selection (personal choice) and accumulated disadvantage (Zuckerman 2001). However, after controlling for other factors, gender is often a weak indicator of publishing productivity (Lee and Bozeman 2005; Teodorescu 2000).

Various studies have shown that academic rank is one of the strongest indicators of individual and departmental publishing productivity (Xie and Shauman 1998; Sheehan and Welch 1996; Kyvik and Teigen 1996; Kyvik 1991; Ramsden 1994; Bentley 2012; Dundar and Lewis 1998). As a predictor of publishing productivity, rank captures a variety of underlying attributes including the positive effects of research experience, as well as the potentially negative impacts of aging on intellectual functioning (Stephan and Levin 1992) and research motivation (Cole and Cole 1973). Studies across a range of countries have found age and the aging effects to be relatively minor (Gingras et al. 2008; Kyvik and Olsen 2008; Teodorescu 2000), but the positive effects of seniority may mask this due to the endogeneity research output and promotion (Mishra and Smyth 2012). Academics are promoted based on demonstrated research performance, and access to research resources (e.g. time, funding, research support staff)

may be concentrated based on status criteria (Kyvik 2009). Other status criteria include doctoral training, particularly in countries where research has only recently emerged as a primary academic duty (e.g. China), or where teaching-focused institutions have become integrated into the university sector (e.g. Australia and the UK).

Academics also differ in their dedication and approach towards research. It is generally accepted that collaboration has a positive effect on scientific publishing and various studies have shown a positive correlation between high productivity and high levels of co-authorship (Katz and Martin 1997). However, when fractionalised based on number of co-authors, the relationship between collaboration and productivity is not always statistically significant (Lee and Bozeman 2005). Time spent on research is partly a residual category for what time remains after other duties such as teaching, but research time is also strongly related to research interest (Bentley and Kyvik 2013). Combined, research time and interest are strongly associated with publishing productivity across many countries (Fox 1992; Sax et al. 2002; Teodorescu 2000).

Publishing productivity is also influenced by the institutional support for research both in terms of time and resources. Academics are expected to at least partially engage in teaching and service and this comes at the cost of time available for research, which also differs between institutions and countries (Bentley and Kyvik 2012). A number of studies have reviewed and critically examined the relationship between teaching duties and research output, with some suggesting trade-offs between teaching and research (Fox 1992), while others finding no relationship (Hattie and Marsh 1996; Marsh and Hattie 2002). Generally, teaching hours have a much weaker relationship with research publishing than research hours (Teodorescu 2000). The amount of research funds one receives is a strong predictor of individual publishing productivity (Teodorescu 2000; Dundar and Lewis 1998), but unlike baseline research support resources (e.g. libraries and other infrastructure), research funding may be concentrated amongst those with past research performance and thus partly endogenous to research output. Nevertheless, there

are large cross-country differences in national spending on R&D in higher education institutions which would likely lead to differential outcomes.

Beyond the workforce and institutional characteristics, the quantum of published output also reflects the availability and choice of publication channel. Peer-reviewed research takes longer to publish and academics in countries where this is the “gold standard” likely publish less (on a per researcher basis). Similarly, academics will have different ranges of domestic language publication channels. For academics in English-language systems, linguistic hegemony in science communication means they can communicate with international audiences in their local language, but this also means they cannot publish initially in their local language and subsequently in English. This is somewhat similar for academics in small countries with unique local languages in the “scientific periphery” due to their minimal local publication outlets and necessity for international collaboration (Kyvik and Larsen 1997). The potential benefit of double-publishing is most applicable in non-English speaking countries serving large domestic audiences.

4.3 Research questions and hypotheses

Consistent with previous within-country studies of individual-level publishing productivity (Fox 1983; Teodorescu 2000; Fox 1992), the determinants of higher productivity may be placed into three broad categories: demographic, motivational and institutional characteristics. Assuming that the factors associated with publishing operate in a similar fashion across countries, it may be expected that cross-country differences in individual publishing productivity will relate to these academic workforce characteristics. These form the basis of the first four hypotheses.

H1. Cross-country differences in individual publishing productivity can be attributed to the *demographic* profile of the academic workforce;

H2. Cross-country differences in individual publishing productivity can be attributed to the *motivation and achievements* profile of the academic workforce;

H3. Cross-country differences in individual publishing productivity can be attributed to the *institutional characteristics* of the academic workforce;

H4. Cross-country differences in individual publishing productivity can be attributed to the combined *demographic, motivation and achievements*, and *institutional characteristics* of the academic workforce;

If similar research is published concurrently in multiple languages, then individual publishing productivity would be inflated in non-English speaking countries where multi-language publishing possibilities are greatest. Therefore, one may expect that individual publishing productivity of English-language publications will be less variable across countries because it excludes research re-published across multiple languages.

H5. Cross-country differences in individual publishing productivity will differ less in English-language publications, controlling for the demographic, motivation and achievements, and institutional characteristics profile of the academic workforce.

Similarly, if research is both published in non-peer reviewed and peer-reviewed channels, or if countries differ in the extent to which

they publish in these channels, total publishing would be inflated in countries where non-peer reviewed research is more common. Therefore, one may expect that individual publishing productivity will differ less across countries when publications fractionalised for peer review.

H6. Cross-country differences in individual publishing productivity will differ less in peer-reviewed publications, controlling for the *demographic, motivation and achievements, and institutional characteristics* profile of the academic workforce.

4.4 Data and methodology

Data

The data analysed in this study comes from the Changing Academic Profession (CAP) project, an international survey of the academic profession conducted in 2007–08. The full sample included 26,000 higher education employees across Hong Kong and 18 countries, but this study is restricted to a subsample of university academics in Hong Kong and 10 countries: Australia, Canada, China, Finland, Germany, Italy, the Republic of Korea, Norway, UK, and the USA. Argentina, Brazil, Japan, Mexico, Malaysia, Portugal, South Africa and the Netherlands were excluded due to insufficient respondents.

To avoid problems with mean research productivity being skewed by cross-country differences in the proportion of part-time or specialised (research-only and teaching-only) staff, data is restricted to full-time academics working at least 30 hours of work per week and engaged in both teaching and research. Secondly, the sample includes only research universities and excludes colleges, polytechnics and universities of applied science.

The national samples were found to be broadly representative of the respective populations on strata such as gender, academic rank and institutional type (RIHE 2008), but response rates were mostly below 40% and academics in senior ranks tended to be overrepresented in the majority of samples (Rostan et al. 2014). The relatively low response rates were likely due to the large number of survey questions and surveys not being received (particularly online invitations), while the overrepresentation of senior academics probably reflects their more stable forms of employment and greater contactability. Given the positive relationship between rank and published output, the original national samples (including part-time staff) were weighted according to the population estimates for rank. The 7,642 cases in the weighted sample is around 10% less than the total number of respondents, mostly due to the exclusion of part-time staff from the sub-sample (who tended to be in lower ranks and receiving greater weightings).

Although the weighting process helps overcome non-response bias, self-selection bias is a potential problem if publishing behaviours influenced one's choice to respond. This is unlikely to be the case, given the CAP survey was comprehensive and not specifically targeted towards research behaviours, but due to confidentiality of respondent (and non-respondent) identity, it is not possible to estimate self-selection bias. Self-selection is more likely to be a problem in China where although response rate was high, so too was item non-response. Due to a relatively large number of partially completed surveys, only 61% of respondents in China provided usable data on publishing (compared over 90% of respondents in other countries). The sample characteristics are shown in Table 4-1, along with the means for the two publishing productivity variables.

Table 4-1. Sample characteristics and response rates, mean article equivalents and English-language article equivalents.

	Total sample	Sub-sample	Item response rate (%)	Survey response rate (%)	Article equiv.	English article equiv.	Peer-reviewed article equiv.
Australia	1,381	624	91	25	9.2	9.2	7.2
Canada	1,152	886	93	17	8.3	6.5	6.3
China	3,612	916	61	86	13.5	4.6	3.0
Finland	1,452	567	94	28	9.1	5.7	5.6
Germany	1,265	548	94	32	10.8	6.1	6.1
Hong Kong	811	394	90	13	11.8	10.5	9.7
Italy	1,701	1,441	98	35	14.5	8.5	8.3
Korea	900	797	99	13	16.7	6.6	8.4
Norway	1,035	392	95	36	11.0	8.1	8.2
UK	1,663	457	91	15	8.4	8.2	6.4
USA	1,146	619	95	21	6.5	6.4	4.9
Total	16,118	7,642			11.5	7.3	6.8

Dependent variable - Article equivalents

Individual publication productivity is based on “article equivalents”, calculated as the weighted sum of self-reported articles in books or journals (1 point), edited books (2 points) and authored books (5 points) over the three years prior to the survey (typically, 2005-2007). The broadness of the measure captures publishing productivity in its entirety, rather than publications within a narrow range of outlets. A three year reference period is considered appropriate for assessing research performance and producing reliable results (Abramo et al. 2012). Using article equivalents and weighting of books more heavily reflects the relative contribution of the different publication types, minimises differences across disciplines and is consistent with similar multi-disciplinary studies of research output (Kyvik and Teigen 1996; Ramsden 1994).

English-language and peer-reviewed article equivalents are used as fractionalised versions of the dependent variable. In Australia, UK, USA, Hong Kong and English-language Canadian universities, English-language article equivalents is based on the proportion of one's publications in English. In other countries and French-language Canadian universities, it is based on the proportion "published in a language different from the language of [institutional] instruction", which is a close approximation. The vast majority of non-native English speakers who did not research primarily in their native language, reported that they conducted their research in English (98%). Therefore, it is reasonable to assume that publications in languages different from the language of instruction will overwhelmingly be in English. Peer-reviewed article equivalents are based on the proportion of one's publications which were peer reviewed. There is a risk that respondents engaged in non-scholarly publishing (e.g. reports and newspaper articles) may include these publications in their estimate of peer review, thus underestimating their percentage for scholarly publications. However, most academics reported either 100% or 0% for peer review, and there was no meaningful correlation between peer review and the number of non-scholarly publications. Therefore, we may be confident that the peer review estimates are reliable.

Publication productivity is roughly normally distributed but positively skewed. Outliers on the dependent variable (more than 100 article equivalents) were removed. Just under 8% of the sample reported no publications, while 15% published more than 20 article equivalents. Alternative transformations of the dependent variable were also tested, such as articles-only or an unweighted sum of publications, but the OLS results were very similar. All of the models were also replicated with a square root transformation for article equivalents and its fractionalised variations. The square root transformation further normalised the distribution, strengthened the statistical significance and fit of the model (coefficient of determination), but had minimal impact on the overall results and conclusions. For space reasons, the complete OLS models for article

equivalents (and fractionalised versions) are presented in the results section and the square root transformation models in Appendix 4-B.

Limitations of the dependent variable

Publication counts do not measure impact or quality of publications, and the fractionalisation measure for peer review is imprecise. This is unavoidable due to the survey data, but also a necessary limitation because the purpose of the study is to examine the total publishing productivity, rather than a narrower range of outlets in disciplines where citation impact is an acceptable proxy for quality. Secondly, this study is reliant on self-reported data and some may question its accuracy. Although imperfect, there are few reasons to believe self-reported publications would be subject to systematic error or bias. Publications are often reported as core performance criteria, and the anonymous nature of the survey provides detachment and neutrality, mitigating any social desirability response bias. Self-reported publications have also been found to highly correlate with verified publications in specified outlets (Clark and Centra 1985). Finally, articles and books cannot be fractionalised for co-authorship due to the lack of a specific question in the survey. This will overestimate publishing productivity in countries where co-authorship is more common.

OLS regression models

Each of the six hypotheses are examined based on an OLS regression model. Hypotheses 1, 2, 3 and 4, correspond, respectively, to model 1 (M1), model 2 (M2), model 3 (M3), and model 4 (M4). A reference model (M0) is also computed with only the control variables for country and academic field (social sciences as the reference category). For M0-M4, the dependent variable is raw article equivalents and the USA is the reference country, due to the lowest mean (see Table 4-1).

Hypotheses 5 and 6 follows the same methodological approach, but use fractionalised measures for English-language article equivalents (M5) and peer-reviewed article equivalents (M6). China is the reference country in these models, due to having the lowest mean (Table 1). For space reasons, only the combined OLS models are listed in M5 and M6.

Independent variables associated with publishing productivity

As outlined above (under “Determinants of research productivity”), previous studies suggest that the factors associated with publishing productivity fall into three broad categories: demographic, motivation and achievement, and institutional characteristics. These form the theoretical rationale for the inclusion and grouping of independent variables, and their expected relationship with publishing productivity. Means for all independent variable means are listed in Appendix 4-A.

Demographic characteristics include gender and experience. Males have routinely been found to publish more than females, but the experience has mixed effects. Older academics tend to benefit from increased seniority and research expertise which comes with career progression. Therefore, years of experience in the higher education or research sector (beyond research or teaching assistant) captures these positive linear effects. However, the aging process may lead to a gradual decline in productivity for reasons including declining research motivation and intellectual functioning. A squared transformation of years of experience is included to capture these negative non-linear effects.

The second block of variables for motivation and achievement include qualifications (PhD), research collaboration, research hours and research interest. It is expected that country workforces with higher proportion of PhDs and those with stronger research engagement will tend to publish more. Research interest was defined on a 4-point

Likert scale from primarily in teaching (1) to primarily in research (4). Research hours was computed based on a weighted average of self-reported hours during the teaching period and non-teaching period (with the teaching period weighted as twice the duration of the non-teaching period). Research collaboration was defined as having collaborators in any current research project.

The third block of institutional characteristics include self-reported hours spent on teaching, self-reported hours on administration and service (combined), and a constructed variable for institutional research support. Presumably, hours spent on non-research activities will not contribute to research output or exhibit a negative effect by leaving less time for research, though the effects of these variable have been weak in previous studies. Research support is expected to be positively related to publishing and constructed as a 5-point scale (from 1 to 5) based on self-reported satisfaction with up to five items: laboratories, research equipment, computer facilities, library holdings and faculty offices. Not all research support resources were relevant to all academics, so an index was created based on the mean across relevant resources. This index was internally consistent (Cronbach's Alpha = 0.78), indicating that each item of research support index measures a unique (but related) type of institutional research support.

4.5 Results

As shown in Table 4-1, academics in the four countries with the highest mean publishing productivity – Korea, China, Germany and Italy – were, on average, more than twice as productive as the American counterparts. What may account for these large differences across countries? Four possible workforce explanations are investigated, differences in: the demographic and experience profile (H1), research motivation and associated behaviours (H2), institutional support for research (H3), and a combination of these (H4). Additionally, we examine whether cross-country differences found in total publishing productivity may be related to the propensity to publish in domestic-language publication outlets (H5)

or non-peer reviewed outlets (H6). The results for the respective OLS regression models are listed in Table 4-2 (M1-M3) and Table 4-3 (M4-M6).

The model summary statistics indicate that the addition of each block of independent variables increases the explanatory value of the model beyond the use of control variables for country and academic field (M0). However, the inclusion of each block showed only a weak association with article equivalent productivity, increasing the adjusted R-square value from 0.08 in the reference model (M0) to 0.11 in M1, 0.13 in M2 and 0.09 in M3. The combined model accounted for the greatest share of variance in article equivalent publishing, with an adjusted R-square of 0.18, suggesting each block of variables captured distinct elements. Given the large ratio of cases to independent variables, statistical significance of each independent variable is less important than the relative size of the beta coefficients.

Table 4-2 OLS results for article equivalent publishing (M0-M3)

	M0		M1		M2		M3	
	B	SE	B	SE	B	SE	B	SE
(Constant)	6.05**	0.51	0.97	0.61	-5.59**	0.81	7.10**	0.89
Australia	2.34**	0.69	2.65**	0.71	1.93**	0.70	2.48**	0.69
Canada	1.52*	0.62	1.97**	0.63	0.44	0.63	1.78**	0.62
China	7.48**	0.62	7.85**	0.63	9.04**	0.65	8.28**	0.63
Finland	2.66**	0.71	3.70**	0.73	2.17**	0.72	2.92**	0.71
Germany	4.19**	0.69	5.00**	0.71	3.76**	0.70	4.02**	0.69
Hong Kong	5.33**	0.76	4.79**	0.78	4.31**	0.76	5.42**	0.76
Italy	8.04**	0.56	8.09**	0.56	8.56**	0.59	8.42**	0.57
Korea	10.36**	0.62	10.11**	0.64	9.64**	0.63	10.74**	0.63
Norway	4.45**	0.77	3.48**	0.78	3.99**	0.78	4.98**	0.77
UK	1.70*	0.72	2.23**	0.72	0.92	0.72	1.83*	0.71
Humanities	0.44	0.43	0.39	0.44	1.09**	0.43	0.62	0.43
Nat. Sciences	0.08	0.37	-0.44	0.38	-0.91*	0.36	0.00	0.37
Technology	-0.58	0.44	-1.20**	0.45	-1.03*	0.43	-0.83	0.44
Medicine	3.42**	0.46	3.13**	0.47	3.54**	0.45	2.70**	0.46
Male (%)			2.27**	0.30				
Experience			0.45**	0.04				
Experience Squared			-0.01**	0.00				
PhD (%)					3.42**	0.34		
Research collaboration (%)					2.93**	0.36		
Research hours					0.10**	0.01		
Research interest (1-4)					1.80**	0.21		
Teaching hours							-0.12**	0.02
Admin and service hours							0.05**	0.02
Research Support (1-5)							0.04	0.18
Adjusted R Square	0.08		0.11		0.13		0.09	
n	7,056		6,599		6,824		7,042	

Note: Statistical significance * p<0.05 **p<0.01; USA and social sciences as reference categories.

Table 4-3. OLS results for article equivalent (M4), English language (M5), and peer-reviewed publishing (M6)

	M4		M5		M6	
	B	SE	B	SE	B	SE
(Constant)	-14.71	1.29	-13.79	1.08	-11.90	1.08
Australia	2.58	0.71	2.72	0.62	2.19	0.62
Canada	1.33	0.63	0.17	0.56	1.59	0.56
China	10.12	0.67	N/A	N/A	N/A	N/A
Finland	4.02	0.74	0.05	0.63	1.41	0.64
Germany	4.82	0.71	-0.84	0.61	0.87	0.61
Hong Kong	4.00	0.77	3.73	0.68	4.34	0.68
Italy	9.35	0.60	2.95	0.49	4.23	0.49
Korea	9.83	0.65	0.49	0.56	3.87	0.56
Norway	3.67	0.78	1.09	0.68	2.85	0.68
UK	1.95	0.73	2.09	0.64	1.65	0.64
USA	N/A	N/A	0.66	0.60	0.50	0.60
Humanities	0.88	0.44	0.20	0.38	-0.15	0.38
Nat. Sciences	-1.35	0.37	3.49	0.32	2.07	0.32
Technology	-1.47	0.45	2.22	0.39	0.50	0.39
Medicine	2.73	0.47	5.15	0.40	4.42	0.40
Male (%)	1.61	0.30	1.21	0.26	1.10	0.26
Experience	0.43	0.04	0.27	0.04	0.29	0.04
Experience Squared	-0.01	0.00	-0.01	0.00	-0.01	0.00
PhD (%)	3.53	0.36	2.93	0.31	2.32	0.31
Research collaboration (%)	2.36	0.37	1.71	0.32	1.90	0.32
Research hours	0.17	0.02	0.12	0.01	0.10	0.01
Research interest (1-4)	2.13	0.22	2.14	0.19	1.99	0.19
Teaching hours	0.03	0.02	0.01	0.02	-0.02	0.02
Admin and service hours	0.14	0.02	0.12	0.02	0.11	0.02
Research Support (1-5)	-0.03	0.18	0.34	0.16	0.14	0.16
Adjusted R Square	0.18		0.16		0.14	
n	6,383		6,092		6,091	

Note: Statistical significance * $p < 0.05$ ** $p < 0.01$; USA and social sciences as reference categories in M4, China and social sciences M5-M6.

H1. Results for demographic characteristics

Hypothesis 1 received no support from our data. Males tend to publish around two additional article equivalents, while each additional year of experience translates into half of one article equivalent. The positive effect of experience declines in later years, as reflected by the negative beta coefficient for the squared transformation of this variable. This likely indicates that publishing productivity steadily increases throughout one's career, perhaps reinforced through the promotion and tenure system, but plateaus in later years. However, in terms of accounting for cross-country differences in publishing productivity, the inclusion of these variables has little effect on the size of the country beta coefficients.

Based on the 10 dichotomous countries variable beta coefficients, all countries differed significantly ($p < 0.01$) from the USA in their article equivalent publishing controlling for experience, gender and academic field. Compared to the model with only control variables (M0), the addition of these independent variables often strengthened the significance and size of the country beta coefficients. In other words, certain demographic characteristics are associated with greater levels of publishing, but cross-country differences in these factors do not account for differences in individual-level publishing productivity between countries.

H2. Results for individual achievement and motivation variables

Hypothesis 2 received only limited support. Collectively, all individual achievement and motivation variables exhibited statistically significant and meaningful relationships with article equivalent publishing, both in isolation (M2), and when combined with all other variables (M4). However, controlling for differences, qualifications, research collaboration, research hours and research interest, large statistically significant differences remain between highly publishing countries (Germany, Italy, China and Korea) and

the rest. With the exception of Canada and UK, all country variable beta coefficients were statistically significant ($p < 0.01$). Even though the independent variables included in M2 account for variability between individual academics in ways which support previous within-country examinations (such as higher productivity amongst those with PhDs and stronger dedication or interest in research), there is little evidence to suggest they account for, or even minimise, cross-country differences in publishing productivity. Therefore, cross-country differences in publishing productivity cannot be attributed to large cross-country differences in these variables.

H3. Results for institutional characteristics

Hypothesis 3 also received no support from our data. The addition of variables for institutional characteristics were mostly insignificant in statistical and meaningful senses. On their own, there were no meaningful differences in the size of the country beta weights in M3 compared to the reference model (M0), and all country beta coefficients were statistically significant ($p < 0.05$). When all other independent variables were included (M4), most of the institutional characteristics variables lost their statistical significance and meaning, suggesting they neither account for between-country or within-country differences. The positive beta coefficient for hours spent on administration and service in M4 is counterintuitive and should be treated with caution. There is no logical reason to interpret causation, it is more likely that highly publishing academics are sought out for leadership duties.

H4. Results for the combined model

Hypothesis 4 received very limited support. The model itself accounted for the greatest share of variance (adjusted R-Square 0.18) and many of the independent variables retained strong and meaningful relationships with publishing productivity, in particular the variables for experience, PhD, research time and research interest.

These results are entirely consistent with former within-country studies of individual publishing productivity, but given that all ten country beta coefficients were statistically significant (nine at the 0.01 level), these workforce characteristics do not account for the differences in mean publishing productivity between countries. Similar results were found when using a square root transformed dependent variable, suggesting the results are not skewed by prolific or non-publishing academics (see results for M7 in Appendix 4-B).

H5. Results for English-language publishing

Hypothesis 5 proposed that academics in large countries with unique local languages may benefit from publishing separately for their domestic and international audiences. Table 4-1 showed that the top-4 countries in terms of individual article equivalent publishing – Korea, China, and Italy – were all non-English-speaking countries with relatively large domestic audiences. These countries remained the most productive controlling for academic workforce characteristics in M4. However, the results for mean English-language publishing placed these countries nearer the bottom, with China and Korea ranked lowest and fourth-lowest, respectively (Table 1). Only Hong Kong had relatively high article equivalent publishing and high English-language publishing. This was due to the tendency for publications in English-speaking countries to be almost exclusively in English (99% in Australia, 97% in the USA, 96% in UK, and 88% in Hong Kong), compared to a minority of publications in Korea (35%) and China (30%). English language publishing was the dominant, but not exclusive, form of publishing in Norway (72%), Italy (62%), Finland (62%) and Germany (60%). Canada was different to other English-speaking countries with only 80% of publications in English, but this was due to French-language publishing at French-language universities.

Hypothesis 5 received moderate support from the results in M5. Whereas all countries differed significantly from the lowest publishing country in article equivalents (USA in M4) only a four

countries differed significantly from the lowest publishing country in English-language article equivalents (China in M5). In these four countries - UK, Australia, Italy and Hong Kong - academics may be expected to publish between two to four additional English-language article equivalents over a three year period. Although still relatively large, it is considerably smaller than the differences between China and these countries before controlling for workforce characteristics (shown in Table 4-1). The relative size of the country beta coefficients are also considerably smaller in M5 compared to M4 in their standardised format (not shown) as well as relative to the means. In other words, English-language publishing is less variable across countries and increasingly so when controlling for workforce characteristics. However, when using a square root transformation of the dependent variable, the results country level differences remained relatively large (see results for M8 in Appendix 4-B). This suggests that mean English-language publishing in China and other low-publishing countries may be more dependent on a minority of relatively prolific English-language publishers.

H6. Results for peer-reviewed publishing

Hypothesis 6 proposed that the propensity to publish in non-peer reviewed channels may account for the large observed differences in mean publishing across countries. This received moderate support from the results. Fractionalising total publications for peer review reduced the gap between the countries with relatively high total publishing (e.g. China and Germany) and the USA. After controlling for workforce characteristics, differences in mean peer-reviewed publications reduced even further in M6. Whereas all countries differed from China when controlling only for academic field, only six countries differed from China at a comparable level of statistical significance in M6 ($p < 0.01$, full results not shown in Table 4-3). Therefore, there is evidence that peer-review publishing is less variable across countries than total publishing, and variation between countries in terms of peer-reviewed articles may be partly accounted for by differences in academic workforce characteristics. However, meaningful and statistically significant differences remained,

particularly between Hong Kong, Italy, Korea and lower publishing countries. Academics in these high publishing countries may be expected to publish around four additional peer-reviewed article equivalents over a three year period. Further, all countries differ significantly from China when using a square root transformed version of this variable (see results for M9 in Appendix 4-B), suggesting that peer-reviewed publishing is more positively skewed in lower publishing countries.

4.6 Discussion

The main bibliometric databases indicate large differences in country-level scientific publishing productivity, with large increases in recent years in Asia and a relative stagnation in the USA. However, it is difficult to translate country-level productivity to the level of individual academics (or researchers more generally) because countries have different sized research labour forces containing different compositions of researchers. Bibliometric databases also do not capture the breadth of research output, particularly in the social sciences and in non-English publishing channels. Therefore, the purpose of this study has been to investigate cross-national differences in publishing productivity at the individual academic level across a range of academic fields. Previous cross-country studies of individual-level productivity differences have indicated large differences across countries (Cummings and Finkelstein 2012; Altbach 1996), but it remained unclear whether these differences were attributable to the structure of the workforce (e.g. balances between research and other duties) and domestic publishing opportunities.

The first four hypotheses specifically referred to the structure of the academic workforce in terms of the relationship between publishing productivity and cross-country differences in demographic, individual motivation and achievement, and institutional characteristics. None of the results suggested that high levels of individual publishing productivity found in China, Korea, Italy and Germany, can be attributed to workforce characteristics favouring

high individual publishing, such as research time allocations or research qualifications. While these factors explained variation within countries, cross-country differences were persistent (or even greater) when controlling for such factors. For example, China and Italy had high levels of individual publishing productivity despite less than half of all academics included in the samples holding PhD qualifications. Therefore, academics in similar institutions, exhibiting roughly comparable individual-level roles and attributes, published at significantly different rates across countries. In other words, the CAP data suggested academics in China, Korea, Germany and Italy, create more tangible published outputs than academics in other countries, even when controlling for country differences in research capabilities, opportunities and support.

However, one limitation of these results is that publishing productivity is not analogous to (new) research productivity. High individual-level publishing productivity may reflect a greater tendency to republish existing results for different audiences in new publications. One example would be publishing similar research in different languages. Some consider it unethical for academics who have already published research results or ideas in their local language, to later publish similar research in an English book or journal. Such academics may be engaging in “double-publishing” or “redundant publishing” (Neate 2012). However, it is extremely difficult to determine what constitutes redundant publishing. For example, researchers may initially release their descriptive research results in their local language, and subsequently analyse the results in more detail and through a theoretical lens for disciplinary community publications. Such publications may even include attributions to the original research publication. Research funded by national or local government agencies may even require or expect findings to be published in the local language (Schuckit 1997). Refining and repackaging research for multiple audiences is certainly not restricted to multiple-language publishing, but it is more difficult to detect such occurrences.

The fifth hypothesis of this study was that cross-country differences publishing productivity would be smaller when examining English-language publications, partly because it would remove some potentially overlapping research published in multiple languages. This approach towards fractionalising publications clearly favoured English-speaking countries because such academics published almost exclusively in English. English was also the dominant language for research in smaller European countries with unique local languages, perhaps due to their location within the “scientific periphery” where there are relatively weak domestic publishing opportunities and greater importance placed on publishing internationally (Kyvik and Larsen 1997). The greatest disadvantage was for China and Korea, where English publications were a minority, and to a lesser extent in Germany and Italy.

It is very difficult to address the role of non-English domestic-language publishing as an explanation for cross-country differences in published output, but it is unlikely to be mere coincidence that high publishing productivity was associated with countries where academics publish to a greater extent in a language other than English. After removing publications which can only be read by a domestic audience (i.e. produced in the local language of instruction in non-English language universities), publication productivity differed much less across countries. For example, had the highest total publishing productivity but was bottom amongst the 11 countries in English-language publishing. Highly publishing Korea, Italy and Germany were also closer to the mean of all countries on this fractionalised measure.

A final possible reason for the large differences across countries in scholarly publishing is that certain countries may prioritise higher quality publications, whereas others emphasise quantity. This received some support from the data. Although peer review practices differ across (and within) disciplines and tends to be more dominant in English-language outlets for international audiences (Verleysen and Engels 2014), at the very least peer-reviewed research takes longer to publish and to some extent can be taken as a proxy for baseline

scientific quality. In China and Korea the mean proportion of peer review reported by respondents was only 24% and 48% respectively. This compared to a majority in other countries, including between 72-76% in the UK, Australia, Canada and Hong Kong. When publications were fractionalised for peer review there were fewer differences across countries, partly because country-level mean individual publishing productivity was roughly inversely related to peer review. The additional independent variables for workforce characteristics further reduced country-level differences, which was not the case for total publishing. This provided evidence that peer review and workforce characteristics partly account for both within and between country differences in publishing productivity.

Overall, cross-country differences in mean publishing productivity remained statistically significant across all of the publication types examined in this study, even after controlling for workforce characteristics. However, the importance of international and peer-reviewed outlets offers a partial explanation. Countries tended to be either very high in total publishing but low-moderate in English-language or peer-reviewed publishing (China, Korea and Germany), or relatively low in total publishing but have higher levels of English-language or peer-reviewed publishing (Australia, Canada, Norway, UK). Only Hong Kong, and to a lesser extent Italy, stood out as countries with uniformly high levels of publishing productivity across all categories. To some extent USA was low across all categories, though this was somewhat reduced when examining English-language or peer-reviewed publications after controlling for workforce characteristics. On the other hand, it could be argued that academics in many of the highly publishing non-English speaking countries are more productive because they publish for multiple audiences. For example, not only do academics in Germany or Korea publish a similar number of English-language and peer-reviewed publications as their American counterparts, they also publish widely in their local language and in non-peer reviewed outlets. Furthermore, certain research publications will be relevant only to a domestic audience in their local language or in a non-peer reviewed format, particularly books in the humanities or some social sciences.

Therefore, restricting measured research output to peer-reviewed or English-language publishing is a blunt approach to quantifying publishing productivity, even if these choices offer a partial explanation for why academics in some countries publish more than others.

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Appendix 4-A. Independent variable means by country

Country	AUS	CAN	CHI	FIN	GER	HK	ITA	KOR	NOR	UK	USA
Male (%)	54.4	58.4	67.8	55.7	74.6	68.3	67.0	82.0	68.4	51.8	57.4
Experience (years)	14.0	13.3	12.0	12.3	12.0	14.8	17.0	13.8	19.4	13.4	17.0
Experience squared	291.1	282.0	211.0	240.5	255.2	301.0	436.3	264.8	484.0	284.1	428.3
PhD (%)	77.9	93.0	45.1	63.4	76.7	89.3	48.2	97.8	77.5	81.1	84.9
Research collaboration (%)	87.5	86.7	76.1	90.2	72.7	83.4	83.4	75.6	83.5	84.5	82.8
Research hours	17.4	19.8	20.2	20.9	22.5	20.5	21.7	21.2	17.0	18.2	18.6
Research interest (1-4)	2.9	2.8	2.5	3.0	3.0	2.8	2.9	2.7	3.0	3.0	2.6
Teaching hours	15.5	16.4	19.6	14.8	12.3	16.1	15.5	17.3	17.6	15.1	15.1
Admin and service hours	12.9	11.3	8.7	7.2	11.5	12.7	7.2	10.7	9.7	11.0	12.8
Research Support (1-5)	3.6	3.3	3.2	3.8	3.6	3.7	3.2	3.1	3.8	3.2	3.5
Social Sciences (%)	33.9	38.2	24.9	29.7	23.7	44.1	21.5	37.6	31.4	33.7	34.6
Humanities (%)	14.3	17.4	9.6	13.8	9.7	20.5	11.5	16.6	15.7	20.8	22.8
Nat. Sciences (%)	23.1	21.7	34.0	26.3	30.8	12.3	39.4	20.2	24.7	18.7	19.5
Technology (%)	6.7	8.3	28.7	14.9	19.1	8.8	16.6	17.9	9.0	9.3	9.4
Medicine (%)	22.1	14.4	2.9	15.4	16.8	14.2	11.0	7.9	19.2	17.5	13.8

Appendix 4-B. OLS results for square root transformed article equivalents (M7), English language (M8), and peer reviewed publishing (M9)

	M0		M1		M2	
	B	SE	B	SE	B	SE
(Constant)	-1.24	0.17	-2.14	0.17	-1.96	0.18
Australia	0.51	0.09	0.91	0.10	0.96	0.11
Canada	0.30	0.08	0.37	0.09	0.86	0.10
China	1.69	0.09	N/A	N/A	N/A	N/A
Finland	0.71	0.10	0.22	0.10	0.67	0.11
Germany	0.74	0.09	0.02	0.10	0.48	0.10
Hong Kong	0.64	0.10	0.96	0.11	1.18	0.12
Italy	1.61	0.08	0.81	0.08	1.14	0.08
Korea	1.59	0.09	0.08	0.09	0.83	0.10
Norway	0.60	0.10	0.49	0.11	0.95	0.12
UK	0.42	0.10	0.82	0.10	0.87	0.11
USA	N/A	N/A	0.49	0.10	0.56	0.10
Humanities	0.18	0.06	0.06	0.06	-0.05	0.06
Nat. Sciences	-0.25	0.05	0.75	0.05	0.40	0.06
Technology	-0.31	0.06	0.48	0.06	0.05	0.07
Medicine	0.26	0.06	0.90	0.06	0.66	0.07
Male (%)	0.24	0.04	0.21	0.01	0.23	0.04
Experience	0.07	0.01	0.05	0.00	0.05	0.01
Experience Squared	-0.00	0.00	-0.00	0.04	0.00	0.00
PhD (%)	0.71	0.05	0.74	0.05	0.57	0.05
Research collaboration (%)	0.38	0.05	0.36	0.05	0.42	0.06
Research hours	0.03	0.00	0.02	0.00	0.02	0.00
Research interest (1-4)	0.35	0.03	0.41	0.03	0.39	0.03
Teaching hours	0.00	0.00	0.00	0.00	-0.01	0.00
Admin and service hours	0.02	0.00	0.02	0.00	0.02	0.00
Research Support (1-5)	0.00	0.02	0.06	0.03	0.03	0.03
Adjusted R Square	0.24		0.24		0.19	
n	6,383		6,092		6,091	

Note: Statistical significance * $p < 0.05$ ** $p < 0.01$; USA and social sciences as reference categories in M7, China and social sciences as reference categories in M8–M9

5. Gender differences and factors affecting publication productivity among Australian university academics

Peter James Bentley

Abstract

This article examines gender differences in publication productivity and factors correlated with high productivity in Australian universities, during the periods 1991-93 and 2005-2007. Measured as a weighted sum of books and journal articles, females reported significantly fewer publications than men during both periods. Gender differences appear to have reduced over time, with female publishing increasing from 57 percent of the male average in 1991-1993 to 76 percent in 2005-2007. Statistical analyses reveal that women published at similar levels to men of equal rank during both periods, except among Level A staff in 1991-1993 where males published significantly more. Academic rank, doctorate qualifications, research time and international research collaboration were the strongest factors positively associated with publication productivity, but women typically reported significantly lower levels on each of these factors. Institutional and family characteristics were comparably poor predictors.

Key words: gender, higher education, academic profession, research. ⁵

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The Australian academic profession underwent dramatic changes over the past quarter of a century. The Dawkins reforms of the late 1980s, new public management and marketisation, profoundly affected the research orientation and gender profile of Australian universities. The proportion of female academics more than doubled between 1985 and 2010, from 21.6 to 43.6 percent (Carrington and Pratt, 2003; DEEWR, 2010). Over the same period, the proportion of senior ranking positions held by women (above Level C/Senior Lecturer) also increased from 6.0 to 26.7 percent. The growing numbers of female academics has been partly attributed to the Dawkins reforms, which removed the binary divide between universities and former teaching-oriented, vocational 'colleges of advanced education' (CAEs) (Carrington and Pratt, 2003). While the proportion of women was only marginally higher in CAEs compared to the pre-1987 universities (Bell and Bentley, 2005), the unification broadened the disciplinary base of universities by incorporating non-traditional disciplines where women held a critical mass but had weaker research traditions, such as teacher training and nursing. However, despite well established equal employment opportunity legislation and affirmative action frameworks, women have remained overrepresented in junior ranks and underrepresented in science-related disciplines (Allen and Castleman, 2001; White, 2003).

The 'vertical segregation' of women in lower ranks and 'horizontal segregation' by discipline has received considerable attention (Carrington and Pratt, 2003). The precedence of research performance in promotional decisions is frequently cited as a barrier to improved gender equity. The academic hierarchy arguably institutionalises male dominance by associating merit primarily with research publishing, an activity which males receive greater patronage and support (Burton, 1997). Female doctoral students report significantly less encouragement to publish, to apply for research funding, to present research at conferences and to collaborate on research projects (Dever, et al., 2008). This forces women to play 'catch up' later in their careers (Symonds et al., 2006) and likely has negative long term and cumulative career consequences (Long et al., 1993). White (2001) also contends that women have less interest in research and are

concentrated in positions with heavier teaching loads. The deeper implementation of new public management in lower ranks also undermines equal employment opportunity legislation by entrenching the gendered character of university power relations (Lafferty and Fleming, 2000). The concentration of external research funding in science-based and male-dominated disciplines, further hampers female research opportunities (Bell and Bentley, 2005).

Despite its perceived importance, surprisingly few multi-disciplinary Australian studies have examined the publication productivity of men and women, or factors associated with stronger publication records. Sheehan and Welch (1996) found women were less likely than men to publish books, articles, reports and conference papers. Asmar (1999) found early career females were less likely than males to publish as a co-author during their doctorate studies, but equally likely to publish as a sole author. However, both studies only analysed the proportion of men and women publishing, not mean levels of output. Ramsden (1994) examined the factors associated with higher publication productivity and found that women published less than men, but gender had no direct effect after controlling for academic rank. Burton (1997: 24) claims that gender-based comparisons of publication data 'are misleading when not broken down by academic level'. Reviews of institutional reports and earlier studies find few gender differences in publishing above the lowest ranks (Burton 1997; Castleman, et al., 1995). Teodorescu (2000) examined factors associated with article publication productivity and found gender was not significant after controlling for individual-level factors, such as academic rank, research time and research funding. However, none of these aforementioned studies specified the size of gender differences in publishing or whether factors, such as family responsibilities and research collaboration, operate differently for men and women.

5.1 Rationale for the study and research questions

The lack of empirical evidence on gender differences in publishing productivity in Australia raises three questions this article will address:

1. How large are gender differences in publication productivity?
2. Have gender differences in publication productivity changed over time?
3. What factors are associated with increased publication productivity among men and women?

5.2 Data

The data comes from two international surveys: the 1993 Survey of the Academic Profession conducted by the Carnegie Foundation for the Advancement of Teaching (hereafter 'Carnegie') and the 2007 Changing Nature of the Academic Profession (CAP) survey. The target populations were academic staff in Australian public universities, excluding private and overseas providers. Including partial responses, the Carnegie survey generated a sample of 1,420 respondents (response rate 40 percent), while the CAP survey included 1,252 respondents (response rate 24 percent). Both samples closely represented their target populations, were considered appropriate for national level generalisations and have formed the basis of previous Australian studies (Coates, et al., 2008; Sheehan and Welch, 1996). This study examines a subset of respondents: those who answered the research publication question, reported a full-time contract with at least 30 hours per week, and spent at least one hour per week on both teaching and research. The subset includes 713 men and 327 women in the 1993 Carnegie sample, and 341 men and 292 women in the 2007 CAP sample. The sample distributions by rank and gender are shown in Table 5-1.

Table 5-1 The number and percentage of full-time academics by rank and gender, 1993 and 2007 samples

	1993 Carnegie						2007 CAP					
	Male		Female		Total		Male		Female		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Level A	31	4	53	16	84	8	20	6	28	10	48	8
Level B	219	31	172	53	391	38	107	31	123	42	230	36
Level C	245	34	67	20	312	30	94	28	84	29	178	28
Level D	130	18	18	6	148	14	63	18	33	11	96	15
Level E	84	12	11	3	95	9	55	16	24	8	79	12
Unknown	4	1	6	2	10	1	2	1	0	0	2	0
Total	713	100	327	100	1040	100	341	100	292	100	633	100

5.3 Methodology and variable summary

The production function approach treats publication productivity as a function of independent variables (Teodorescu, 2000). Consistent with Fox's (1983) widely cited framework and Teodorescu's earlier study of the Carnegie data, independent variables are classified as background, work habits or institutional variables. Summarised in Table 5-2, the variables form the basis of the regression analyses for factors affecting publication productivity.

Dependent variable

Publication productivity is measured as a weighted sum of an individual's self-reported publications during the three years prior to each survey, 1991-1993 and 2005-2007. The three-year reference period is sufficient to accommodate the time lags between research, submission and publication (Fox and Mohapatra, 2007; Kyvik, 1991).

However, in the case of the 1993 data, the reference period includes a transitional period for staff formerly employed in teaching-focused CAEs. Publication productivity is expressed in 'article equivalents' and calculated as a weighted average of 'articles or chapters in academic books or journals' (1 point), 'edited books' (2 points) and 'authored books' (5 points). By including multiple publication types and giving heavier weighting to books, the productivity index minimises differences across academic fields and is consistent with previous multi-disciplinary studies (Kyvik, 1991; Kyvik and Teigen, 1996; Ramsden, 1994).

Few academics publish nothing, but the majority of research is published by a small minority. As suggested by Fox and Mohapatra (2007), a square root transformation of article equivalents is used to normalise the skewed distribution of article equivalents for linear multiple regression. Separate regression analyses were also conducted using (untransformed) article equivalents as the dependent variable. These analyses achieved comparable results to those with the square root transformation, but with generally lower beta weights, lower coefficients of determination (R-square) and fewer variables achieving significance. Gender-based comparisons of means are computed with an independent samples *t*-test and 95 percent significance level.

The dependent variable has clear limitations. No information is available on the number of co-authors, the publication length, quality or impact through citation counts or peer review. This will favour academics who publish a large number of short, co-authored and non-peer reviewed publications. Secondly, non-respondents to the publication productivity question were removed from the sample. Non-respondents likely include many non-publishing staff. Therefore, there may be an overestimation of actual publishing levels in the sample.

Independent variables

Age is a scale variable based on years of age.

Marital status (CAP only) has three categories: 'single', 'married to an academic' and 'married to a non-academic'. Marriage is considered positive for publication productivity, particularly for men (Kyvik, 1991; Long, 1990). Females also benefit from marriage (Hartley and Dobeles, 2009), but the positive effects may be negated by the presence of children (Long, et al., 1993). Men married to comparably educated women have been shown to have lower publication productivity than other married men, which may be due to a more equal distribution of household work (Creamer, 1998). Women are more likely to be married to fellow academics, but such marriages have only moderately positive effects on publication productivity compared with other marriage types (Fox, 2005). This may be due to the effect of being a 'trailing spouse' whose career follows the husband (Sonnert and Holton, 1995).

Number of children living at home (CAP only) has four categories: 'no children', 'one child', 'two children' and 'three or more children'. A review of previous studies shows mixed results for the effect of children on publication productivity (Creamer, 1998), but the effect is typically smaller than work habits and institutional factors (Sax et al., 2002). The negative effect of children for women has been shown to increase with the number of children (Long, 1990), but younger children (under 10 years) affect female publication productivity more negatively than older children (Kyvik and Teigen, 1996).

Child and elder care (CAP only) is a continuous variable based on the number of years respondents had interrupted their employment for child or elder care. The greater frequency and duration of career breaks have been interpreted as a long-term disadvantage for female researchers (Long, et al., 1993).

Doctoral degree is a dichotomous variable based on possession of a doctoral degree. The lack of a doctoral degree amongst female academics in Australia has been identified as a barrier for entry, promotion and opportunities for research time (White, 2004). Females also report less supervisor support during their doctoral studies (Dever, et al., 2008).

Academic rank is a scale variable based on the ordinal ranks from Assistant Lecturer/Level A (1) to Professor/Level E (5). Academic rank is among the strongest predictors of publication productivity (Xie and Shauman, 1998). Australian women and men of identical academic rank publish at similar levels (Burton, 1997; Ramsden, 1994).

Interest in research over teaching is a scale variable based on the ordinal responses for self-reported interest in research over teaching, ranging from: 'primarily in teaching' (1), 'in both, but leaning towards teaching' (2), 'in both, but leaning towards research' (3), and 'primarily in research' (4). It has been argued that women are less interested in research than men (White, 2001), but such claims are disputed in surveys (McInnis, 1999).

Research collaborators is a dichotomous variable based on whether or not respondents have research collaborators. Collaboration is highly correlated with co-authorship and publication productivity (for a summary see: Katz and Martin, 1997). Collaboration has been shown to be more important for female publication productivity (Kyvik and Teigen, 1996), though early-career female researchers in Australia collaborate less (Dever et al., 2008; Asmar 1999). For female post-doctoral researchers, being married increases the likelihood of research collaboration with senior males, but children have the opposite effect (Long, 1990).

International research collaboration is a dichotomous variable based on whether or not respondents have international collaborators. International collaboration is associated with increased publication

productivity (Kyvik and Teigen, 1996), but women arguably have weaker international networks and opportunities for international collaboration (Burton, 1997: 108; Cole and Zuckerman, 1984; White, 2001).

International conference participation is a dichotomous variable based on whether or not respondents attended an overseas conference in the previous year. Conference participation is an important correlate of publication productivity in international studies (Teodorescu, 2000), particularly when one is invited to present research (Kyvik and Larsen, 1994). Australian male academics are more likely to be invited to international conferences (Ramsay 1999 in White, 2001: 68; Bazeley 1999 in White, 2004: 230) and spend time on conference organisation (Probert, 2005). However, early-career males and females are equally likely to present research at conferences (Asmar, 1999).

Hours per week on research, teaching and administration are three scale variables based on usual weekly hours during teaching and non-teaching periods. The teaching period is weighted as twice the duration of the non-teaching period. To avoid outlier effects, total working hours are capped at 70 hours. Research hours are a significant predictor of article publishing in Australia (Teodorescu, 2000) and additional teaching and administrative duties may limit time available for research (Milem, et al., 2000). The concentration of women in teaching-focused positions is offered as one reason for women's underperformance in research in Australia (White, 2004). Teaching loads are the most frequently reported factor hindering research, reported by 65 percent of Australian academics and 71 percent of women (McInnis, 1999: 45). Teaching hours have been shown to negatively correlate with publication productivity for Australian academic economists (Fox and Milbourne, 1999), but are insignificant in multi-disciplinary studies (Teodorescu, 2000).

Research funding satisfaction is a scale variable based on ordinal responses regarding satisfaction with institutional research funding, ranging from poor (1) to excellent (5). Almost half of all Australian

academics report difficulty obtaining research funding as a barrier to research (McInnis, 1999: 45). Women are horizontally segregated in disciplines with weaker access to industrial and national research priority area funding (Carrington and Pratt, 2003) and female doctoral students receive less encouragement to apply for funding (Dever, et al., 2008). However, women are no less successful than men when applying for Australian Research Council grants (Bell, 2010).

Institutional facilities is a scale variable based on a composite of six Likert-type items assessing the adequacy of laboratories, research equipment, computer facilities, library holdings, faculty offices, and secretarial support. The Carnegie survey measured the items using a four-point ordinal scale, while the CAP survey used a five-point scale. The six scores were summed and then divided by the number of questions answered, with the resulting score ranging from poor (1) to excellent (4 or 5).

Collegial support for research (CAP only) is a scale variable based on the response to the statement 'At my institution there is collegial support for my research', ranging from 'strongly disagree' (1) to 'strongly agree' (5). Women acknowledge and place a greater importance on collegial and supervisor support, even though they may receive less support overall (Sonnert and Holton, 1995: 140-1; Dever, et al. 2008).

University group (CAP only) includes four dichotomous variables based on the respondent's university institutional grouping: 'Group of 8' (Go8); 'Innovative Research Universities' (IRU), 'Australian Technology Network of Universities' (ATN) and 'other'. The Go8 universities receive almost double the research funding of the other 31 universities combined (DEEWR, 2008: 44), and with the University of Tasmania, were also responsible for roughly two thirds of total research publications in the ISI Web of Science and Scopus indexes between 2004 to 2008 (Williams, 2009). Membership in a highly productive research department is one of the best structural predictors of publication productivity (Ramsden, 1994: 219).

Table 5-2 Independent variable description, means and Pearson correlation coefficients with article equivalents

Variable	Description	Mean		2007		Pearson correlation coefficient			
		1993				1993		2007	
		Male	Female	Male	Female	Male	Female	Male	Female
Age	# of years	45.70*	42.58	48.46	47.18	0.08*	0.15*	0.11	0.03
Unmarried	=1 if yes; = 0 otherwise	N/A	N/A	0.09*	0.25	N/A	N/A	-0.08	-0.03
Married (academic)	=1 if yes; = 0 otherwise	N/A	N/A	0.20	0.17	N/A	N/A	0.08	0.07
Married (other)	=1 if yes; = 0 otherwise	N/A	N/A	0.71*	0.58	N/A	N/A	-0.03	-0.02
No children	=1 if yes; = 0 otherwise	N/A	N/A	0.40*	0.57	N/A	N/A	-0.06	-0.03
One child	=1 if yes; = 0 otherwise	N/A	N/A	0.20	0.18	N/A	N/A	0.05	0.01
Two children	=1 if yes; = 0 otherwise	N/A	N/A	0.31*	0.19	N/A	N/A	0.01	0.00
3+ children	=1 if yes; = 0 otherwise	N/A	N/A	0.09	0.06	N/A	N/A	0.03	0.05
Child/elder care	# of years	N/A	N/A	0.08*	1.65	N/A	N/A	0.05	-0.11
Doctoral degree	=1 if yes; = 0 otherwise	0.65*	0.34	0.80*	0.73	0.27*	0.29*	0.29*	0.32*
Academic rank	5 point scale (Level A=1; E=5)	3.02*	2.26	3.08*	2.66	0.35*	0.36*	0.47*	0.49*
Interest in research	4 point scale (primarily research=4)	2.67*	2.47	2.86	2.85	0.28*	0.30*	0.32*	0.32*
Res. Collaborators	=1 if yes; = 0 otherwise	0.80*	0.70	0.88	0.89	0.15*	0.19*	0.18*	0.09
Int. collaborators	=1 if yes; = 0 otherwise	0.51*	0.42	0.66*	0.54	0.24*	0.24*	0.37*	0.35*
Int. conference	=1 if yes; = 0 otherwise	0.62*	0.46	0.54	0.57	0.29*	0.26*	0.31*	0.25*
Research hours	# of hours per week	17.18*	14.90	17.50	16.73	0.26*	0.26*	0.34*	0.35*
Teaching hours	# of hours per week	17.18*	20.13	15.34	16.11	-0.19*	-0.21*	-0.27*	-0.28*
Administration hours	# of hours per week	8.86	7.95	9.48	9.82	0.03	0.09	0.03	-0.07

Note: Independent samples *t*-test gender difference, significance level * $p < 0.05$

Table 5-2 Independent variable description, means and Pearson correlation coefficients with article equivalents (cont.)

Variable	Description	Mean				Pearson correlation coefficient			
		1993		2007		1993		2007	
		Male	Female	Male	Female	Male	Female	Male	Female
Res. funding satisfaction	5 point scale	3.71	3.54	2.45	2.43	0.17*	0.15*	0.23*	-0.03
Institutional facilities	4 / 5 point scale (Carnegie/CAP)	2.23*	2.16	3.37	3.33	0.09*	0.18*	0.13*	0.03
Collegial support	5 point scale	N/A	N/A	3.16	3.11	N/A	N/A	0.10	0.05
Group of 8	=1 if yes; = 0 otherwise	N/A	N/A	0.41	0.40	N/A	N/A	0.20*	0.17*
ATN	=1 if yes; = 0 otherwise	N/A	N/A	0.20	0.20	N/A	N/A	-0.02	0.02
IRU	=1 if yes; = 0 otherwise	N/A	N/A	0.04	0.05	N/A	N/A	0.02	-0.11
Other University	=1 if yes; = 0 otherwise	N/A	N/A	0.35	0.35	N/A	N/A	-0.20*	-0.15*

Note: Independent samples *t*-test gender difference, significance level * $p < 0.05$

5.4 Results

During the period 2005-2007, full-time male academics published, on average, 10.5 article equivalents. This was significantly more than females, who published 8.0 article equivalents. By comparison, during the period 1991-1993 males published 8.2 article equivalents, significantly more than females who published 4.6 article equivalents. This represents a general increase in publication productivity of 28 percent for men and 72 percent for women between the two surveys. Gender differences narrowed, with females achieving 76 percent of the male average in 2005-2007, compared to 57 percent in 1991-1993. Gender differences in publication productivity were statistically significant across all publication types in the 1993 data, with women publishing just over half as many authored books (0.17 vs. 0.34), edited books (0.19 vs. 0.29) and articles (3.38 vs. 5.88). Due to the smaller sample and overall reduction in gender differences in the 2007 data, only articles published were significantly different (6.21 vs. 8.28). These results are shown in Table 5-3.

Table 5-3 Mean publications and standard deviation by type and gender, 1991-1993 and 2005-2007

	1991-1993				2005-2007			
	Male		Female		Male		Female	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Books authored	0.34*	0.79	0.17	0.48	0.34	0.72	0.28	0.62
Books edited	0.29*	0.86	0.19	0.65	0.24	0.68	0.17	0.54
Articles	5.88*	7.35	3.38	5.74	8.28*	10.16	6.21	7.07
Article equiv.	8.17*	9.33	4.63	7.08	10.47*	11.67	7.96	8.34

Note: Independent samples *t*-test gender difference, significance level * $p < 0.05$

When classified into the five academic fields based on the guidelines of UNESCO (1978), publication productivity in the 1993 sample was highest in the natural sciences (8.4 article equivalents), humanities (8.2) and medicine (7.7), significantly higher than in the social sciences (6.2) and technology (5.2) (ANOVA, Games-Howell *t*-test, $p < 0.05$). There were no significant differences between any academic fields in the 2007 sample, but article equivalents were higher in the technology (10.4), natural sciences (10.3) and humanities (9.9), compared to social sciences (8.7) and medicine (8.3). Had publication productivity been measured based on articles only, gender differences would be partly due to the greater proportion of men in the sciences, where articles are more common than books. However, the use of the article equivalents minimises the impact of academic field because books received a heavier weight than articles.

The academic field differences in publication productivity in the 1993 data were probably due to the amalgamation of CAEs into universities in the late 1980s and early 1990s, as teaching-based social science and technology staff were required to immediately become research active. However, gender differences in publishing were consistent across academic fields. Women published significantly fewer article equivalents than men in the same academic field in all cases, except in technology in the 2007 sample and the natural sciences in the 1993 sample. Even within the traditionally female and former CAE discipline of education and teacher training, males published significantly more than females in both samples. Given that differences between academic fields were far smaller than gender differences within fields, the importance of academic field in explaining gender differences in publishing levels is probably minor compared to other factors where women differ significantly from men, such as academic rank, doctorate degree and international research collaboration.

Publication productivity is heavily skewed and highly variable. Most academics publish below the mean and the standard deviation is high. This indicates that a minority of highly productive researchers account for a disproportionate share of total publications. In the 1993

data, the most productive 15 percent of females published 55 percent of female output, while the most productive 15 percent of males published 46 percent of male output. These findings are very similar to the earlier Australian study by Ramsden (1994: 218) where 14 percent of all staff accounted for half of all research output. In the 2007 data, the same group accounted for 44 percent of female and 48 percent of male output. Therefore, overall increases in female publication productivity between 1993 and 2007 were associated with a more equitable distribution of female publications.

The reduction in gender differences is largely due to a dramatic increase in female research participation. The proportion of academics publishing at least one article equivalent increased from 86 percent of men and 76 percent of women in 1991-1993, to 92 percent and 91 percent respectively in 2005-2007. The proportion of academics with relatively few publications also became similar for men and women. During 1991-1993, more than half of all women averaged less than three article equivalents, compared to 30 percent of men. During 2005-2007, 25 percent of women and 23 percent of men were in this category. While the proportion of women publishing at very high levels increased, males remained almost three times more likely to publish 20 or more article equivalents in 2005-2007. When examined by academic field, the proportion of academics in this highly publishing category closely reflected the overall sample distribution. This suggests that the greater frequency of highly publishing males is not primarily due to their location in the scientific disciplines.

Mean article equivalents increased rapidly with academic rank and the smaller percentage of women in higher academic ranks accounted for much of the overall gender differences in publishing. During 1991-1993, publication productivity increased from 2.8 article equivalents at the lowest rank (Level A) to 15.0 article equivalents among professors (Level E). The relationship with rank was even stronger in 2005-2007, increasing from 3.2 to 21.6 article equivalents. Differences between men and women of equal rank are insignificant, except among the lowest rank (Level A) in 1991-1993, where males published significantly more article equivalents than women (4.4 vs. 1.9). These

results are very similar to earlier studies which found no gender differences in publishing above Level B (Burton, 1997: 24).

The independent variable summary statistics (Table 5-1) show that men and women differ in their mean levels for many independent variables. Gender differences across most variables were statistically significant in the 1993 sample in the direction hypothesised as disadvantageous to publication productivity. Gender differences were clearly smaller in the 2007 sample, but men remained significantly more likely to have high academic rank, a doctorate degree, international research collaborators, be married, have children and not have interrupted their career for child or elder care. The Pearson correlation coefficients with article equivalents were broadly similar for men and women, suggesting that the factors affecting publishing differ little by gender.

The separate effect of each independent variable on publication productivity (square root of article equivalents) is indicated in the linear multiple regression results in Table 4. The 2007 data provided information on 22 independent variables, while the 1993 data was restricted to 12 variables. To improve comparability between data sets, a standard 12 variable and full 22 variable regression model are shown for the 2007 data. Multicollinearity among independent variables was not a concern because bi-variate correlations among the independent variables were low and variance inflation factors reached a maximum of 3.39. The proportion of variation in publication productivity accounted for by the 12 variable model (adjusted R-square) was 32 and 42 percent among men and women in the 1993 data, and 44 and 47 percent respectively in the 2007 data. The effect of the ten additional institutional, background and family variables available in the 2007 data was minor, with few achieving significance.

Table 5-4 Linear multiple regression beta weights for publication productivity (square root of article equivalents)

	1993 data		2007 data		2007 Full model	
	Male	Female	Male	Female	Male	Female
<i>Background variables</i>						
Age	-0.08 ⁺			-0.14**		-0.13*
Married (academic)	N/A	N/A	N/A	N/A	0.13 ⁺	
Married (other)	N/A	N/A	N/A	N/A		
One child	N/A	N/A	N/A	N/A		
Two children	N/A	N/A	N/A	N/A		
Three or more child.	N/A	N/A	N/A	N/A		
Child/elder care break	N/A	N/A	N/A	N/A		
<i>Work habits variables</i>						
Doctoral degree	0.13**	0.20**	0.14**	0.19**	0.12*	0.14*
Academic rank	0.34**	0.29**	0.35**	0.46**	0.31**	0.48**
Interest in research	0.14**	0.22**				
Research collaborators		0.13*				
Int. Collaborators	0.11**		0.17**	0.17**	0.18**	0.16**
Int. Conference	0.14**		0.13**		0.11*	
Research hours	0.13**	0.13 ⁺	0.18**	0.15**	0.15*	0.16*
<i>Institutional variables</i>						
Teaching hours						
Administration hours						
Funding satisfaction						
Institutional facilities						
Collegial support	N/A	N/A	N/A	N/A		
Group of 8	N/A	N/A	N/A	N/A		0.13*
ATN	N/A	N/A	N/A	N/A		0.10 ⁺
IRU	N/A	N/A	N/A	N/A		
Adjusted R-square	0.32	0.42	0.44	0.47	0.43	0.48
n	550	203	317	270	306	244

Note: significance level ** $p < 0.01$ * $p < 0.05$ + $p < 0.10$

The work habits variables, particularly academic rank, were clearly the strongest predictors of publication productivity. The number of women reporting a stronger interest in research increased from less than half in the 1993 data, to over two thirds in the 2007 data. However, while having an interest in research was a relatively strong predictor of publication productivity in the 1993 data, it was insignificant in the 2007 data. By contrast, despite an equally dramatic increase in the proportion of female academics with doctorates,

holding a doctorate remained consistent in strength and significance across the two samples. One of the most notable changes was the increased importance of international research collaborators. In the 2007 sample, over 90 percent of academics who published at least 10 article equivalents reported international collaborators. This compared with less than half of other academics. International research collaboration showed a uniformly positive effect for men and women in the 2007 data. This contrasted sharply with international conference attendance which was positive only for men in both samples, despite men and women being equally likely to report international conference attendance in the 2007 sample. This suggests that international collaboration is important for all academics, regardless of rank, qualifications or gender, while international conference attendance is positive only for men.

The number of hours spent on research was positively associated with higher publication productivity and the effect was similarly strong for men and women. In the 1993 data, men spent significantly more hours than women on research (17.2 vs. 14.9), which partly explained the overall gender differences in publication productivity. However, gender differences were not statistically significant in the 2007 data. Total weekly hours (not shown in Table 5-1) were significantly longer for men in the 1993 data (50.2 vs. 48.8), but roughly equal in the 2007 data (49.2 vs. 49.9). Therefore, the number of hours and proportion of time spent on research offered a partial explanation for gender differences in publication productivity during 1991-1993, but not during 2005-2007.

The block of institutional variables generally failed to achieve significance. Administration hours were roughly equal for men and women in both samples and had no effect on publication productivity. Somewhat surprisingly, teaching hours were insignificant as a predictor of publication productivity, despite negative bi-variate correlations with article equivalents. Satisfaction with research funding, institutional facilities and having collegial support for one's research, also showed no effect on publication productivity. Location within one of the two more research intensive university groupings,

Go8 and ATN, had a positive effect on publication productivity, but only for women.

The background variables also failed to account for much of the variation in publication productivity. Age exhibited a negative relationship with publication productivity for men in the 1993 data and women in the 2007 data. However, a negative impact of aging on publication productivity can not be inferred from these results due to the cross-sectional nature of the data. The greater proportion of younger staff with doctorates and preferences towards research in the 2007 data, suggests clear generational differences within the samples. The additional marital, family and career interruption variables, available only in the 2007 data, failed to achieve significance for women in the regression analysis. For men, being married to a fellow academic showed a positive effect on publication productivity compared to being single or married to a non-academic.

5.5 Discussion

The first two objectives of this study were to quantify the size of gender differences in publication productivity and changes over time. The results suggest an overall improvement in the position of women in research since the early 1990s. The results for the 2005-2007 period showed that women published 24 percent fewer article equivalents than men, compared to 46 percent fewer over the 1991-1993 period. The increase in female publication productivity and overall reduction in gender differences was mostly due to a reduction in the proportion of women with zero or very few publications. The high proportion of low or non-publishing female academics in the 1993 sample and greater proportion of women with doctorates and research interests in the 2007 sample, probably reflects the integration of formerly teaching-focused CAE staff into research positions and the growing research credentials of younger academics. The more equitable distribution of female publishing in the 2007 sample is an important departure from previous gender-based studies, which have emphasised the overrepresentation of women as non-publishers

(Creamer, 1998) and the dominance of a few prolific female publishers (Cole and Zuckerman, 1984). Men and women of equal rank published at similar levels, except among the lowest ranks in the 1993 sample, but the high publishing elite remained overwhelmingly male. These findings are consistent with previous Australian studies (Burton, 1997; Ramsden, 1994).

The third objective of this study was to examine whether the hypothesised determinants of publication productivity operated similarly for men and women. Fox's (1983) and Teodorescu's (2000) clusters of individual background, work habits and institutional variables accounted for a reasonably large proportion of the variability in publication productivity, between 32 and 48 percent. Most variables operated in the same direction for men and women, but there were noticeable differences in the strengths of variables. The strength of academic rank, doctorate degree, international research collaboration and research hours, is illustrative of how research habits and conditions affect publishing, though the relationships may also be reciprocal. Women reported lower levels on these four core variables and differences were statistically significant in all cases, except research hours in the 2007 sample. The stronger effect of academic rank, doctoral degree and institutional location on female publishing in the 2007 sample, also suggests female research opportunities are particularly affected by their structural position and seniority within Australian universities (White, 2003, 2004).

Teaching and administrative loads are frequently reported as a barrier to research (McInnis, 1999; Milem, et al., 2000). Research hours exhibited a consistently positive effect on publication productivity and the significantly fewer hours women spent on research in the 1993 data partly explains differences in publication productivity. While there was support in the 1993 data for gendered patterns in time use, the 2007 data indicated no significant gender differences in the mean number of research, teaching or administrative hours, or their relationship with publication productivity. These findings are consistent with other Australian studies which found no gender differences in assigned teaching loads (Probert, 2005) or classroom

teaching hours (McInnis, 1999). The minimal effect of teaching hours on publishing is also consistent with Dever and Morrison's (2008) positive accounts of compatibility between teaching and research among highly publishing females. However, the results do not necessarily contradict the claims that women are more likely to become trapped in lower ranked positions with heavier teaching loads (White, 2004). Teaching-only and part-time academics were explicitly excluded from the samples and such academics may include a higher proportion of women. However, the results from the 2007 sample suggest that men and women in combined research and teaching positions spend similar hours on each of the three core academic duties, with comparable effects on publication productivity.

Perhaps the most important finding from this study is the role of international research networks. In the 1993 data, less than half of all women had international research collaborators and the positive effects were evident only for men. Women remained significantly less likely than men to report international research collaborators in the 2007 sample, but the positive effects were equal for men and women. The importance of international research collaboration for female publication productivity is consistent with previous gender-based studies (Kyvik and Teigen, 1996). International collaboration can increase the visibility of academics, their access to large-scale external funding, their attractiveness for future collaborators, and lead to an accumulation of positive reinforcement and advantage (Fox, 1983). The significantly fewer women with international collaborators, supports the assertion the women have weaker international networks and this negatively impacts their publication productivity (Cole and Zuckerman, 1984; Ramsay 1999, in White, 2001: 68).

International conferences offer an opportunity, not just to develop international networks, but also to present research results. Men were significantly more likely to attend international conferences in the 1993 data, but no gender differences were evident in the 2007 data. While this appears to be an encouraging sign of greater gender equality, the positive effects were significant only for men in both samples. One possible reason is that Australian men are almost twice

as likely as women to dedicate time to conference organisation and management (Probert, 2005). If women are less involved in organising conferences, women may attend international conferences but fail to benefit from presenting their research to a relevant audience (Kyvik and Larsen, 1994). Even where international conference organisers directly invite Australian women to present their research, responsibilities for young and teenage children prevents some high profile female researchers from accepting their invitations (Probert, 2005).

The unequal division of labour in the household is an intuitive reason for why women lack time and energy for publishing. The results of this study indicate no direct effect of marriage, children or career interruptions for female publication productivity, but a small positive effect of marriage for male productivity. The overall weak effect of the female background variables, compared to work habit variables, is very consistent with a previous American study (Sax, et al., 2002) and Dever and Morrison's (2009) interviews with highly publishing Australian women. The results may also be due to selectivity factors and lack of detail in the data. Compared to male academics, females are more likely to consider career pressures when deciding about children and marriage (Sonnert and Holton, 1995). Female publication productivity is more directly affected by young children (Kyvik and Teigen, 1996) and women are more likely to have fewer children and be unmarried (Long, et al., 1993). Detail on family decision making and the age of children is not available in the data, but selectivity effects are implied by the significantly higher proportion of female academics who are unmarried and without children. Further, if family responsibilities limit the opportunities for women to gain a doctorate or promotion, then the effect of the family variables may have been absorbed by the stronger effects of doctorates and academic rank for females in the 2007 data.

This study has demonstrated that Australian female academics in full-time research and teaching positions have become increasingly similar to their male counterparts in publication productivity and many of the factors affecting publication. However, gender differences remain and

the nominal improvements in the research conditions of full-time female academics may mask decreasing research opportunities for women in non-standard positions. Employment flexibility in Australian universities has coincided with increased academic labour market segmentation. Ongoing part-time employees face formal or practical restrictions in promotion (Winchester, et al., 2006), while casual and sessional positions tend to be teaching-based with poorer research prospects (Junor, 2004). Academic labour market segmentation has a disproportionate impact on women since they remain under represented in full-time positions (Probert, 2005). If research is more difficult outside full-time employment, then future studies must investigate whether full-time female academics are an increasingly selective group, successful on the traditional and masculine terms that circumscribe the academic career.

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6. Academic staff and public communication: A survey of popular science publishing across 13 countries

Peter James Bentley & Svein Kyvik

Abstract ⁶

This study is a cross-national empirical analysis of popular science publishing among university staff in a thirteen-country sample. The countries included in the study are: Argentina, Australia, Brazil, Canada, Finland, Germany, Hong Kong, Italy, Malaysia, Mexico, Norway, the United Kingdom, and the United States. The study seeks to quantify the extent of popular science publishing and its relationship with scientific publishing. Popular science publishing was measured as the number of articles written by scientists in newspapers and magazines over a three-year period 2005-2007. Our findings suggest that popular science publishing is undertaken by a minority of academic staff and to a far lesser extent than scientific publishing. Despite the arguably fewer rewards associated with publishing for the non-specialist public, our data suggests that academic staff with popular publications have higher levels of scientific publishing and academic rank. The positive relationship between scientific and popular publishing is consistent across all countries and academic fields. The extent of popular science publishing varies with field and country.

Keywords: dissemination of research, popular science, popular science publishing, popularisation of research, science communication

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6.1 Introduction

In many countries, greater emphasis is now being placed on the dissemination of research results to a general or non-specialist public (Kalleberg 2000, Kyvik 2005, Scott 2005, Royal Society 2006a, Jensen et al. 2008, Peters et al. 2008b). Such activity, performed by science journalists or by academic staff themselves, is often labelled popularisation of research. The literature on science communication has dealt primarily with the role of science journalists in the popularisation of research, the relationship between researchers and journalists, and the way the general public receives and understands science news (Logan 2001, Weigold 2001). The focus of this article, however, will be on popularisation by academic staff members themselves.

Popularisation by academics can take different forms, such as articles in magazines and newspapers, public lectures, interviews with the press, and participation in radio and TV programmes. Such forms of popularisation have received little attention in the field of science studies (Felt 2003), and only a handful of single-country studies have attempted to quantify the extent of these activities in the academic community (Kyvik 1994, 2005, Jensen et al. 2008). Due to the accessibility of large databases that register scientific journal publishing and the comparable lack of data on popular science output, the fields of bibliometrics and scientometrics have focused entirely on the study of science publishing. We know of no multiple-country study that has examined the publishing of popular science articles for the non-specialist public.

The results of the few existing studies suggest that (a) popularisation of research is considered secondary to scientific publishing, (b) there are large individual differences in the propensity to perform such activities, (c) there is a positive relationship between scientific and popular publishing, and (d) popularisation of research is more common in the “soft sciences” (humanities, social sciences) than in the “hard sciences” (natural sciences, medicine, technology).

The purpose of this article is to examine these issues by using data on the number of articles published by university academics in newspapers and magazines across 13 countries: Argentina, Australia, Brazil, Canada, Finland, Germany, Hong Kong, Italy, Malaysia, Mexico, Norway, the United Kingdom, and the United States. Hong Kong is a semi-autonomous special administrative region of China, but for consistency in terminology it shall be referred to as a country. This data set enables us to examine the extent to which country specific results apply to a wider range of countries. Based on the former literature in this field, we will develop some propositions of what we can expect to find in this cross-national study.

(a) Popularisation of research is considered secondary to scientific publishing

Several possible reasons have been given for why popular publishing remains secondary to scientific publishing. These include a lack of interest, time, rewards and incentives, and communication channels.

First, academic staff are often accused of being reluctant to engage themselves in communicating with the public because they are first and foremost interested in pursuing their research interests and in furthering their research career (Checkoway 2001). Thus, Gascoigne and Metcalfe (1997) found that Australian scientists regard public communication as an optional activity, not a basic part of their work. This viewpoint has, however, been questioned (Lewenstein 1995, The Royal Society 2006b).

Second, time pressure is a frequently used justification for not engaging with the public. Academics have a range of competing commitments and they will prioritise time on activities they perceive as more valuable to their career (Gascoigne and Metcalfe 1997). When asked how important it was to find time for public engagement compared to other work activities, the majority of British scientists saw public engagement as less important than other activities (Royal

Society 2006b). Poliakoff and Webb (2007: 258) found that a perceived lack of time was associated with negative perceptions of popularisation, but did not predict actual participation. They conclude that perceived time pressures may affect perceptions of public engagement and mask broader concerns with the activity.

Third, although Dunwoody (1986) has argued that engagement with the public can be rewarding for many scientists in terms of personal satisfaction, public recognition, employer recognition, political recognition, and peer recognition, these factors are insufficient to motivate most academics to popularise their research. Several studies report that academic staff do not engage in popularisation because such activities are not rewarded financially, socially or in applications for promotion. Peters et al. (2008a) found that only a minority of epidemiology and stem cell researchers in France, Germany, Japan, UK and USA believed their media engagements had a mostly positive influence on their professional career. Enhanced public or professional reputation was rarely reported as motivations for media engagement. Among French scientists, Jensen et al. (2008) found that public dissemination had only a weak and generally insignificant effect on promotion. Overall, in comparison to other perceived drawbacks of popularisation (e.g. time constraints), negative peer attitudes is relatively minor concern (Royal Society 2006b, Wellcome Trust 2000, Poliakoff and Webb 2007). However, for the minority of staff who consider peer attitudes as important, this may be an important reason for not engaging in popularisation.

Fourth, a final argument is that even though academic staff might be interested in publishing articles for a lay public, they may have severe difficulties in finding a proper magazine or a newspaper that is willing to publish their story. While there are an abundance of scientific journals, there is a general shortage of popular science magazines that offer space for articles written by researchers themselves. In many cases, journalists would prefer to interview scientists and scholars and make their own story. Moreover, Jensen et al. (2008) argue that media engagements are driven by an external

demand and invitations are generally received by a small group of highly visible scientists.

(b) There are large individual differences in the propensity to popularise research

Given that public dissemination is considered by many as a secondary or optional activity, it is unsurprising that academics differ to a greater extent in their popular publishing than scientific publishing. In two previous Norwegian surveys, half of all popular science articles were published by 6 percent of all tenured university staff, while half of all scientific articles were published by roughly 20 percent of the staff (Kyvik 1994; 2005). Whereas scientific publishing was stable across age groups, academics over 40 years of age published twice as many popular articles compared to those under 40. The Wellcome Trust (2000) survey of British scientists found that only 13 percent had published a popular science or newspaper article in the previous year, and only 26 percent at least once during their career. The Royal Society's (2006b) survey, which included a broader definition of publishing for the non-specialist public (including for the media, articles and books), found that 25 percent of scientists had written popular articles in the previous 12 months. The Royal Society (2006b) also found broader forms of public engagement were more likely to be undertaken by senior ranking academics. These patterns were also supported by Jensen et al. (2008), where 86 percent of senior ranking French scientists were involved in public engagement activities, compared to 14 percent of junior staff.

(c) There is a positive relationship between scientific and popular publishing

Former studies indicate that writing for the non-specialist public is related to a commitment to scientific publishing. Consistent across academic fields, Norwegian academics with popular articles published around 40 percent more scientific publications than those

without popular publications (Kyvik 1994, 2005). More broadly, Jensen et al. (2008) concluded that popularisation is an activity of the French scientific “elite”, with those involved with press, radio, and public conferences having significantly higher than average scientific bibliometric indices. Peters et al. (2008a) also found frequency of media contact increased with higher levels of peer reviewed publications among epidemiology and stem cell researchers.

(d) Popularisation of research is more common in the “soft sciences” than in the “hard sciences”

A common argument is that it is not possible or meaningful to popularise research in highly codified disciplines, such as mathematics or chemistry. Surveys of Norwegian academics have consistently found popular science publishing to be more extensive in the humanities and social sciences, compared to the natural sciences and technology (Kyvik 1994, 2005). One of the barriers to publishing for the lay public is the belief by scientists in a public deficit in either literacy or interest in science (Winter 2004). The perception of public ignorance or disinterest in scientific research may be greater in highly codified fields where disciplinary terminology must be translated into plain language for public communication. Dunwoody (1986) argues that newspaper editors perceive social science research as more relevant to the lay public audience, leaving less space for other fields of research. Scientists within some scientific disciplines, such as physics and geology, perceive their research as uncontroversial, rarely engage in disputes outside their discipline, lack training in communicating disciplinary knowledge in plain language and believe in a public deficit in science literacy (Winter 2004). The belief in a public ignorance or disinterest in science may therefore shape the perceived and actual opportunities for popular publishing in some disciplines.

(e) There are national differences in the extent of popular science publishing

No previous multi-country studies have examined popular science publishing and little is known on how differences across countries may affect engagement in public communication. However, there are several reasons why the extent of popular publishing might differ. First, some countries, more than others, have long traditions of dissemination of scientific knowledge to the lay public; in Europe dating back to the age of the enlightenment, and in the United States to the early nineteenth century (Gregory and Miller 1998). Second, norms for proper engagement with the public may vary. Third, the level of “civic scientific literacy” and “public understanding of science” probably differs greatly across countries. A study by Miller (1998) indicates that a larger proportion of the population in the USA than in the European Union can be classified as scientific literate, and that in the latter group of countries the UK ranks first. Many African, Asian and Latin-American countries would probably earn a low score on a similar index. Public dissemination will be affected by the extent to which there is an educated population interested in reading about advances in science and technology, as well as interpretations of social and cultural phenomena. Fourth, there might be national differences in the quantity of popular science magazines and newspapers, their willingness to publish contributions by academics, or in the degree to which science journalism is developed as a profession. If science journalists disseminate research findings on behalf of academics, the role of academics may be limited. Finally, there might be national differences pertaining to the need by academic staff to “go public”. In the competition for research funding, media visibility may be an important strategy to gain political recognition and support (Weingart 1998, Peters et al. 2008a).

6.2 Data and methods

The data for this article comes from the Changing Nature of the Academic Profession (CAP) project, an international survey of

academics conducted in 2007/2008 (University of Kassel 2008). The main target population of the CAP project were academic staff in higher education institutions offering a baccalaureate degree or higher. To improve cross-national comparability, the CAP project used a common survey instrument and random sampling protocol. In this article we restrict ourselves to a subset of the CAP sample: full-time academic staff (with 30 hours or more per week) at research universities. We also restrict ourselves to 13 of the 17 countries where data is currently available, due to insufficiently few respondents from research universities (Japan), low response rates (below 10 percent in Korea and Portugal) or high non-response to the dependent variable (36 percent in China).

The common sampling protocol ensured some degree of consistency across selected countries. The response rates, including partially completed responses, were mostly below 40 percent (see Table 6-1). While the national samples were found to be broadly representative of the respective populations on strata such as gender, academic rank and institutional type, non-respondents may differ from respondents in their research profile. Therefore, there is a risk of non-response bias in the sample.

The CAP questionnaire required respondents to specify their number of scholarly contributions over the previous three years. Non-response was a particular problem for this question. Some respondents, identified as research staff, either skipped the entire research section of the survey or left the relevant question on research publications unanswered. It is very difficult to interpret these missing responses. A lack of answer may indicate that the question was not applicable or that they did not know or wish to reveal their research output. However, one could speculate that some respondents without any publications chose to leave the question unanswered rather than entering a zero into every appropriate box. We decided to remove all non-respondents from the sub-sample, rather than recoding their answers to zero publications. This will likely underestimate the proportion of non-publishers, particularly in Malaysia where 11 percent of university staff did not answer the research question. The

response rates and proportion of staff excluded due to non-response are listed in Table 6-1.

Table 6-1. Number of survey invitations; number of surveys returned; response rate; percentage of full-time university staff who did not answer the research question; number of remaining full-time academic staff (n)

	Surveys sent	Surveys returned	Response rate	No research answer	(n)
Argentina	3,438	826	24%	0%	(378)
Australia	5,496	1,381	25%	3%	(660)
Brazil*	4,702	1,200	26%	0%	(368)
Canada	6,693	1,152	17%	5%	(897)
Finland	3,902	1,115	29%	4%	(629)
Germany*	3,891	1,246	32%	4%	(661)
Hong Kong	6,291	811	13%	4%	(596)
Italy	4,797	1,701	35%	2%	(1,466)
Malaysia*	3,401	1,113	33%	11%	(480)
Mexico	986	680	69%	1%	(429)
Norway	2,719	949	35%	3%	(535)
UK*	11,000	1,663	15%	3%	(613)
USA	3,732	848	23%	4%	(671)
Total	61,048	14,685	29%	3%	(8,383)

** Surveys sent, Surveys returned and Response rate includes a small number of non-university institutions*

The CAP data included information on publishing activities of 8,383 full-time academic staff members during the three year period 2005-2007. Academic staff were re-classified according to the guidelines of the UNESCO (1978), from 11 disciplinary categories into five

academic fields of learning: the social sciences (Education; Social and behavioural sciences; Business and economics; Law; Personal, transport and security services), humanities (Humanities and arts), natural sciences (Life sciences; Physical sciences, mathematics, computer sciences; Agriculture), technology (Engineering, manufacturing and construction, architecture) and medical sciences (Medical sciences, health related sciences, social services). Social sciences and natural sciences are the academic fields with the highest number of respondents, but the distribution across these categories differs across the 13 countries examined (see Table 6-2).

Table 6-2. Percent of full-time academic staff by field

	Soc. Sci.	Hum.	Nat. Sci.	Tech.	Med. Sc.	Total
Argentina	19	13	36	21	10	100
Australia	34	14	23	7	22	100
Brazil	28	9	29	11	24	100
Canada	38	17	22	8	14	100
Finland	31	13	25	15	16	100
Germany	24	13	28	15	21	100
Hong Kong	44	19	13	10	14	100
Italy	21	12	40	16	11	100
Malaysia	22	8	23	34	12	100
Mexico	29	10	33	14	14	100
Norway	31	16	25	9	20	100
UK	34	21	19	10	16	100
USA	35	22	19	10	15	100
Total (mean)	30	14	26	14	15	100

The distribution of academic staff across fields in the different countries affects estimates of scientific and popular publishing. While

significant variation exists within academic fields, journal articles are the traditional publication channel for scientific communication in the natural sciences, medicine and technology, while books are relatively more common in the humanities and social sciences (Creamer 1998). Regarding popularisation of research, higher publication rates have been reported in the humanities and social sciences (Kyvik 1994; 2005). Therefore, the distribution of academics by field in each national sample will likely affect international comparisons across publication types.

As Hilgartner (1990) has argued, popularisation is a matter of degree. The boundary between scientific research and popular versions of this research can be drawn at different points, and these ambiguities leave some flexibility concerning which articles should be regarded as scientific/scholarly versus popular. In this article, we examine several types of publications. Authored books, edited books and articles published in an academic journal or book, are considered scientific publications. Articles written by academics in newspapers and magazines are considered popular publications. However, some journal articles or books may have been published in non-peer reviewed channels, likely leading to an overlap between scientific and popular publishing.

Research indexes that give more weight to book publications over articles and fractionalise publications based on the number of authors, have been shown to markedly reduce disparities in average productivity across fields of learning (Kyvik and Teigen 1996). To recognise the relative contributions of each scientific publication type and offset differences across fields, scientific publications shall be expressed in terms of "article equivalents". In this study, article equivalents shall be calculated as a weighted sum of journal/book articles (1 point per article), books edited (2 points) and books authored (5 points) for each academic. Unfortunately the CAP data does not distinguish between solo and multi-authored publications. Therefore, publications with more than one author will be counted more than once, if both co-authors are included in the sample. This will likely overestimate scientific publication rates, particularly within

the “hard sciences” where joint-authorship is more common (Creamer 1998).

We have applied tests of significance to check the robustness of differences in popular publishing. When making pairwise comparisons, such as between senior and junior ranked staff, we adopt an independent samples t-test with a 95 percent significance level. Multiple pairwise comparisons, such as between each of the 13 countries, are based on one-way ANOVA Games-Howell multiple comparisons with a 95 percent significance level. This choice is justified based on the unequal group sizes, variance and positively skewed (non-normal) distribution of the popular articles. The Games-Howell test is preferable under such sub-optimal conditions as it maintains robust significance levels (Jaccard et al. 1984).

Previous studies suggest popularisation is positively associated with the number of scientific publications, senior academic rank, location within the “soft” academic fields and a stronger commitment to public dissemination as an academic duty. Given the secondary nature of popular publishing, those engaging in popularisation probably also report more time on voluntary and unpaid activities beyond the core tasks of teaching, research and administration. Due to the skewness of popular publishing, we shall use binary logistic regression to identify how each of these factors independently affect the likelihood of academics publishing at least one popular article. The independent variables are operationalised in the following ways:

Female is a dichotomous variable (yes=1; no=0).

Senior rank is a dichotomous variable (senior academic rank=1; junior rank=0).

Level of scientific publishing consists of three dichotomous variables: “low scientific publishing” (0 to 2 article equivalents; bottom quartile),

“medium” (3 to 14; middle two quartiles) and “high scientific publishing” (15 or more; top quartile). Medium shall be the reference group.

Obligation to popularise research is a dichotomous variable based on agreement with the statement: “Faculty in my discipline have a professional obligation to apply their knowledge to problems in society” (strongly agree/agree=1; neutral/disagree=0).

Hours on core activities is a continuous variable based on self-reported hours spent by academics per week on “teaching”, “research” and “administration” during the teaching and non-teaching periods. We consider the teaching period as twice as long as the non-teaching period and weight the working time estimates accordingly, except in Mexico where the non-teaching period is not included due to lack of data.

Hours on non-core activities is based on self-reported hours spent on “service” (service to clients and/or patients, unpaid consulting, public or voluntary services) and “other academic activities” (activities other than teaching, research and administration).

Academic field consists of five dichotomous variables: “social sciences”, “humanities”, “natural sciences”, “technology” and “medical sciences”. Humanities shall be the reference group.

Country consists of 13 dichotomous variables. Germany shall be the reference group.

6.3 Results

The number of academics publishing for the scientific community is far greater than those publishing for the non-specialist public. Over 90 percent of the academic staff included in the CAP survey had at least one scientific publication (article equivalent) during the 3 year period (2005-2007), but only a third published a popular article. Regarding scientific publishing, academic staff across the 13 countries published, on average, 0.6 authored books, 0.4 edited books and 7.2 articles in a book or journal. In contrast, the mean number of popular articles did not amount to more than 1.6 over the three-year period.

Popular publishing is extremely skewed; half of all popular articles were published by 3 percent of all academic staff, with the top 1 percent producing 31 percent of all popular articles. Overall, scientific publishing is considerably less skewed than popular articles, with half of all article equivalents published by 18 percent of all staff members.

There are noticeable differences across academic fields in the proportion of academic staff publishing popular articles (Table 6-3). Academics in the natural sciences were significantly less likely to report a popular article compared to academics in all other fields except technology. Academics in the social sciences averaged significantly more popular articles than academics in the natural sciences and technology, but differences with other fields were insignificant. When comparing popular science publishing between fields within each of the 13 countries, the natural sciences tends to have the lowest levels of publishing, but many of the field differences are insignificant. The proportion of academic staff producing half of all popular articles varies only slightly across fields, from 3 percent in the social sciences and natural sciences to 4 percent in the other fields. This indicates that while popular publishing is more common within the social sciences, the higher mean is partly due to a small number of prolific publishers.

Table 6-3. Popular articles and article equivalents, 2005-2007, by field: mean, standard deviation, percent of academic staff with at least one publication and ratio of article equivalents to popular articles

		Soc. Sci.	Hum.	Nat. Sci.	Tech.	Med.	Total
Popular articles	<i>Mean</i>	2.1	1.5	1.3	1.2	1.7	1.6
	<i>Std dev.</i>	8.0	4.5	4.8	3.4	5.7	5.9
	<i>%</i>	38	33	27	31	35	34
Article equivalents	<i>Mean</i>	10.2	11.3	11.2	9.3	13.2	11.0
	<i>Std dev.</i>	10.3	11.7	12.3	12.4	15.5	12.3
	<i>%</i>	92	93	93	86	92	91
Ratio		4.9	7.5	8.6	7.8	7.8	6.9

There are also differences in scientific publishing across academic fields (Table 6-3). The inclusion of books and the use of a weighted index for article equivalents helped minimise differences across fields, as book publications were more common among academic staff in the social sciences and humanities, while journal/book articles were more common in the natural sciences. The higher rates of scientific publication in the medical and natural sciences is consistent with previous studies (Creamer 1998) and may partly be due to the stronger tradition of co-authorship and associated lack of fractionalisation based on the number of authors in the CAP data. Academics publish around eight article equivalents per popular article in all fields except the social sciences where the ratio is approximately closer to five. These field differences are as expected, but given the skewed nature of publishing in general and popular publishing in particular, these findings should be treated with caution.

On average, academics in Hong Kong reported the greatest number of popular articles in newspapers and magazines (2.3), followed by Germany (2.0), Norway (2.0) and Argentina (1.9). Popular publishing in each of these countries, plus Finland (1.5) and Canada (1.4), differed

significantly from the two countries with the least popular articles, Malaysia (0.7) and the United Kingdom (0.7). Participation in popular publishing ranged from almost half of all academic staff in Argentina, to under one fifth in Malaysia. Academics were significantly more likely to have popular publications in Argentina, Canada, Finland and Norway, compared to the USA, UK, Italy and Malaysia.

Weighted as article equivalents, mean scientific publishing was greatest in Germany (14.7) and Italy (14.6), significantly more than all other countries except Hong Kong. Academics in most countries averaged between five to six article equivalents per popular article, but the ratio is highest in the UK (13.6) and Malaysia (12.1). The higher levels of popular science publishing in Hong Kong and greater ratio of article equivalents to popular articles in Malaysia, may be related to field differences. In Hong Kong, a relatively high proportion of staff are in the social sciences, where popular publishing tends to be stronger (see Table 6-2). In Malaysia, a high proportion of staff are in technology, a field with typically lower levels of popular publishing. However, the low levels of popular publishing in the English speaking countries appear despite a relatively high proportion of staff in the social sciences and humanities. Further, in English speaking countries, academics in technology are more likely to publish popular articles than social scientists or humanists.

Table 6-4 Popular articles and article equivalents, 2005-2007, by country: mean, standard deviation, percent of academic staff with at least one publication and ratio of article equivalents to popular articles

Country	Popular articles			Article equivalents			Ratio	(N)
	Mean	St. Dev	%	Mean	St. dev	%		
Argentina	1.9	4.2	49	10.4	13.4	89	5.5	(378)
Australia	1.4	5.8	31	9.2	10.2	92	6.6	(660)
Brazil	1.7	6.1	37	10.0	11.3	92	5.9	(368)
Canada	1.4	3.0	42	8.7	8.5	92	6.2	(897)
Finland	1.5	3.7	41	10.1	12.4	89	6.7	(629)
Germany	2.0	6.4	35	14.7	15.1	95	7.4	(661)
Hong K.	2.3	8.7	34	13.1	15.2	94	5.7	(596)
Italy	1.8	7.3	28	14.6	13.5	97	8.1	(1,466)
Malaysia	0.7	2.7	20	8.5	11.4	81	12.1	(480)
Mexico	1.7	7.7	37	7.8	8.4	82	4.6	(429)
Norway	2.0	7.6	40	11.7	12.5	92	5.9	(535)
UK	0.7	2.0	26	9.5	9.8	93	13.6	(613)
USA	1.2	4.9	30	6.9	8.6	82	5.8	(671)
Total	1.6	5.4	35	10.4	11.6	90	6.5	(8,383)

The contention by some scientists that popularisation is an activity conducted by those not good enough for an academic career (Royal Society 2006b) does not receive much support in our data. Academics participating in popular publishing averaged significantly more article equivalents (13.5) than those without any popular articles (9.5). The difference between these groups is significant within all countries except the United States, where it is positive but statistically insignificant. The positive association between popularisation and scientific publishing is consistent with previous studies (Kyvik 2005; Jensen et al. 2008; Peters et al. 2008). When academics are categorised into quartiles based on their number article equivalents relative to

others within their country, those in the top quartile average significantly more popular articles (2.7) than other academics (1.2). These high scientific publishers are also significantly more likely to report at least one popular article (46 percent) compared to other academics (30 percent). Academics with high levels of article equivalents average more popular articles than other academics in each of the 13 countries and the differences are significant in all countries except USA, Mexico, Hong Kong, Brazil and Australia.

Compared to academics in junior ranks, senior ranking academics published, on average, significantly more article equivalents (13.2 versus 7.7) and popular articles (1.9 versus 1.1). Lower ranked academics were also significantly less likely to have published a popular article (28 versus 38 percent). However, while this may indicate that some junior ranked staff hold concerns about how popularisation is viewed by their superiors, 10 percent of junior staff are without publications of any type compared to 4 percent of senior academics. Academics aged 40 years or younger are significantly less likely to publish a popular article compared to older academics (28 versus 36 percent) and publish significantly fewer such articles (1.2 versus 1.8). However, differences in mean popular publications based on age are significant only in Finland, Germany, Hong Kong, Malaysia and USA. This is somewhat inconsistent with previous studies of popular publishing (Kyvik 2005, Jensen et al. 2008) and popularisation more generally (Royal Society 2006b) which found younger staff to be less likely to engage in such activities. Male academics, on average, published significantly more popular articles than females (1.8 versus 1.2) and were significantly more likely to have published at least one such article (35 versus 32 percent). However, differences are rarely significant within individual countries and partly reflect gender differences in scientific publishing and rank.

Full-time academics in the CAP data averaged 48.3 hours per week. Academics with popular publications worked significantly more hours per week compared to those without popular articles (49.3 versus 47.8 hours), including significantly more hours on unpaid

service to clients and other activities (8.3 versus 6.2 hours). However, academics with popular publications reported significantly fewer hours on the core tasks of teaching, research and administration (39.0 versus 40.1 hours). Differences in hours spent on non-core tasks are significant in each of the 13 countries. This indicates that those with popular articles may have slightly more discretionary hours to dedicate to voluntary or secondary activities. However, it is also likely that working time patterns reflect the perceived value of public engagement relative to the core activities (Poliakoff and Webb 2007).

The binary logistic regression model (Table 6-5) shows the effect of each independent variable on the probability of publishing at least one popular article. Academics in the humanities and Germany, with medium scientific publishing (3 to 14 article equivalents), operate as the reference groups due to their moderate levels of popular publishing participation. The effects of each of the behavioural factors (variables other than field or country) are broadly consistent within each of the 13 countries. Being among the top quartile of all scientific publishers is the strongest dichotomous factor positively associated with participation in popular publishing. This lends support to the hypothesis that academics with strong scientific publication records have more opportunities to popularise their research. Academics in the bottom quartile of scientific publishers are significantly less likely to publish popular articles, but the negative effect of this factor is relatively small. Somewhat surprisingly, being female is negatively associated with popular publishing, even after controlling for the positive effects of senior rank. Those who believed that academics have a professional obligation to apply their knowledge to problems in society are more likely to publish popular articles. Each additional hour dedicated to service and other non-core activities also increased the likelihood of popular publications, but hours spent on the core academic duties (teaching, research and administration) had no effect.

Table 6-5 Binary logistic regression for factors affecting the odds of having at least one popular publication

Predictor	B	S.E.	Exp (B)
Constant	-1.27**	0.16	0.28
High scientific publishing	0.54**	0.06	1.71
Obligation to popularise	0.39**	0.06	1.48
Senior rank	0.23**	0.06	1.25
Non-core activities (hours)	0.03**	0.00	1.03
Core activities (hours)	0.00	0.00	1.00
Female	-0.18**	0.06	0.84
Low scientific publishing	-0.19*	0.07	0.83
Social sciences	0.09	0.07	1.09
Technology	-0.18	0.10	0.84
Medical sciences	-0.31**	0.09	0.74
Natural sciences	-0.36**	0.08	0.70
Argentina	1.00**	0.14	2.71
Finland	0.61**	0.14	1.84
Canada	0.44**	0.12	1.55
Norway	0.36*	0.15	1.44
Brazil	0.27	0.17	1.31
Mexico	0.18	0.15	1.20
Australia	0.03	0.14	1.03
Hong Kong	0.00	0.13	1.00
USA	-0.08	0.13	0.92
Italy	-0.20	0.11	0.82
UK	-0.27	0.14	0.76
Malaysia	-0.51**	0.18	0.60

Reference categories: Medium scientific publishing (3 to 14 article equivalents), Humanities and Germany.

Model Summary: -2 Log likelihood = 8331.55; Nagelkerke R Square = 0.10;

Significance level: ** p<0.01 *p<0.05

The results for the country and academic field variables are more difficult to interpret. While the overall negative effect of being located in the natural sciences is consistent with the bi-variate comparisons,

the negative effect of medical sciences is mostly due to field differences in hours spent on non-core voluntary service activities, which are roughly twice as long in this field. If we run separate binary logistic regression models for each of the 13 countries, academic field is significant in eight countries. Natural sciences is negative in Canada, Hong Kong, Italy, Norway and UK, while technology is negative in Argentina, Finland, Hong Kong and Italy. However, the overall insignificance of technology within the combined sample masks the significant positive effect of this variable in Australia and the UK. Many of the differences in popular publishing across countries remain significant after controlling for the included behavioural and field variables, such as the strongly positive effect of location in Argentina, leaving a large amount of cross-country variance unexplained by the model.

6.4 Discussion

The results of this study raise at least six essential questions:

- To what extent are the survey results representative for the total population of academic staff in universities in each country?
- To what degree does our indicator on popular publishing resemble the view held by academics themselves on what constitutes this type of activity?
- How can the relatively low levels of popular publishing be explained?
- Why do we find such large individual differences in popular publishing?
- Why are popular articles by academic staff less common in the “hard” sciences than in the “soft” fields?
- Why do we find differences in popular publishing between individual countries?

Reliability of data

Regarding the reliability of our data, we know of only one study that has investigated the relationship between science publishing and publishing for a lay public using comparable data to the present study. In Norway, a mail survey undertaken in 2001 among university staff of the rank of assistant professor or higher, asked academics to provide information on the number of self-reported scientific and scholarly publications, as well as popular science articles, in the three-year period from 1998 to 2000 (Kyvik 2005). Their scientific and scholarly publications included four categories: (1) articles in scientific and scholarly journals; (2) articles in research books, text books, and conference proceedings; (3) research books and text books; and (4) reports that formed part of a publication series. The staff were also asked to specify the number of articles they had published in the same period that they would characterise as popular science.

Thus, the Norwegian study helps us to answer our first two questions. The response rate in the 2001 survey was 60 percent; in the Norwegian CAP-survey 35 percent. Both surveys cover a three-year period, with results based on self-reported number of scientific and popular publications. However, while the Norwegian study asked academic staff to report the number of popular science articles, the CAP survey asked staff to report only the number of popular articles written for a newspaper or magazine. A comparison of the results of these two surveys displays relatively similar results. During the years 1998-2000, the academic staff in Norwegian universities published on average 2.1 popular science articles and 9.0 scientific publications, while in the CAP-survey the equivalent numbers were 2.0 and 8.2. During the years 1998-2000, 50 percent of the academic staff reported to have published at least one popular science article; in the CAP-survey 40 percent had done so. This higher percentage in the former study may be due to a broader definition of popular publishing, thus encompassing other types of outlets than magazines and newspapers.

Low levels of popular publishing and large individual differences

Overall, the CAP results confirm the belief that popular publishing is far less common than scientific publishing and is still an activity committed to by a minority of scientists in most fields (Jensen et al. 2008, Royal Society 2006b). How can the relatively low levels of popular science publishing be explained and why do we find such large individual differences in popular science publishing? Previous studies have given several possible explanations for the overall lack of engagement in popularisation and why some academics find these activities problematic. These include a lack of interest, time, rewards or incentives, publishing outlets and experience in dissemination of research to the public.

Lack of interest: The low levels of participation in popular publishing compared to scientific publishing in the CAP data may indicate a relative lack of interest in popularisation, but it is difficult to conclude that this stems from an over-commitment to publishing for the scientific community. Academics with the highest levels of scientific publishing were most likely to publish popular articles and generally averaged more popular articles than other groups. This indicates that interest in publishing for the wider community may actually be complemented by a stronger commitment to publishing for the disciplinary community.

Lack of time: Academics may have a genuine interest in spending more time on public engagement, but the existing demands of teaching, research and administration may leave little time for additional duties. If academics believe that public engagement is a secondary activity, then it is doubtful whether time spent on public engagement will increase without a commensurate decrease in time spent on other activities. The CAP data indicated that full-time academics work about 48 hours per week, including around 40 hours per week on the core activities of teaching, research and administration. Academics with popular articles spend significantly fewer hours on the core activities, but significantly more hours on service and other activities and significantly more hours overall. The differences in total hours

and core activities are small (about one hour) and rarely significant within each national sample, but academics with popular articles spend significantly more hours on unpaid service and other activities (about two hours) in each of the 13 countries. These additional hours significantly increase the likelihood of participating in popular publishing across most countries. While the overall long working hours in academia supports the argument that academics generally face a lack of time, it can not explain why popularisers consistently found about two extra hours per week for service and other activities.

Lack of rewards and incentives: Unfortunately, there is no way of knowing how the incentive system affects motivation to publish popular articles in the CAP data, as these issues were not covered in the survey. Further, without historical publication and promotional data, the effect of popular publishing on one's chance for promotion is also not directly clear. However, indirectly we can say that compared to academics without popular articles, those with popular articles are significantly more likely to be in senior academic ranks (64 versus 54 percent). This finding may indicate that academics engaged in popularisation receive slightly higher extrinsic rewards. However, determining causality between popular publishing and other variables is not possible. For example, academics of higher ranks may be approached more often to write popular articles, thus academic rank may be both a cause as well as a consequence of popularisation.

Lack of publishing outlets: We have no data or information that might have illuminated this proposition.

Lack of experience: Gascoigne and Metcalfe (1997) found that Australian academics lacking experience or training with media communication were more likely to hold negative opinions of popular science publications. Inexperienced staff were also more likely to evaluate popular science by scientific standards and be embarrassed by the thought of their peers reading simplified explanations of their work. Qualitative findings suggest junior ranking and younger staff are keen to first establish a reputation within the research community before

engaging outside (Royal Society 2006b). While we have no information in the CAP data on experience in media communication or the views of academics on popular publishing, we do find that younger academics publish significantly fewer popular articles than academics over the age of 40. However, younger academics also publish significantly fewer scientific articles. The number of article equivalents per popular article is very similar for younger academics (6.9) compared to older academics (6.7). Therefore there is no support in the CAP data suggesting younger academics prefer scientific publishing more than older academics.

Field differences

In the CAP data we found that academics in the natural sciences and technology published, on average, the fewest popular articles and were also least likely to have published any such articles. A possible reason is that academic staff in these fields do not have the public as an important and legitimate audience, simply because the general public is more interested in reading about cultural heritage, social problems and advances in medical treatment (Kyvik 2005). A related explanation is that academic staff in these fields may gain reputation in the general public, making them less dependent upon a particular set of specialist colleagues (Whitley 1984). Still another explanation is that natural scientists and technologists may have greater difficulties communicating their research in terms easily understood by the non-specialist public (Kyvik 2005).

National differences

Why do we find such large differences in popular science publishing across the countries surveyed? This is a far more difficult proposition, given that this is the only known study to examine popularisation across multiple countries with comparable data and sampling techniques. In fact, we are not able to explain these differences, but will put forward some possible partial explanations. In the introduction, we suggested a number of possible reasons for national differences in the level of popular article publishing.

Firstly, there are long traditions of dissemination of scientific knowledge to the lay public in the United States and Europe (Gregory and Miller 1998). However, while popular publishing is generally more common in the continental European countries compared to Asian countries, popular publishing is comparably rare in the USA.

A second explanation may be national differences in the norms for proper publishing behaviour. In Norway, where popular science publishing is more common than in most other countries, dissemination of research to the public is included as one of the tasks of universities (though not by individual staff members) in addition to teaching and research (Kyvik 2005).

Third, differences in the level of “scientific literacy” across countries may affect the demand for popular science publications. However, there is little evidence to suggest a clear relationship. For example, Finland, Hong Kong and Canada are the top three ranking countries for average science literacy amongst high school students, while Mexico, Argentina and Brazil are amongst the lowest ranking countries (OECD 2006). While this may partly account for why academics in Hong Kong had the highest mean popular publications, it fails to explain why academics in Latin America are generally more engaged in popularisation than their counterparts in English-speaking countries where science literacy is apparently higher.

Given that academics are not the sole popularisers of science, a fourth explanation may lie in cultural differences pertaining to the role of media in science communication. In the UK, where scientists themselves are not very active, it has earlier been contended that the task of science reporting has increasingly fallen into the hands of journalists (Shortland and Gregory 1991). Thus, there might be less space in the media for scientists who want to publish popular science articles themselves.

Finally, there might be national differences in the need and incentives for academic staff to “go public” in order to compete for research funding, media visibility and political support (Weingart 1998, Peters et al. 2008a). Popular publishing may broaden one’s channels for research funding and strengthens one’s competitiveness within traditional channels. However, the comparably low level of popular publishing relative to scientific publishing in the UK, suggests that the perceived benefits of popularisation are not as important as additional scientific publications in highly competitive systems of research funding.

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7. The relationship between basic and applied research in universities

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Abstract

What is the central research activity in modern universities? This paper uses a comprehensive survey among individuals from 15 countries to map differences in orientation towards basic/fundamental research, applied/practical research, and a combination of the two. Despite some claims in the literature that basic research is no longer a preoccupation of universities, our findings point at a continued strong presence of basic research in universities but with large variations between countries and academic disciplines. At the individual level, most academics engage in a combination of basic and applied research, rather than specialising, with applied orientations generally more common. Academics specialising in basic research tend to receive less commercial research funding, work in environments where applied research is less emphasised, and hold weaker professional obligations to apply their knowledge to problems in society.

Key words: basic research, applied research, Mode 2, academic profession, academic work.

7.1 Introduction

The higher education literature is bursting with examples of how universities are changing in response to societal transformations and new demands. Many of these changes are described in rather pessimistic terms because they imply reduced funding, different activities and numerous tensions and challenges (Enders 2013). Only by protecting their so-called academic heartland can universities retain a degree of autonomy and a connection with widely shared values among their employees (Clark 1998). Long-term scientific work is at the centre of this heartland.

Basic research, or research undertaken with a primary purpose of the advancement of knowledge for its own sake, has traditionally been fundamental to university missions and their public funding. The “linear model” of innovation, popular during the post-1945 era, saw basic research as the primary contributor to innovation and economic growth, with universities as the institutional locus for public funding (Mowery and Sampat 2005). However, the centrality of basic research has come under question. The Mode 2 thesis, first outlined in *The New Production of Knowledge* by Gibbons and colleagues (1994), argued that disinterested, academic-oriented, disciplinary and autonomous research conducted exclusively within universities (Mode 1) is no longer the core mode of knowledge production. Mode 2 knowledge, produced within the context of application, has become the dominant form. Re-visiting the Mode 2 discourse, Nowotny, Scott and Gibbons (2003) summarised: “... the research that is variously described as ‘pure’, ‘blue-skies’, fundamental, or disinterested, is now a minority preoccupation – even in universities” (p. 184).

The Mode 2 diagnosis is broader than just the decline of fundamental research, it also includes shifts towards collaborative and transdisciplinary research, greater heterogeneity in the sites of knowledge production, deeper social accountability and broader forms of quality control (beyond discipline-based peer review). The exceptionally wide scope of the Mode 2 discourse has been criticised

for its lack of coherence and empirical validity (Hessels and Van Lente 2008). To date there has been little evidence to support or refute Nowotny and colleagues' (2003) claims, yet the Mode 2 discourse has influenced higher education and research policy makers and been cited in almost ten thousand documents, with the vast majority of scientific papers treating it as an accepted or background concept (Hessels and Van Lente 2008).

Mode 2 is not necessarily new or unique, it competes with other popular characterisations of the changing research agenda, some of which pre-date it. In the 1980s, Irvine and Martin (1984) identified the emergence of "strategic research", combining academic excellence with an orientation towards future practical utility. According to Rip (2004), strategic research is the basic way of carrying out research in the regime of "strategic science". However, strategic research retains a linearity between basic research and practical utility, including basic research as a cornerstone of its definition: "Strategic research [is] basic research carried out with the expectation that it will produce a broad base of knowledge likely to form the background to the solution of recognized current or future practical problems" (Irvine and Martin 1984). A similar conceptualisation, "translational research," shares many of these characteristics, focussing on the harnessing of basic research for practical uses, particularly within the health sciences (Woolf 2008). Other conceptualisations, such as "finalised science" and "post-normal science" also emphasise strong practice-orientation, but these concepts are much more nuanced in their interpretation, limiting their implications to certain disciplines or policy-relevant fields (Weingart 1997).

More recently, the Triple Helix model of university-industry-government relations has also had considerable impact on research policy (Etzkowitz and Leydesdorff 2000). Like Mode 2, it contends that the future legitimization of science depends upon application orientation and contribution to economic development. However, it distinguishes itself from Mode 2 because universities retain distinctiveness as the core knowledge institutions and the application orientation process is emergent, rather than complete (Etzkowitz and

Leydesdorff 2000). Academic capitalism also stresses the growing engagement of academics in application-oriented and commercially funded research, but the extent of such engagement is limited based on the closeness of one's discipline to the market (Slaughter and Leslie 1997). Overall, the Mode 2 claims regarding the shifting research agenda away from fundamental research is unique only in its comprehensiveness, particularly with reference to country and disciplinary context.

This study is in particular interested in the claim that universities are no longer preoccupied with basic or theoretical research. Our decision to limit ourselves to this component follows Hessels and van Lente's (2008) recommendation that Mode 2's impact necessitates empirical research on each of the constitutive parts separately. We do so by drawing on data from an international survey among academic staff in research universities in 15 countries and across 10 academic fields. The lack of international comparable indicators has been a crucial limitation for understanding how universities operate in national innovation systems (Mowery and Sampat 2005, p. 234). The comparative dimension allows us to test whether the assumptions surrounding Mode 2 apply to different contexts. Firstly, we investigate the extent to which individual academics world-wide consider basic or theoretical research a core part of their current research. Secondly, we examine the extent to which academics specialise only in basic or applied research, or combine these activities. Thirdly, we investigate variations in the extent to which academics specialise only in basic or applied research. Why might some academics within certain countries and academic fields choose to engage in both types of research, whilst others choose not to? We investigate three possible explanations. We expect engagement in basic and applied research to relate to: access to external research funding; institutional expectations/policies; and individual normative/social behaviour.

Question 1: To what extent is basic research still a defining characteristic of universities across the world?

Nowotny and colleagues (2003) are clear regarding three generalizable causes for the decline in fundamental research: increased steering of research priorities; increased commercialisation of research (resulting from decreased public funding and increased attention to intellectual property ownership); and broader accountability of science.

The limited evidence of how individual academics view their primary research points to the contrary, that basic research continues to be sustained as a major activity. A large-scale Finnish investigation found that an “academic orientation” with strong emphasis on basic research remains central across disciplinary fields (Ylijoki et al. 2011). The authors question the thesis that a significant transformation is taking place in universities, arguing instead that academics find different ways to combine an academic orientation with various forms of societal engagement. A UK interview study found the same, although it also emphasised how the term “basic research” is flexible and may be adapted to varying circumstances (Calvert 2004). Gulbrandsen and Kyvik (2010) also found that 90% of Norwegian academics undertook basic research, with slightly less than half declaring their research “very much” basic (maximum value on a 5-point scale), confirming other findings that basic research remains a strong identity marker for university staff (Gulbrandsen & Langfeldt 2004). These results are indicative of the resilience of basic research within universities, but may not be generalisable to other countries. Public funding of university research retains a strong position in Norway (Kyvik 2007).

National context is potentially of greater importance to understanding changes in knowledge production than implied by the Mode 2 thesis. Even if one acknowledges that universities across the world have experienced increased steering of research priorities and accountability pressures, it is unlikely that the effects would be

uniform across countries. Shinn (2002) argues there is little evidence that science has become de-nationalized and it is inappropriate to generalise broad changes across national settings. According to Shinn, despite globalisation trends, universities, business and government still function predominantly within the national settings. The interaction between these institutions has implications for university governance and research behaviours. European countries have stronger traditions of academic self-determination, whereas market coordination has stronger traditions in most English-speaking countries and state control in parts of Asia (Clark 1983). Even within regions of similar academic traditions, convergences in higher education policies have not diluted the national character of academic labour markets and their internal regulation of research (Musselin 2005). This makes a dataset from different countries particularly valuable.

National governments remain the main funder of university research in almost all OECD countries, but this varies from over 80% of total funding of R&D in higher education institutions in Argentina, Australia, Italy, Finland, Germany, Norway and the Netherlands, to closer to two thirds in the USA, UK and Canada, and just over half of all funding in China (OECD 2013). Countries also differ in how this public funding is allocated to universities for research. According to Auranen and Nieminen (2010), core public research funding is determined predominantly via input orientated measures in many European countries (e.g. Norway, Finland, Netherlands and Germany), whereas output-oriented funding models are more dominant in Australia and the UK. Although many European countries have been moving towards output oriented funding models, there has been stronger resistance from universities and their implementation has been weaker. This likely reflects the traditionally stronger academic oligarchy within these countries (Clark 1983).

The implications for engagement in basic research is not directly clear, but one would reasonably assume that country-level differences in how universities are governed and funded would lead to greater diversity in research behaviours. For example, systems with greater

levels of core funding based on input measures have higher levels of stability compared to output-oriented and externally funded systems (Auranen and Nieminen 2010). By implication, risky, fundamental and disinterested basic research may be more likely to flourish in the countries with more predictable funding. Although we cannot test empirically *why* country-level differences in basic research engagement may exist (countries differ across a range of idiosyncratic characteristics, not just governance or funding), it is appropriate to test the robustness of Nowotny and colleague's general claims.

Question 2: To what extent do academics specialise only in basic or applied research, or combine these activities?

If universities are no longer preoccupied with pure, fundamental and disinterested research, what have become the dominant research preoccupations? Nowotny and colleagues (2003) discuss how Mode 2 knowledge production is characterised by diversity, reflexivity and a shift away from the stable, clear and unchallengeable taxonomy of disciplinary research. Further, the original Mode 2 argument stated that Mode 2 did not replace Mode 1; it supplemented and grew alongside it (Gibbons et al. 1994). Accordingly, individual academics engaged in Mode 2 knowledge production may continue to be involved in basic research alongside application-oriented research. Adding further complexity, application-orientation (and the four other attributes characterising Mode 2 knowledge) are "not present in every instance of Mode 2" (Gibbons et al. 1994). Thus application-orientation is neither a prerequisite, nor a sufficient, characterisation of Mode 2. This is similar to Stokes' (1997) argument that considerations of use often go hand in hand with a quest for fundamental understanding. Despite these challenges, one may reasonably understand Nowotny and colleagues' (2003) argument to imply a shift in the balance between basic and applied research, towards more applied research specialists.

The few studies that have reported on this issue indicate, however, that a traditional academic orientation is resilient rather than new

combinations. Albert (2003) found no evidence that Canadian academics in sociology and economics departments had shifted their research attention away from disciplinary research intended for their peers and begun specialising in interdisciplinary and practical research. Studies of scientists in the Netherlands (van Rijnsoever and Hessels 2011) and Finnish academics in technology, social science and humanities departments (Hakala and Ylijoki 2001) also indicate high commitment to Mode 1-type research over purely applied research. Finally, Gulbrandsen and Kyvik (2010) found that only a few of Norwegian academics in 2000 were engaged exclusively in basic research, but this was still greater than the proportion engaged exclusively in applied research, although a combination was most common for all university staff members. Each of these aforementioned studies are somewhat limited by their national context. Our international data provides us with a useful opportunity to examine this relationship.

Another contextual limitation of the Mode 2 thesis is academic field (Hessels and Van Lente 2008). Disciplinary cultures span international boundaries and influence what types of research are considered legitimate within the scientific community (Becher 1994). Weingart (1997) argues that Mode 2 attributes, such as application-oriented research, make little sense in scientific disciplines distanced from policy makers. Likewise, Godin (1998) notes the difficulty certain disciplines face when modifying their research towards applied and practical purposes. According to Becher (1994), academic disciplines differ in their cognitive knowledge structure from pure (theoretical) to applied (pragmatic). Applied disciplines within the technological sciences (e.g. engineering) are purposive and pragmatic in their knowledge, oriented towards mastery of the physical environment, resulting in products/techniques. In the pure sciences (e.g. physics), knowledge is cumulative, atomistic, well organised and results in discovery or explanation, rather than directly practical outputs. Social sciences and humanities may also be pure or applied, depending on whether they are oriented towards practical, utilitarian and functional improvements to professional practice (e.g. education), or understanding and interpretation (e.g. humanities).

Based on Becher's typology, we may expect specialisation in basic research to be more common in the hard-pure disciplines (e.g. life sciences and physical sciences) and soft-pure disciplines (humanities and social sciences). By contrast, specialisation in applied research may be more common in the science based professions within hard applied disciplines (e.g. agriculture, engineering, medical sciences) and social professions within the soft applied disciplines (e.g. education, law). Our data will allow us to extend disciplinary-based findings from specific countries to an international context, controlling for other individual-level factors.

Question 3: What might explain individual differences in specialisation versus combining basic and applied research?

Few universities are completely insulated from the increased steering of research priorities, commercialisation and accountability pressures, but this does not imply that individual academics will respond in consistent and uniform ways. Despite the decline in autonomy, academics still retain a relatively high degree of discretion over their non-teaching hours and have the freedom to seek research activities of professional and personal engagement, although the latter may not always be compatible with a secure academic career (Davies 2013). Why might some academics in comparable disciplines and countries engage predominantly in basic research whilst others do not? We put forward three possible explanations: commercial research funding, institutional expectations and professional norms.

Nowotny and colleagues (2003) argue that inadequacy of public funding has caused universities to shift their research preoccupation away from basic research. Government core funding of research has declined in a range of OECD countries and the mechanisms for disbursing public funds has shifted from stable block grants towards results-based models

(Auranen and Nieminen 2010). Given that basic research leads to unpredictable results and tends to attract little private sector funding,

we may expect that access to business and industry funding will also be a differentiator between individual academics for basic and applied research engagement within countries. Academics able to source business and industry funding for research are less reliant on dwindling institutional funding and may be more likely to be engaged in applied research.

A second important factor is institutional expectations for research. Universities across the world have seen stakeholder expectations widen and deepen, including the expectations for producing practical knowledge and training. Clark (1998) describes the situation in terms of a demand-response imbalance: “demands on universities outrun their capacity to respond” (p. 6). In terms of functional differentiation, modern universities are characterised by “overcomplexity and underdifferentiation” (Enders 2013). However, universities are not entirely victims of past history and stakeholder demands. Universities are capable of choosing which stakeholder demands to respond to, where within the organisation these responses will occur and how. For example, entrepreneurial responses may occur at the “developmental periphery”, where traditional disciplinary research meets the outside world through interdisciplinary research, contract research, contract education and consultancy (Clark 1998). Such engagement with external stakeholders can diversify the funding base, promote an entrepreneurial culture throughout the university, as well as stimulate the “academic heartland” where traditional disciplinary and theoretical research is maintained. In other words, universities have the capability to respond to stakeholder needs by promoting commercial and interdisciplinary research. Therefore, we may expect that academics who work in such environments will be more likely to engage in applied research, and not necessarily to the detriment of their engagement in basic research.

A third factor explaining diversity is professional norms. One of the defining characteristics of academia is autonomy and protection from external influence. The freedom of professors to teach without external control was a core principle of the medieval university and has influenced the development of universities, not just in central and

Western Europe, but also in the USA (Altbach 2001). The emergence of privately funded, practically oriented research for commercial or technology transfer purposes in the mid to late twentieth century challenged established scientific norms, particularly the norms of disinterested research and public ownership of knowledge (Stuart and Ding 2006). The changing funding patterns have been described as placing the future of basic research in jeopardy (Altbach 2001). However, scientific norms are not static. Etzkowitz (1998) argues that scientific norms have progressively accepted commercial research and academic entrepreneurialism with profit-making motives. These normative changes may be considered the “second revolution” in academia, following the first revolution which made research a core function of universities. Given the challenges that applied research pose to traditional scientific norms, we expect that engagement in applied research will reflect how individuals view applied research. Those who view applied research as a professional obligation will be more likely to be more engaged in applied research.

7.2 Data and methodology

The data comes from the Changing Academic Profession (CAP) international survey of the academic profession across 19 countries during 2007-08: Argentina, Australia, Brazil, Canada, China and Hong Kong, Finland, Germany, Italy, Japan, Malaysia, Mexico, the Netherlands, Norway, Portugal, South Africa, Republic of Korea, UK, and the USA. The CAP project used a common random sampling protocol and survey instrument. The target population of the CAP survey were professionals in universities or other higher education institutions offering a baccalaureate degree or higher. Given that this article addresses research orientation, we restrict ourselves to academics employed in universities with research and teaching missions, generally those universities awarding doctorate degrees (i.e. excluding polytechnics, teaching-focused colleges, research institutes). We exclude four of the 19 countries from our analysis. This is due to an inability to differentiate between teaching-focused and research-focused universities or small sample sizes (Japan and Korea), low

response rate (Portugal) or limited information on the sampling framework (South Africa).

The response rates, including partially completed responses, were mostly below 40 percent. Therefore, there is a potential risk of non-response bias in some countries. However, national samples were found broadly representative of the respective populations on strata such as gender, academic rank and institutional type (Cummings and Finkelstein 2012; RIHE 2008; Vabø and Ramberg 2009). Further, there are few reasons to expect that non-respondents would differ substantially in terms of self-declared research orientation. After removing non-respondents to the core questions regarding basic and applied research orientation and respondents not employed in academic ranks, we were left with a sample of 12,379 academics.

Table 7-1. Response rates and sample sizes by country

	Response rate	Total survey respondents	Valid cases (n)
Argentina	34%	826	760
Australia	25%	1,370	934
Brazil	26%	1,147	403
Canada	17%	1,152	927
China	86%	3,612	2,459
Finland	29%	1,452	464
Germany	32%	1,265	840
Hong Kong	13%	811	644
Italy	35%	1,701	1,296
Malaysia	30%	1,220	729
Mexico	69%	1,973	530
Netherlands	18%	1,167	447
Norway	36%	1,035	529
UK	15%	1,565	716
USA	23%	1,146	701
Total	28%	21,442	12,379

Dependent variable - measuring basic and applied research

We consider Nowotny and colleagues' (2003) references to "pure", "blue-skies", "fundamental", or "disinterested" research to be analogous to basic or theoretical research, and context of application to be analogous to applied or practically-oriented research. Our data for measuring research orientation comes directly from the CAP survey. The relevant question asked: "How would you characterize the emphasis of your primary research this (or for the previous)

academic year?" Respondents provided a score ranging from "very much" (1) to "not at all" (5) on seven separate criteria. This study examines the results for two of these criteria: "basic/theoretical" and "applied/practically-oriented". The explicit reference to theory and practical orientation is consistent with the extended definitions of basic and applied research in the OECD's Frascati Manual (2002). Given that respondents provided scores on each criterion separately, it was up to individual to determine whether the concepts of basic and applied research were mutually exclusive or inclusive.

We are interested both in the extent to which basic research is a defining characteristic of academic work, as well as its relationship with applied research. We distinguish between five distinct research orientations: pure basic; leaning towards basic; equally, basic and applied; leaning towards applied; pure applied. A sixth category for respondents with neither basic nor applied research orientation is a residual category for those not declaring a clear research orientation. The definition of each research orientation group and number of respondents in each group is presented as a cross-tabulated matrix in Table 7-2.

Table 7-2 Research orientation categorisation and definition

Survey question: "How would you characterize the emphasis of your primary research this (or the previous) academic year?"

Category	Definition
Equally, basic and applied:	Very much (1) or high (2) for both basic and applied (3,133 respondents).
Leaning towards basic:	Very much (1) or high (2) for basic, and to a lesser extent (2 or 3) for applied (2,048 respondents).
Leaning towards applied	Very much (1) or high (2) for applied, and to a lesser extent (2 or 3) for basic (2,722 respondents).
Pure basic	Very much (1) or high (2) for basic and little (4) or Not at all (5) for applied (1,547 respondents).
Pure applied	Very much (1) or high (2) for applied, and little (4) or Not at all (5) for basic (1,931 respondents).
Neither basic nor applied	(3) or less for both (998 respondents).

There are certain limitations which may affect how the research results are interpreted. Firstly, there is a risk that the concepts of “basic”, “theoretical”, “applied” and “practically-oriented” may be understood differently across countries, particularly after translation into local language. In countries where English was not the language of the survey, most used a combination of professional translators, academic translators, survey piloting and peer review (e.g. regions with common languages), in addition to internal review by the project team.

Although we are confident the concepts of basic and applied research were translated accurately, there is a risk the concepts are interpreted differently, particularly in countries where research has not traditionally been conducted within universities. Secondly, one assumes that differences in responses to Likert-type questions reflect differences in substantive engagement, and that engagement is related to contextual factors such as research norms of the discipline or institution. However, academics may exaggerate or define their research in accordance with norms, rather than contextual factors influencing substantive engagement.

Independent variables – factors associated with research orientation

The operationalization of independent variables are outlined below. Means on each variable are listed for each country in the Appendix 7-A.

Country is a dichotomous variable based on country of employment: Argentina; Australia; Brazil; Canada; China; Finland; Germany; Hong Kong; Italy; Malaysia; Mexico; Netherlands; Norway; UK; and USA.

Academic discipline is a dichotomous variable based on discipline of one's current academic unit: education (teacher training and education science); humanities (humanities and arts); social sciences (social and behavioural sciences); commerce (business and administration, economics); law; life sciences; physical sciences (physical sciences, mathematics, computer sciences); engineering (engineering, manufacturing and construction, architecture); agriculture; medicine (medical sciences, health related sciences, social services); and other (personal services, transport services, security services or other). Based on Becher's (1994) disciplinary typology, we expect basic research to continue to be a core preoccupation of academics within hard-pure sciences, and soft-pure social sciences and humanities.

Commercial research funding is the percentage of one's research funding (in the current or previous academic year) which came from business firms or industry. We expect that engagement in applied research will be greater amongst those academics with greater access to external commercial research funding.

Individual normative/social behaviour includes one scale variable based on the ordinal responses (from "strongly agree" [5] to "strongly disagree" [1]) to the following statement: "Faculty in my discipline have a professional obligation to apply their knowledge to problems in society". We expect that engagement in applied research will reflect the extent to which individuals view applied research as a professional obligation.

Institutional norms and expectations/policy/strategy includes one scale variable based on the ordinal responses (from "strongly agree" [5] to "strongly disagree" [1]) to the following statement: "Your institution emphasizes commercially-oriented or applied research". We expect that academics working in environments emphasising commercially-oriented and applied research, will tend to engage more in applied research.

7.3 Results

Basic research as a pre-occupation

Our first research question addressed the extent to which basic research is still a defining characteristic of universities. When asked to characterise the emphasis of their primary research in the previous year on a scale of 1 (“very much”) to 5 (“not at all”), 61% reported significant engagement in basic research (values of 1 or 2). Very few academics (7%) reported being “not at all” engaged in basic research, with the remainder engaged partly in basic research (32%). Based on these results, Nowotny and colleagues’ (2003) claims that fundamental research is a minority preoccupation in universities received little empirical support, with 93% reporting at least some engagement with basic research. At the very least, claims that fundamental research is a minority preoccupation should be qualified by country. Levels of significant engagement in basic research ranged from 78% in China to just under half of all academics in Argentina (49%). Universities in Argentina, and to a lesser extent, Brazil, tend to employ a large number of part-time and teaching-only staff, but this does not account for their relatively weak engagement in basic research. Part-time staff in these countries did not differ from their full-time colleagues in their engagement in basic research.

Although most academics engage in basic research, a greater proportion report engagement in applied research. To this extent, fundamental research may be not be the primary preoccupation of universities, even though the majority engage in it. More than two thirds (69%) of academics characterised their research as applied to a large extent, one quarter (25%) were partly engaged in applied research, and 6% not at all. China was again the country where academics were most likely to report strong engagement in applied research (86%). Norway and the Netherlands were the only countries where more academics reported significant engagement in basic research compared to applied research. The proportion of academics in each country reporting significant engagement in basic research

(values of 1 or 2) is shown in Figure 7-1 on the left-hand bar, while the proportion reporting significant engagement in applied research is shown on the right-hand bar. Note that the basic and applied characterisations were derived from separate questions. Therefore, it was up to the respondent to decide whether the two categories (basic and applied) were mutually exclusive characterisations. The fact that sum of both bars exceeds 100% in all countries is evidence that most academics do not consider these characterisations as mutually exclusive.

Figure 7-1. Proportion of academics whose primary research was to a considerable extent basic/theoretical (left-hand bar) and applied/practical (right-hand bar), by country

Specialisation versus the coexistence of basic and applied research

In order to investigate the relationship between basic and applied research, and tendency towards specialisation, we exclude respondents who were not sufficiently engaged in basic or applied research. Rather than being engaged in research outside the basic/applied typologies, academics with no clear research orientation are better understood as insufficiently research active. For example, they published little, spent very few hours on research and were also unlikely to characterise their research in other ways (e.g. commercially-oriented, single-disciplinary or interdisciplinary). These 998 respondents were classified as “neither basic nor applied” in Table 7-2 (8% of the total sample) and are subsequently excluded from the valid cases for further analysis.

Amongst academics with clear research orientations, 14% specialised as “pure basic” researchers. On this basis, only a small minority of academics may be understood to be preoccupied entirely with basic research. However, the lack of specialisation was not primarily due to a tendency to specialise in applied research, only 17% could be considered “pure applied” researchers. The bulk of the sample engaged in both basic and applied research. The most frequent categorisation was “equally, basic and applied” (27%), followed by “leaning towards applied” (24%) and “leaning towards basic” (18%). In other words, basic research is not the primary preoccupation of most academics, but this is because it is integrated with applied research in most cases.

Specialisation varied considerably across countries. Pure basic researchers were most common in Italy, Netherlands and Norway, comprising roughly one quarter of all academics and outnumbering those in the pure applied category. At the other extreme, almost no academics were specialised in basic research in China (2%) and Malaysia (5%). However, this reflected a greater tendency to combine basic and applied research in these countries, rather than an aversion

to basic research. The balance between basic and applied research was most skewed in Australia, where pure applied researchers were more than twice as common as pure basic researchers. The proportion of academics specialising in basic or applied research by country is shown in Figure 7-2. The full breakdown across the five research orientation categories is shown for each country in Appendix 7-B.

Figure 7-2. Proportion of academics engaged purely in basic/theoretical research (left-hand bar) and purely applied/practical research (right-hand bar), by country

Research specialisation was closely aligned with Becher's (1994) disciplinary typology of pure/theoretical and applied/pragmatic

knowledge structures. Pure basic researchers were most common in the humanities (28%), life sciences (22%), social sciences (19%), and physical sciences (18%). These discipline-based differences were broadly consistent across country samples, with humanities ranked in the top-3 basic research disciplines in all countries other than Australia. Comparably few pure basic researchers were located in Becher's applied disciplines within the science-based and social professions, such as medicine (9%), business studies (8%), education (7%), agriculture (4%) and engineering (3%). The balance between specialisation in basic or applied research also aligns with Becher's typology, with few disciplines having a roughly equal number of pure applied and pure basic researchers. One possible exception may be law, where pure applied research was rare (10%) compared to pure basic (18%). This appears to contradict the practice orientation of the discipline. However, it may be that purely "practically-oriented" research is defined differently by law academics, given that research within a legal practice involves direct remuneration for specific clients. The proportion of academics specialising in basic or applied research by discipline is shown in Figure 7-3 (full breakdown by discipline in Appendix 7-C).

Figure 7-3. Proportion of academics engaged purely in basic/theoretical research (left-hand bar) and purely applied/practical research (right-hand bar), by discipline of current academic unit

Compared to the country-level results where pure applied researchers were only marginally more common than pure basic researchers, research orientation is considerably more fragmented across disciplines. This also supports Becher's claims that disciplinary cultures often span national boundaries and embody collective norms. Taken together, the large differences across countries and disciplines suggests that claims regarding basic, theoretical or blue sky research should be nuanced with reference to national and disciplinary context.

Multinomial results

Our third research question was how we might account for individual-level differences in engagement and specialisation in basic and applied research. From the above results, the disciplinary implications are clear. Given that countries differ in their proportion of academics by discipline, cross-country comparisons need to control for these differences. However, significant variation within countries and disciplines suggests that other factors may also influence specialisation. To examine this further, we computed a multinomial logistic regression with three categorical outcomes: pure basic, pure applied, and basic and applied as the reference category (merging the three categories which involved both types of research). Controlling for country and discipline, we investigated whether specialisation in basic or applied research was also associated with differences in access to commercial research funding, institutional expectations/policies, and individual normative/social behaviour. We also checked whether the results differed when controlling for demographic characteristics (gender, age and age squared), but the main results did not change. The multinomial logistic regression results are presented in Table 7-3.

Table 7-3 Multinomial logistic regression results, factors associated with pure basic and pure applied research orientations

	Research orientation = pure basic			Research orientation = pure applied		
	B	Std. Error	Exp(B)	B	Std. Error	Exp(B)
Intercept	0.63**	0.21		-2.12**	0.20	
Education	-0.66**	0.20	0.52	0.26	0.15	1.30
Humanities	0.50**	0.12	1.65	-0.43**	0.15	0.65
Commerce	-0.51**	0.16	0.60	0.36**	0.14	1.43
Law	0.18	0.21	1.20	-0.33	0.25	0.72
Life Sciences	0.05	0.14	1.06	-0.25	0.16	0.78
Physical sciences	-0.09	0.12	0.91	-0.22	0.13	0.80
Engineering	-1.27**	0.18	0.28	0.48**	0.12	1.62
Agriculture	-1.57**	0.35	0.21	0.78**	0.16	2.19
Medicine	-0.66**	0.15	0.52	0.67**	0.12	1.95
Other	-0.36	0.24	0.70	0.36	0.19	1.44
ARG	0.20	0.19	1.22	0.09	0.15	1.10
AUS	0.00	0.20	1.00	0.27	0.15	1.31
BRA	0.13	0.26	1.14	0.05	0.22	1.05
CAN	0.25	0.18	1.29	0.08	0.15	1.08
CHI	-1.92**	0.24	0.15	-2.22**	0.18	0.11
FIN	0.65**	0.21	1.92	0.09	0.19	1.10
GER	0.22	0.18	1.24	0.06	0.15	1.06
HK	-0.07	0.21	0.93	-0.10	0.16	0.90
ITA	1.04**	0.17	2.83	0.38**	0.14	1.46
MAL	-0.78**	0.27	0.46	-1.24**	0.21	0.29
MEX	0.20	0.25	1.22	-0.36	0.22	0.70
NET	0.54**	0.20	1.72	0.01	0.19	1.01
NOR	0.70**	0.19	2.02	0.23	0.17	1.26
UK	0.05	0.19	1.05	-0.61**	0.18	0.54
Commercial res. funding	-0.03**	0.00	0.97	0.01**	0.00	1.01
Institutional norms	-0.15**	0.03	0.86	-0.01	0.03	0.99
Individual norms	-0.46**	0.03	0.63	0.20**	0.03	1.22

n=8654

Significance level: ** p<0.01 *p<0.05

Model fit: -2 Log likelihood (final) 8277.046; Chi-Square 2253.616; df 54; Sig. 0.000

Pseudo R-Square: Cox and Snell 0.229; Nagelkerke 0.281; McFadden 0.154

Reference categories: Both basic and applied (dependent variable); USA; Social sciences.

The likelihood ratio tests from the multinomial regression results (not shown) indicated a statistically significant relationship between research specialisation and commercial research funding, organisational expectations and individual norms. However, organisational expectations for commercially-oriented or applied research (institutional norms) were not a statistically significant factor differentiating between all categories of research specialisation. Compared to the reference category for those engaged in both basic and applied research, and holding other factors constant, a one unit increase in agreement (on a five-point scale) with the statement “Your institution emphasizes commercially-oriented or applied research” was only statistically significant in its negative association with being a pure basic researcher (with a decrease in the multinomial log-odds of 0.15 per unit increase). Agreement with this statement was not significant in its relationship with being a pure applied researcher. In other words, institutional norms emphasising research commercialisation appear to increase engagement in applied research but not specialisation in this type of research. On the other hand, individual norms were significantly associated with both types of specialisation. A one unit increase in agreement with the statement that “Faculty in my discipline have a professional obligation to apply their knowledge to problems in society” was associated with an increased likelihood of being pure applied. Agreement was even more strongly associated with a decrease in the likelihood of being a pure basic researcher.

External commercial research funding was a significant differentiator for research specialisation, but mostly in its negative relationship with pure basic research specialisation. A one point percentage increase in the proportion of one’s research funding coming from business or government sources was associated with a small but statistically significant decrease in the likelihood of being a pure basic researcher. To a lesser extent, commercial research funding was also positively associated with pure applied research. In other words, commercial research funding tends to increase the likelihood of being engaged in applied research, but mostly in combination with basic research rather than in specialisation. This relatively minor relationship is partly due

to the small share of academics for whom commercial funding is a main source of research funding. In most countries, the mean proportion of research funding from business and industry was around 5% or less. However, in Germany and China, these proportions were considerably greater at 10% and 15% respectively (see Appendix 7-A). This is consistent with their high proportion of higher education R&D expenditure financed by industry, at 14% and 33% respectively, versus 6% across all OECD countries (OECD 2013).

The control variables for country and discipline remained statistically significant in their relationship to research specialisation. Specialisation in pure basic or pure applied research was significant and negatively associated with being located in China and Malaysia (compared to the reference category of USA), which was to be expected given the aversion towards specialisation found in the descriptive results. The other regional patterns which remained significant were the greater likelihood of pure basic researchers to be located in the Western European countries of Italy, Norway, the Netherlands and Finland. Disciplinary differences continued to reflect Becher's (1994) typologies. Pure basic researchers were significantly more likely to be located in the humanities, while pure applied researchers were significantly more likely to be located in engineering, agriculture, medicine and commerce.

In summary, pure basic researchers could be more clearly differentiated from others based on their research funding, professional norms and perceptions of institutional expectations, while pure applied researchers share more in common with those engaged in both basic and applied research.

7.4 Discussion and conclusion

Basic research is an activity that continues to define academic work at most research universities around the world. The majority of academics (61%) in our data material based on more than 10,000

researchers from 15 countries report significant engagement in basic research and very few report no engagement in basic research (7%). Although these aggregate results mask considerable diversity across countries, there is little evidence that basic research is a minority preoccupation in any of the countries for which we have data. However, more academics are engaged in applied research than basic research. Those academics that engaged in both types did not do so equally, with more academics leaning towards applied over basic. This suggests there are some trade-offs between the two activities. Therefore, basic research may be considered to be an important part of most academics' research, but often secondary to applied research. Our cross-sectional data does not allow us to investigate the extent to which theoretical research has declined from a dominant position, but the resilience of theoretical research lends stronger support to the more nuanced position of the Triple Helix model (Etzkowitz and Leydesdorff 2000). The shift towards Mode 2 or practical research appears to be emergent, rather than complete, with universities remaining a core producer of theoretical knowledge.

Our research generally supports Stokes (1997) since a main result is that combining basic and applied work is the norm for the majority of academics, regardless of country and discipline. It also supports earlier work claiming that traditional academic orientations remain strong in universities, even in periods of decreased core funding and increased pressure for various forms of societal engagement (Ylijoki et al. 2011). We still do not have sufficient evidence to conclude whether the frequent "hybrid profiles" of academics are productive and meaningful, or whether they to a greater extent represent incommensurable activities leading to stress and insecurity (c.f. Davies 2013).

Disciplinary-based analyses showed basic research to be relatively weaker in the professional social science disciplines (e.g. business and education) and the applied sciences (engineering, agriculture and medicine). Academics within these disciplines were rarely primarily focused on theoretical research, but these patterns probably reflect the cognitive knowledge structures of these disciplines and their

orientation towards practical outputs (Becher and Trowler 2001), rather than a weakening importance of theoretical research. The diversity within these disciplines also suggests that theoretical research can be an important, and even dominant, motivation. Highly practical results may be the starting point for conducting research in some applied disciplines, but academic prestige has a strong appeal for academics across various disciplines (Hakala and Ylijoki 2001). Nevertheless, with up to around one third of academics in the applied sciences engaging purely in applied research, compared to less than one fifth in other fields, a complete devotion towards practice orientated research is clearly more relevant in certain fields. This lends stronger support to the field dependent interpretations offered by Weingart (1997) and Woolf (2008) in their competing frameworks for understanding changes to the science system.

Our cross-country results are less easy to explain and should be treated with caution due to the limitations of the data. The strong position of basic research in Finnish and Norwegian universities has been noted previously (see Ylijoki et al. 2011; Gulbrandsen and Kyvik 2010), but our international results from other countries suggest a more nuanced interpretation. Although more academics were significantly engaged in basic research than applied research in Norway and the Netherlands (with an equal division in Italy), these countries were the exceptions. Applied research dominated in most countries, particularly in Australia where academics were roughly twice as likely to specialise or lean towards applied research compared to basic research. This tendency was also noticeable in the USA and Hong Kong. One possibility is that applied research engagement reflects academic governance systems, with a stronger academic oligarchy protecting the place of basic research compared to market-driven systems (Clark 1983), but this was not consistent with results in all countries.

Institutional norms emphasising research commercialisation were weakest in Mexico, Argentina and Brazil, and relatively weaker in most European countries (see Appendix 7-A). This was consistent with traditional systems of bureaucratised governance within Latin

American universities, which have been criticised for creating few incentives to engage in research commercialisation and research productivity more generally (Thorn and Soo 2006). However, although each of these institutional aspects differentiated between individuals within countries in consistent ways, the differences across countries remained. For example, strong institutional-level norms towards research commercialisation in the UK were not consistent with the rather moderate engagement in applied research in this country. Nor were weak commercialisation norms in Brazil and Argentina consistent with the moderate engagement in applied research and weak engagement in basic research. In Latin America it has been claimed that university discourse has shifted enthusiastically towards Mode 2, but the academic evaluation system remains rooted in Mode 1 outputs, leading to an “evaluation system schizophrenia” (Arocena and Sutz 2001, p.1231). Engagement in basic and applied research clearly has strong country-level features, implying that generalised statements about basic or applied research must be qualified for local context.

China and Malaysia are particularly interesting countries because both applied and basic research were strong self-characterisations. Neither country has strong university research traditions, but their respective governments have recently increased their expectations for basic research as part of innovation and development plans (Zhu and Gong 2008; Lee et al. 2013). Up until the mid-1980s, Chinese universities were predominantly teaching-focused, receiving no specific funding for research. Basic research was the responsibility of the Chinese Academy of Science and other national research institutes, while applied research was conducted by research institutes in industrial sectors (Zhu and Gong 2008). Malaysian universities have also been largely teaching-focused and lacked an academic research culture (Lee 2003). Strong engagement in both basic and applied research may reflect an emerging research culture which supports both basic and applied research. According to Mohrman (2008), at the same time that Chinese institutions are encouraging basic research, universities are also responding to demands for applied research as a service to society. This appeared to translate into

individual-level norms. Academics in these two countries were most likely to report stronger agreement that academics had a professional obligation to apply their knowledge to problems in society.

However, the results for China and Malaysia also highlight a broader difficulty in defining basic and applied research engagement. Even though we are confident that concepts of basic/theoretical research and applied/practically-oriented research were understood in each country and the investigation teams went to great lengths to ensure translations were accurate and comparable, there is a risk that subtle differences in understanding might be responsible for parts of the differences across countries in responses. Academics in some countries may declare a greater engagement in basic research due to, for example, a broader definition of what “theoretical” or “practical” research means. This also goes beyond linguistic differences to general understanding, acceptance and reward structures for basic and applied research. The strong relationship between individual norms, institutional expectations and self-reported engagement in applied research, could indicate that academics are responsive to institutional policies supporting applied research. Unfortunately, individuals may also simply exaggerate behaviours in accordance with what they perceive to be the norms of their discipline and institution. This has implications for the growing expectations of research “relevance” from higher education stakeholders around the world (Enders and Musselin 2008). If most academics genuinely believe they are already deeply engaged in practical research, it may indicate they hold a different understanding of applied and practically oriented research compared to the policy makers articulating the need for greater engagement.

We have shown that the emphasis on applied research is not only related to funding and university strategies; it is even more strongly related to individual norms about academics obligations. National and institutional policies for more applied and practically-related activities are therefore not necessarily out of touch with core academic values. Our main finding is that different types of research activities are mixed and combined at the individual level, despite variations

between countries and between academic disciplines. This does not imply that the balance between basic and applied research is equal, or that basic research has not lost its pre-eminence, but it does imply that basic research retains a core position within the research mind sets of most academics. As such our results can be interpreted as a warning against policies striving for clear division in the higher education landscape between institutions primarily doing basic research and others applied. This seems out of touch with widely shared norms and practices among the researchers themselves, who overwhelmingly combine these activities.

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Appendix 7-A. Independent variable means by country

	ARG	AU	BRA	CAN	CHI	FIN	GER	HK	ITA	MAL	MEX	NET	NOR	UK	USA	Total
Education	0.06	0.08	0.07	0.09	0.07	0.10	0.03	0.13	0.02	0.06	0.01	0.02	0.06	0.05	0.10	0.06
Social sci.	0.16	0.13	0.08	0.16	0.12	0.15	0.10	0.18	0.10	0.07	0.07	0.15	0.15	0.21	0.21	0.14
Humanities	0.15	0.12	0.09	0.16	0.02	0.11	0.09	0.16	0.08	0.06	0.17	0.15	0.18	0.16	0.18	0.11
Commerce	0.04	0.13	0.06	0.09	0.13	0.08	0.06	0.12	0.07	0.11	0.09	0.11	0.04	0.10	0.05	0.09
Law	0.02	0.01	0.02	0.02	0.04	0.03	0.02	0.01	0.05	0.01	0.01	0.07	0.02	0.04	0.02	0.03
Life Sciences	0.00	0.09	0.09	0.06	0.03	0.06	0.10	0.04	0.10	0.06	0.10	0.06	0.11	0.07	0.06	0.06
Physical sci.	0.16	0.10	0.15	0.14	0.25	0.11	0.17	0.08	0.25	0.12	0.16	0.23	0.15	0.11	0.10	0.17
Engineering	0.19	0.06	0.10	0.07	0.26	0.11	0.14	0.10	0.18	0.30	0.14	0.08	0.09	0.09	0.09	0.15
Agriculture	0.13	0.02	0.04	0.01	0.01	0.03	0.04	0.00	0.05	0.01	0.05	0.05	0.00	0.00	0.02	0.03
Medicine	0.10	0.24	0.19	0.14	0.03	0.16	0.20	0.15	0.10	0.09	0.15	0.07	0.17	0.18	0.14	0.12
Other	0.00	0.01	0.12	0.07	0.03	0.06	0.04	0.03	0.00	0.09	0.06	0.00	0.06	0.00	0.03	0.03
Commerc. fund.	2.49	7.89	6.25	4.54	14.86	5.36	10.28	2.49	8.50	3.37	3.03	5.45	5.81	4.54	6.78	7.49
Institut. norms	2.50	3.71	2.59	3.15	3.26	3.04	2.78	3.07	3.10	3.76	2.45	2.66	2.92	3.49	3.20	3.12
Individ. norms	3.68	3.79	3.54	3.63	3.97	3.75	3.35	3.74	3.74	3.80	3.87	3.24	3.47	3.59	3.84	3.72

Appendix 7-B. Basic and applied research orientation classifications by country, percentages.

	Pure basic	Leaning towards basic	Equally basic and applied	Leaning towards applied	Pure applied	Total	n
Argentina	16	17	18	26	23	100	691
Australia	10	15	19	29	26	100	883
Brazil	16	18	18	28	20	100	366
Canada	17	18	20	23	22	100	861
China	2	15	53	26	4	100	2,299
Finland	20	19	20	20	21	100	430
Germany	16	20	19	23	22	100	802
Hong Kong	12	18	24	25	20	100	597
Italy	25	20	12	19	24	100	1191
Malaysia	5	18	46	23	8	100	626
Mexico	15	21	21	26	16	100	477
Netherlands	25	19	23	16	17	100	410
Norway	24	23	21	10	22	100	499
UK	17	17	24	29	13	100	637
USA	13	18	19	28	23	100	648
Total	14	18	27	24	17	100	11,417

Appendix 7-C. Basic and applied research orientation classifications, percentages within discipline of current academic unit

	Pure basic	Lean. toward s basic	Equally basic and applied	Lean. s toward applied	Pure applied	Total	n
Teacher training and education	7	12	32	29	19	100	677
Humanities	28	21	26	16	9	100	1,347
Social/behavioural sciences	19	19	24	23	16	100	1,127
Business and economics	8	15	31	28	18	100	980
Law	18	20	34	18	10	100	301
Life sciences	22	26	23	17	12	100	694
Physical sciences, mathematics, computer sciences	18	24	29	19	10	100	1,809
Engineering, architecture	3	13	32	32	21	100	1,667
Agriculture	4	8	23	31	35	100	305
Medical and health sciences	9	16	18	27	30	100	1,322
Other	8	15	33	24	20	100	334
Total	14	18	27	24	17	100	10,563