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**Airline Price Discrimination:
A Practice of Yield Management or Customer Profiling?**

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Abstract: Airline ticket prices frequently change, which is usually caused by yield management as price discrimination practice. Recently, buyers of online airline tickets tend to complain about price discrimination based on customer profiling, e.g. by means of cookie data. As cookie data and other directly or indirectly obtained customer information is easily available via the Internet, airlines may use this information to offer personalized ticket prices. In a month-long experiment, in which prices of airline tickets were tracked, we found that cookies were not used to determine prices. However, customer information from other direct sources seems to be important in dynamic pricing. Besides, it was discovered that most price changes occurred in the morning; these were usually minor price changes and were mostly seen at full-service carriers.

Keywords: *Customer profiling, dynamic pricing, price discrimination, yield management, online marketing, services marketing, e-commerce*

Track: *Tourism marketing*

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1. Introduction

Airlines are challenged to maximize sales and minimize inventory of perishable assets: flight seats. To achieve these objectives, dynamic pricing may be implemented, which is a form of price discrimination (Krugman, 2000). The goal of dynamic pricing is not particularly to attract more money from customers (McAfee and te Velde, 2006), but to allocate the right price to the right capacity (Kimes, Chase, Choi, Lee and Ngonzi, 1998). However, as ticket prices frequently change, and customers are increasingly aware of these changes, the question emerges what underlying practices influence dynamic pricing.

Yield management as basis of airline ticket pricing is a common practice among airlines leading to price discrimination and often to unfair price perceptions among customers. It deals with the trade-off between selling a ticket immediately but at a low price, or waiting for a customer willing to pay more money but with the implied risk that in the end the ticket will not be sold (Alderighi, Nicoli and Piga, 2012).

With the recent technology advances customer profiling practices are now a realistic option; due to increased access to customer information, customer profiling could result in price discrimination on even individual level. The role of direct information (e.g. profile registration) of customers on airline ticket prices has already been investigated and is often used to segment the market based on willingness-to-pay (Bailey, 1998). However, there is not yet evidence of even scientific research on indirectly obtained customer information (e.g. cookie data) that is used for the purpose of applying price discrimination to flight tickets.

In this research, two airline price discrimination practices are explored, with focus on the potential role of customer profiling and yield management as rationales of dynamic pricing. Therefore, in this research, the hypotheses that (1) *customer profiling affects airline ticket prices* and (2) *yield management affects airline ticket prices* are tested.

This article is structured as follows. In section 2, a literature review provides an explanation of the terms dynamic pricing, yield management and customer profiling. Subsequently, the research methodology and results of this experiment are presented. Last, the findings and limitations of this study and possibilities for future research are discussed.

2. Literature Review

2.1 The concept of dynamic pricing

Based on unpredictable demand, and its perishability of inventory, airlines are challenged to minimize inventory and maximize profit (Kimes, Chase, Choi, Lee and Ngonzi, 1998). One technique to achieve those goals is dynamic pricing, which allows charging prices based on segmentation and differences in willingness-to-pay (Klein and Loebbecke, 2000). Accordingly, companies are able to allocate resources and optimize occupancy through dynamic pricing (McAfee and te Velde, 2006).

Despite the appliance of dynamic pricing strategies by many airlines, information about its actual functioning is purposely withheld due to its highly competitive environment (Etzioni, Tuchinda, Knoblock and Yates, 2002). However, literature has extensively discussed dynamic pricing. Kimes, Chase, Choi, Lee and Ngonzi (1998) describe it as the process of “allocating the right price to the right capacity to the right customer at the right place at the right time” (p. 33). Reinartz (2002) refers to price customization, which is defined as “charging different prices to end customers based on a discriminatory variable” (p. 55). As the price of a relatively identical product differs, it would be interesting to understand the underlying practice of dynamic pricing.

2.2 Yield management as price discrimination practice

Yield management was first introduced in the airline industry and refers to “a broad set of techniques that are profitably used by companies as airlines and hotels, to implement a price discrimination policy when customers are heterogeneous, demand is uncertain and capacity is hardly modifiable” (Alderighi, Nicoli and Piga, 2012, p. 2). With yield management practices, airlines try to control prices and inventory, but also to improve service to its individual customers. Alderighi, Nicoli and Piga (2012) mention a capacity-driven approach, and inter-temporal price discrimination (based on heterogeneity of customers) as examples. Yield management practices have extensively been discussed in literature and based on a literature review various mediators have been identified.

First, an airline’s supply influences ticket prices as it is based on its capacity. Birtan and Caldentey (2003) mention flexibility and perishability as moderators within this category. Flexibility enables airlines to relate supply to forecasted demand. Perishability relates to the ability to preserve capacity over time and is defined as inventory, which is the number of seats unsold at a certain point in time. Second, airlines encounter a wide range of costs, which should be taken into account while determining prices. Fixed and variable costs (e.g. aircraft maintenance, crew costs, fuel and catering), individualization costs (i.e. booking and yield management systems), and shelf life costs (i.e. perishability) should be taken into account (Klein and Loebbecke, 2000). Third, competition may influence price, as the presence of low-cost carriers puts pressure on full service carriers (Mantin and Koo, 2009). A traditional distinction between business and leisure travelers seems to fade, whereas on short- and medium-haul destinations, a significant number of business passengers is willing to sacrifice certain services and thus chooses a low-cost carrier (Martinez-Garcia, Ferrer-Rosell and Coenders, 2012). The Internet has contributed to these movements, as the platform serves as a source of information about airlines, flights, and destinations; consequently, customer awareness on prices increases. Forth, a traveler’s itinerary influences a ticket price. Based on route length, different pricing patterns appear, whereas long-haul flights evidently decrease in price within the price metrics (Mantin and Gillen, 2011). Fares can also be influenced by route frequency and the percentage of fully booked flights (Malighetti, Paleari and Redondi, 2009). Last, demand may influence prices. In this sense, time before departure may be considered as moderator, about which contradicting opinions exist. Some authors believe that prices charged are higher when the departure date comes closer (Malighetti, Paleari and Redondi, 2009; Mantin and Koo, 2009), whereas others believe it shows a non-linear pattern (Anderson and Wilson, 2003; Mantin and Gillen, 2011)

2.3 Customer profiling as price discrimination practice

Dynamic pricing causes price changes over time, from customer to customer, and from various bundles of products and services (Kannan and Kopalle, 2001). To implement this practice, information about customers is crucial; a personalized offer can then be made (Klein and Loebbecke, 2000). The required information can be obtained via direct sources (e.g. consumer registration) or indirect sources. To collect the latter, cookie files can be valuable (Alreck and Settle, 2007; Berger, 2010). Bailey (1998) defines a cookie as “a “writable” file for the retailer on the consumer’s client. Any information can be stored there and that information can be retrieved at some time in the future by the same retailer (p. 15).”

Whereas information from direct sources is provided with the explicit consent of consumers, information without explicit consent of customers is retrieved via cookies or other electronic tracking tools (Dwyer, 2009). Recent research has clarified that indirect

information sources are used for marketing purpose, which is called behavioral targeting (Berger, 2010). Consumer's behavior is tracked via cookie data and consequently, advertisement or other services are customized based on this information. Behavioral tracking even uses customer information from electronic tools to get insight in a customer's search behavior and gives companies the opportunity to tailor pages, offers and prices meeting the customer's interest (Alreck and Settle, 2007; Bailey, 1998). Klein and Loebbecke (2000) call this concept of customer profiling "micro-segmentation", in which a company's offering on the web will automatically be differentiated based on electronic tracking tools. It allows companies to track searching and buying patterns to evaluate and forecast individual customer's values. Based on these interpretations, it is possible to offer individualized deals.

Correct application of these practices may provide competitive advantage to a company. However negative consequences may occur too. If companies charge differentiated prices to individual customers based on customer profiling, customers might feel betrayed when they are aware of the fact that they have paid another (higher) price than another customer. This however depends on the nature of the product; dynamic pricing of perishable goods is generally accepted, while dynamic pricing of nonperishable goods is not (Kannan and Kopalle, 2001).

Whereas prices of tickets frequently change, most customers may perceive these changes as a result of discriminative practices. Although literature has acknowledged the existence of customer profiling practices, there is not yet research evidence on the appliance of customer profiling as a basis for price discrimination in the airline industry. Online ticket sales and online customer information can provide a great database of customer information, which could be used by airlines to personalize prices.

3. Methodology

This study investigates the potential role of customer profiling on price dynamics in online airline ticket sales. Therefore, a distinction between two types of customers has been made. An existing, regularly returning customer known to the airline by means of cookie data and a new customer, who is unknown to the airline were distinguished. An experiment was executed by using two computers requesting ticket prices from four European airlines: two full-service (airline 1 and 2) and two low-cost carriers (airline 3 and 4). The two users were asking the price of itineraries by the four airlines, three times a day simultaneously on fixed times, for a period of one month. The computers were two identical notebooks simulating two different conditions. On one notebook, cookies were enabled and in principle any online behavioral tracking was possible. The other notebook was clean, and no behavioral tracking information was available for customer profiling practices. The clean notebook had a dynamic IP address and was programmed to perform an automatic reset every time it was switched off to erase any traceable tracking indications after each session. To make the comparison even more reliable, all search queries were executed simultaneously so that price variations between the two computers due to yield management would be impossible.

The initial intention was to check all four airlines for exactly the same itineraries, but some of the routes were not flown by all airlines. Departures were from Amsterdam Schiphol Airport (airline 1, 2 and 4) or Eindhoven Airport (airline 3). Destinations of airlines 1 and 2 included New York, Barcelona, Bali and Istanbul. Destinations of airline 3 consisted of Stockholm, Barcelona, Rome and Dublin. Destinations of airline 4 were Zakynthos, Barcelona, Luxor and Istanbul. These different itineraries did not affect the validity of the experiment to answer the first hypothesis, because the actual itinerary is not relevant to this research purpose.

Although it was not the primary intention, based on the chosen research methodology, it was possible to track price changes over time, which may occur due to yield management. By tracking prices during one month, it was possible to analyze a potential price pattern at three moments of the day (morning, afternoon and evening). Competition as mediator was investigated by analyzing pricing difference between the two types of carriers.

4. Results

4.1 Customer profiling as price discrimination practice

The first aim of the research was to find whether price discrimination of airlines was based on customer profiling due to obtaining information from cookie data or other user profiling methods. The results were manually registered into an Excel sheet that indicated no differences in the prices between both situations: the prices charged were identically the same at all sessions. With this result, the hypothesis that prices differ based on cookie data or other tracking tools, is not confirmed.

4.2 Yield management as price discrimination practice

Analysis of the data from the experiment provides insight in the role of competition as price mediator. More price changes have been found at the two full-service carriers than at the two low-costs carriers. Whereas the low-cost carriers (airline 3 and 4) count for only nine changes (13%) in total, the full-service carriers (airline 1 and 2) together count for 60 changes, which is 87% of all changes. While analyzing price dispersion, it was found that most price changes (52,17%) were between 0% and 5% and may be either a price decrease or increase. Within this category, most of the changes (75%) are between 0% and 1%, which means a minor change of a few euros or even eurocents. The second biggest category is responsible for price changes between 5% and 10%, which is 27,54% of all changes (19 out of 69). Changes within this category are mostly found between 5%-6% (42,11%). Furthermore, some outliers are identified, which are showed at airline 1 and 3. Airline 1 has implemented a compulsory cancellation option in the second week of the experiment, which cannot be switched off. This measure might be the reason for two exceptional high price increases on a ticket to Bali (37% and 46%). Airline 3 counts for an outlier on its Stockholm flight, which reflects a 40% price decrease in week 4.

As time before departure could not be investigated due to the length of the experiment, the moment on which a ticket was searched might cause price changes. In the experiment, during 18 days prices have been tracked at three moments a day: morning, afternoon and evening. Analysis of the number of changes shows that the majority of price fluctuations occur in the morning (UTC+1:00) at all airlines (39 out of 69 changes or 56,5%). Changes that occurred at the afternoon and in the evening counted for respectively 29% and 14,5%.

5. Discussion

In this research, customer profiling and yield management as price discrimination practices were investigated. The assumption of Kannan and Kopalle (2001) that prices are personalized through customer profiling is not confirmed in this particular case. Whereas airlines sell a large amount of their tickets via the Internet, customer information can easily be obtained via electronic tracking tools; this outcome was unexpected. On the other hand, price

discrimination based on customer profiling may harm the relationship between customer and airline. Airlines may be careful with applying such practices.

Based on the literature, however, it may be assumed that directly obtained customer information is used by airlines. Applying the moderator time before departure, airlines may use directly obtained information to segment the market into price sensitive and price insensitive travelers (Anderson and Wilson, 2003; Mantin and Gillen, 2011).

Competitive pressure may influence full-service carriers in their pricing mechanisms (Mantin and Koo, 2009). Therefore they seem to integrate yield management practices to charge different prices to different customers. As full-service carriers segment their market in both business travelers and leisure travelers, they are able to target both markets when they apply a dynamic pricing system (Anderson and Wilson, 2003). However, the distinction between the business and leisure segment appears to fade, especially on short- and long-haul flights, as business travelers are willing to sacrifice certain services and increasingly start to make use of low-cost carriers (Martinez-Garcia, Ferrer-Rosell and Coender, 2012).

Due to the Internet, customers become more aware of price changes and may be unsatisfied, as they cannot rely on stable prices. Therefore, it would be an option to airlines “to educate customers about the need for dynamic pricing: inventory clearance sales in the Internet domain, over a short time horizon, may result in dynamic prices for items” (Kannan and Kopalle, 2001, p. 79). Consequently, limited transparency about dynamic pricing might positively adjust customer’s expectations. However airlines should be careful with the extent of information transparency, since pricing seems to be a source of competitive advantage (Etzioni, Tuchinda, Knoblock and Yates, 2002).

This study provided some insights into the practice of dynamic pricing of airlines. The conditions contributed to the validity of the outcome that in this case customer profiling has not been used to price discriminate; however not all mediators of yield management could be tested. Therefore, there are several limitations, as well as suggestions for future research. First, the study only used four of the many airlines that exist in the aviation industry. The tested airlines were all European. Other airlines both within and outside Europe were not considered. They might have another approach towards pricing strategies. Second, only a limited sample of destinations was considered within this research. The results are based on the prices of tickets to these destinations, but leave other destinations disregarded. Third, prices were only studied on working days, and may be different than during the weekend. Fourth, this experiment was executed for only one month, in which time before departure is four months in the future. This characteristic limits the ability to analyze the possibility of segmentation based on time before departure.

Future research should take these limitations into account. First, extending the number of airlines and destinations may be valuable. Destinations might also act as a moderator. Non-direct flights might be investigated, since these are influenced by potential charges and prices of these related flight tickets could fluctuate. Furthermore, the moderator time before departure can be tested more extensively, as a contradicting opinion exists of the role of this moderator. Last, future researchers could investigate if price differences are based on computer operating systems, i.e. Windows and Apple Macintosh. Companies may assume that Apple users may have a higher budget and may charge them higher prices.

6. References

Alderighi, M., Nicolini, M. & Piga, C. (2012). Combined effects of load factors and booking time on fares: Insights from the yield management of a low-cost airline (No. 171). *University of Pavia, department of economics and quantitative methods*. Retrieved from <http://econpapers.repec.org/paper/pavwpaper/171.htm>.

- Alreck, P. L. & Settle, R. B. (2007). Consumer reactions to online behavioural tracking and targeting. *Journal of Database Marketing & Customer Strategy Management*, 15(1), 11-23.
- Anderson, C. K. & Wilson, J. G. (2003). Wait or buy? The strategic consumer: Pricing and profit implications. *Journal of the Operational Research Society*, 54(3), 299-306.
- Bailey, J. P. (1998). Internet price discrimination: Self-regulation, public policy, and global electronic commerce. *Proceedings of the Twenty-Sixth Annual Telecommunications Policy Research Conference*, 1-31.
- Berger, D. (2011). Balancing consumer privacy with behavioral targeting. *Santa Clara Computer and High Technology Law Journal*, 27(1), 3-61.
- Dwyer, C. (2009). Behavioral targeting: A case study of consumer tracking on levis.com. *Proceedings of the Fifteenth Americas Conference on Information Systems*, 1-10.
- Etzioni, O., Tuchinda, R., Knoblock, C. A. & Yates, A. (2003). To buy or not to buy: mining airfare data to minimize ticket purchase price. *Proceedings of the ninth ACM SIGKDD International conference on Knowledge discovery and data mining*, 119-128.
- Kannan, P. K., & Kopalle, P. K. (2001). Dynamic pricing on the Internet: importance and implications for consumer behavior. *International Journal of Electronic Commerce*, 5(3), 63-83
- Kimes, S. E., Chase, R. B., Choi, S., Lee, P. Y. & Ngonzi, E. N. (1998). Restaurant Revenue Management Applying Yield Management to the Restaurant Industry. *Cornell Hotel and Restaurant Administration Quarterly*, 39(3), 32-39
- Klein, S. & Loebbecke, C. (2000). The transformation of pricing models on the web: examples from the airline industry. *Proceedings from the 13th International Bled Electronic Commerce Conference*, 19-21.
- Krugman, P. (2000, October 4). Reckonings; What price fairness? The New York Times. Retrieved from <http://www.nytimes.com/2000/10/04/opinion/reckonings-what-price-fairness.html>
- Malighetti, P., Paleari, S. & Redondi, R. (2009). Pricing strategies of low-cost airlines: The Ryanair case study. *Journal of Air Transport Management*, 15(4), 195-203
- Mantin, B. & Gillen, D. (2011). The hidden information content of price movements. *European Journal of Operational Research*, 211(2), 385-393
- Mantin, B. & Koo, B. (2009). Dynamic price dispersion in airline markets. *Transportation Research Part E: Logistics and Transportation Review*, 45(6), 1020-1029
- Martinez-Garcia, E., Ferrer-Rosell, B. & Coenders, G. (2012). Profile of business and leisure travelers on low cost carriers in Europe. *Journal of Air Transport Management*, 20, 12-14
- McAfee, R. P. & Te Velde, V. (2006). Dynamic pricing in the airline industry. Working paper. *California Institute of Technology*, Pasadena, CA. Retrieved from www.vita.mcafee.cc
- Reinartz, W. (2002). Customizing prices in online markets. *SYMPHONYA Emerging Issues in Management*, (1), 55-65
- Zhao, W. & Zheng, Y. S. (2000). Optimal dynamic pricing for perishable assets with nonhomogeneous demand. *Management Science*, 46(3), 375-388