# The Applicability of the Economic Theory of Product Differentiation to the Airline Business

## *- Examples from Europe -*

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**Abstract:**

This paper investigates the applicability and the implications of the economic theory of product differentiation to the airline business. While the aim is not to look for *the* model of product differentiation, I will try to point out what models can be used for what and under which circumstances they can be used. Thus, while keeping the industry constant I will go through different models and analyse their applicability. Focus is on passenger transport and on European carriers. My findings are that the economic theory of product differentiation can provide explanations and reasoning for many developments that have taken place in the airline business, such as the emergence of low cost carriers (LCCs), airport choice of airlines and LCC business models that depart from the business models of LCCs like Southwest and Ryanair. Hence, it should also be possible to make predictions about the future development of the airline industry using the theory of product differentiation.

# 1. Introduction

For a long time in its history the airline business was a highly regulated and nationalised industry. Almost every country had its respective carrier (or flag carrier), markets were sealed off, competition was limited and effectively non-existent. International flights were regulated through restrictive cabotage rights. Each flag carrier enjoyed a comfortable monopoly position within its market. In the 1990s the European aviation market was liberalised, which was somewhat later than the liberalisation process in the US which took place in the 1980s. Liberalisation in the EU came in three packages, 1987, 1990 and 1992. The third stage was certainly the most significant, because it meant the removal of licensing restrictions, the freedom of setting prices and the introduction of unrestricted cabotage rights. What however followed was to a lesser degree the introduction of competition among flag carriers, yet more the introduction of a new business model, that of Low Cost Carriers (LCCs).

Since the rise of LCCs the airline industry has undergone profound changes. Competition had already increased through the liberalisation efforts, mainly in the US- and EU-markets, and LCCs have especially put short-haul markets under severe pressure. The issue of the correct business model has become increasingly important. Consolidation has taken place everywhere. Especially the flag carriers had to adapt their way of doing business and were in a need to cut down costs. It can also be seen that not all LCCs are the same. Some have departed from the models of LCCs of the first days, like Ryanair and Southwest, and adopted a different approach. There is an increasing and ongoing debate over what a LCC really is and what the airline industry will evolve into. Recently, even the first long-haul flight of a LCC could be seen and although it remains an open question weather this will persist and find followers, it has certainly the potential to change the shape of the industry. Economic theory can provide explanations and reasoning for the entry of LCCs and thus, it should (theoretically) also be able to provide justified predictions about the future of the airline business.

Industrial economics offers a broad set tools and (sometimes competing) theories for analysing an industry and explaining market structure. I believe that there is widespread recognition that the airline industry has an oligopolistic market structure. Taking two main subjects of oligopoly theory, price discrimination and product differentiation, it can be seen that, while the issue of price discrimination has been dealt with (Botimer and Belobaba, 1999; Giaume and Guillou, 2004; Gillen and Hazledine, 2006), the issue of product differentiation in the airline business has been neglected to some extent. In Shaw (2004, chapter 5) and Klaas and Klein (2005) the issue is dealt with, but these authors used a marketing and business orientated approach, based on the tools from strategic management. For example, the latter two authors used Porter's (1980, 1985) generic business-level strategies, which claims that differentiation and cost-leadership are generally inconsistent. Yet, Hill (1988) has provided a framework that shows that they can be consistent and even generate competitive advantage.

Product differentiation is one of the defining characteristics of many types of market structure and the understanding of it is essential if one wishes to understand how modern markets work. Product differentiation can be found everywhere. In every shop or supermarkets a range of different products can be found that entice consumers who have differences in tastes and in willingness to pay. There is no single, homogenous brand of detergent, car, mobile phone or soft drink. Shops and supermarkets themselves are also differentiated. Either in terms of shop design

and layout or with respect to geographic location. They may, for example, be located on the high-street or on the outskirts of a city. Chamberlin, who developed the theory of monopolistic competition, wrote in his book (1933, p. 57):

*"[...] it is evident that virtually all products are differentiated, at least slightly, and that over a wide range of economic activity, differentiation is of considerable importance."*

The aim of this paper, which is an abridged version of my diploma thesis, is to apply economic models of product differentiation to the airline business. A lot of models have been developed for horizontal product differentiation. Vertical product differentiation on the other hand received less attention. Models that combine the likely and empirically relevant case of an industry where vertical and horizontal product differentiation is present are even rarer to find. While the aim is not to look for *the* model of product differentiation, I will try to point out what the models can be used for and under what circumstances. I will also try to find out what the economic theory of product differentiation can say about the future development of airline industry. Thus, while keeping the industry constant I will go through different models and analyse their applicability. As industry I will focus on passenger transport only. That means that I will not look at the cargo market, nor at the fringe businesses of airlines, such as car rental or hotel room reservation.

This paper will first give a comprehensive literature review on the economic theory of product differentiation. The third section will present the actual parameters with which airlines are generally able to differentiate their product. The subsequent section will synthesise the economic theory and the airline business. In the fifth section the theory will be combined with the airline industry and it will be shown how the models can be applied. The final section will give an outlook and a summary.

## 2. Literature Review

Lipczynski et al (2005) describe product differentiation as the ability of producers to create distinctions, either physical or psychological in nature, between goods that are close substitutes to each other. Product differentiation can be a measure of non-price competition or establishing barriers to entry. In the terminology of Lancaster (1979), two main types of product differentiation can be distinguished: vertical and horizontal product differentiation. The former refers to a situation in which one product differs in overall quality from all other products in the market (i.e. individuals have a clear ranking over which products to choose if the price were the same for all products). The latter, horizontal differentiation, refers to a situation where the products in a market are of same or similar overall quality, but suppliers offer slightly different attributes embodied in their products. Models of product differentiation can be divided into models of horizontal and vertical product differentiation. Models that combine horizontal and vertical differentiation have also been developed (for an overview see Beath and Katsoulacos, 1991; Waterson, 1994). Figure 1 below gives a breakdown of the different models of product differentiation. Most models of product differentiation are two stage games, where in the first stage firms choose their products and in the second stage they compete in prices. The problem with most models is that there are existence problems concerning the equilibrium in prices, i.e. not always an equilibrium is achieved.

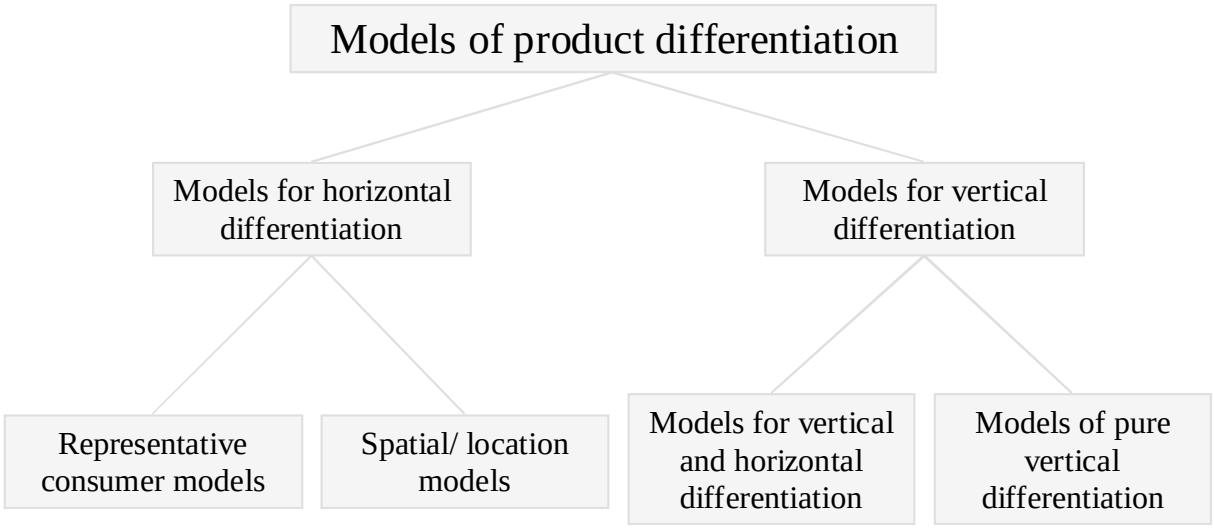


**Figure 1**

**Breakdown of models of product differentiation**

Models of horizontal product differentiation are quite well developed and can be divided into representative consumer models and spatial or location models[1] (Hotelling, 1929; Salop, 1979; Lancaster, 1966). The representative consumer model is essentially the neo-classical model of monopolistic competition developed by Chamberlin (1933) and Robinson (1933, 1934). In such models each firm has a continuous demand function of its own price and the responses of competing firms depend on the cross-price elasticity of demand between different products. In spatial models products are defined by the characteristics and attributes they embody and firms may have discontinuous demand functions for their products. The name spatial model comes from the fact that these models were originally developed in the context of regional economics. They were then applied to product differentiation. Instead of a geographic space there is a characteristics or attribute space where products are located. Instead of transportation costs, there are costs for the mismatch of the most preferred characteristic and the available options. Capozza and van Order (1982) combined these two approaches and identified their similarities and differences. Besides, Cremer and Thisse (1991) point out that under certain conditions models of horizontal product differentiation are nothing else that special cases of vertical differentiation.

The model by Hotelling (1929) is based on a linear street. Consumers are evenly distributed along that street and two producers choose to locate themselves on that street. The consumers face the price for product, which they buy from one of the firms, and the transportation costs for travelling to that firm. In the terminology of product characteristics, the transport costs are viewed as foregone utility, because the firms product characteristics differ from what the consumer actually prefers. Thus, firms compete in prices and location. In the classical model by Hotelling (1929), prices are exogenous and location is endogenous. In this case firms cluster in the middle of the street, which is also called minimum product differentiation (Boulding, 1966). In the case of endogenous prices and fixed locations the price setting is largely influenced by the substitutability among the products.

[1] Sometimes they are also referred to as address or characteristics models. I will continue however using the notion of spatial models.

Models for endogenous prices and locations have also been developed. One idea came from Salop (1979) how considered a circular street. Here, the main advantage is that the street has no ending and no beginning and thus, an equilibrium can be reached in the number of firms, which was also seen as fixed in the original model by Hotelling (1929). The number of firms is determined by the level of fixed set-up costs, the size of the market and transportation costs. The trade-off that solves the problem of the number of firms is the fundamental, classical trade-off known from spatial economics between increasing returns to scale and transportation costs, that goes back to Kaldor (1935) and Lösch (1940) (see also Fujita and Thisse, 2002, chapter 4). Because of the presence of positive fixed costs, the number of firms that can enter is limited, and Phlips and Thisse (1982) speak in this context of bounded differentiation. However, unlike the model of monopolistic competition, the equilibrium price goes up as the number of firms increases. They are able to do this, because as the number of firms increases, the available products in the market place are closer aligned to the idiosyncratic preferences of each consumer. Hence, firms only compete with their direct neighbours no matter how many firms are actually in the market.

Furthermore, Hotelling-type models have the problem that it is unclear whether firms really cluster in the centre of the street or whether they seek maximum differentiation. For example, the assumption on the functional form of the transportation costs has an impact on the outcome. They were assumed to be linear by Hotelling (1929), but once quadratic transportation costs are assumed firms seek maximum differentiation from each other. This problem has been analysed by Eaton and Lipsey (1975), Shaked (1975), d' Aspremont et al (1979), Economides (1984), de Palma et al (1985) and Neven (1985). General conclusion is, that bunching or clustering of firms is only a special case and not a common outcome. Clustering may however exist and be persistent when there are information costs or preferences, respectively consumers, are clustered, either in geographic or in characteristics space.

Lancaster (1966) has developed a model of horizontal product differentiation that is based on the assumption that products can be viewed as bundles of characteristics they embody and consumers seek to maximise the utility they derive from these characteristics. The model is not really a model of product differentiation in the way of the Hotelling or Salop model. It is rather a new theory or new approach to model consumer behaviour. Lancaster criticises the traditional theory of consumer behaviour by saying "[...] that the determinateness of the sign of the substitution effect (the only substantive result of the theory of consumer behaviour) could be derived form the proposition that goods are goods" (1966, p. 132). With this he wants to say that goods are traditionally viewed as intangible and "simply that what consumer want more of" (1966, p. 132). He also states that the traditional theory has few things to say on the intrinsic properties of goods, on new goods and on variations in quality. According to him such a theory has no predictive value. Lancaster proposes a new approach to consumer behaviour, which he also revised and completed in later workings (1971, 1979). There are a number of implications that can be drawn from the Lancaster model, which Archibald and Rosenbluth have presented in their paper (1975). Following the argumentation of the Lancaster model through, for each firm a discontinuous demand function can be derived. The demand function will become more continuous the more rays (i.e. the more products are offered) there are and the flatter the indifference curves (i.e. the higher the substitutability among the products) are, since small price changes causes switching to other brands. If the demand functions become more continuous, the implications of the Lancaster model come very close to that of the model of monopolistic competition. Strong

product differentiation is indicated by rays that are far apart from each other and thus, cross-price elasticities are very high. Hendler (1975) has criticised Lancaster's approach for its assumption of non-negative marginal utility and that the consumers real objective was to maximise utility, not the amount of characteristics as such. He also states that the combination of goods to consume a certain level of characteristics might only be possible in very few cases and that the "mixability" (p. 197) of goods is not a generally valid appearance. He finally states that the Lancaster model is "[...] an interesting and important special case of consumer choice rather than a general model of consumer demand" (p. 199).

Up until now the examined models dealt with the issue of horizontal product differentiation. As a reminder: this means that there was no clear ranking over which product to choose among all consumers in a market if prices for all products were the same. Vertical product differentiation on the other hand refers to a situation where consumers have a clear ranking over which product to choose if prices for all products were the same. It can also be said that products are purely vertically differentiated if they differ in quality and are purely horizontally differentiated if the have the same overall quality and differ only in certain attributes and characteristics. Or put in another way: in horizontal models consumers are differentiated by their preferences (location) and differentiated by income and willingness to pay for quality in models of pure vertical differentiation. Wied-Nebbeling (2004) depicts the situation of vertical differentiation by a vertical street[2] and builds up a model based on the principles form the Hotelling model. Gabszewicz and Thisse (1986, their figure 2) depict vertical differentiation as a horizontal street where the two firms are located outside the interval in which the consumers reside. Thus, there is only one firm that is closest to all consumers. If prices and transportation costs are the same for all firms and consumers have an "unanimous agreement" (Gabszewicz and Thisse, 1986, p. 161) over which product to choose and only one firms serves the entire market. Despite this "unanimous agreement", consumers have different tastes. This time it refers to the willingness to pay for quality, so that some consumers are willing to pay more for a high quality product and others are not. The dependency is also on income and income distribution among consumers. Some will have to buy a low quality product, because they cannot afford products with higher quality. The role of income in vertically differentiated markets was first analysed in the paper by Gabszewicz and Thisse (1979). Other general models of vertical product differentiation can be found in Tirole (1989) and Church and Ware (2000), while the latter based their model on the former. The general outcome of these models is that firms seek maximum differentiation from each other, so that, in the case of two firms (which is generally considered), there is one high- and one low-quality product. One condition is that consumer incomes must be sufficiently distributed and the market must be covered by the firms. An interesting extension to the model of pure vertical differentiation is the finiteness property. Shaked and Sutton (1982) developed a multi-stage game where firms would first choose to enter or not, then choose qualities and finally compete in prices. In this model they show that there is an upper bound to the number of firms that enter the market. This result, however, was achieved by assuming zero production costs and assuming a particular income distribution. In a later paper, Shaked and Sutton (1983) have introduced quality-dependent production costs and present thus a more realistic model. They show that the upper bound in the number of firms, which they call the "finiteness property", is persistent through the interplay of the willingness to pay for quality and change in average variable quality-dependent costs. These costs may only rise disproportionately with quality.

[2] See also Figure 2 in this paper.

Under these conditions, even as the market size increases without bound or fixed set-up costs decline, there still exists an upper bound to the number of firms. A market characterised by these features is labelled as a "natural oligopoly". This is a clear distinction to models of horizontal product differentiation where the number of firms increased with increasing market size. The model does, however, still assume a uniform income distribution. Here, Wauthy (1996) shows that heterogeneity in income distribution does matter and so does the assumption of market coverage. If consumers incomes are concentrated, the quality differential will be greater. A broad dispersion will yield a situation in which the market is not covered. Boccard and Wauthy (1999) show that, when firms are able to commit to quantities (i.e. a Cournot game is played), firms have an incentive towards less vertical differentiation. In their comment on the model of vertical product differentiation Choi and Shin (1992) have added that, if the market is not covered by the firms, "[...] the lower quality firm chooses a quality which is exactly 4/7 of that of the higher quality firm, while its price is 2/7 of the price of the higher quality firm" (p. 229). The issue of entry and exit in markets with pure vertical product differentiation was considered by Gabszewicz and Thisse (1980) and Donnenfeld and Weber (1992). Lutz (1997) has additionally highlighted the role of entry deterrence. Vertical product differentiation is a somewhat special and isolated, yet very interesting, case of product differentiation. The basic model and the extensions show, that in markets where the only source of product differentiation is of vertical nature, there will be less products on offer (compared to horizontal differentiation) and there will be maximum differentiation among the products. The proposition of the natural oligopolies is a very interesting one, but also one that has to be treated carefully, since the estimation of quality-dependent costs might prove to be difficult. Sutton (1986) points out that the utility function is defined in such a way that willingness to pay increases with income and that the finiteness property may well fail to exist when quality dependent costs "increase steeply enough" (p. 395) with quality. The reason for this is straightforward: When it is only disproportionately more costly to produce a higher quality and there is demand and a strict preference for a high-quality product, it will always be profitable to produce the high-quality product. Sutton also points out that once products are allowed to be differentiated in vertical *and* horizontal attributes the finiteness property is also going to break down, since an entrant could easily choose one quality class and then differentiate horizontally (that is, only if market size and fixed set-up costs allow this). Hence, the next logical step is to consider models that are able to encompass both, vertical and horizontal attributes.

In such models consumer utility depends on horizontal attributes *and* vertical attributes. A general utility function can be given by:

$$U_{ji} = \omega_i + Y_j \varphi_i - \lambda\left(a_j - b_i\right) - p_i .$$

Where the utility $U$ of consumer $j$ buying product $i$ is defined by: the basic willingness to pay for the product $\omega_i$, his willingness to pay for quality $Y_j$, the quality of the product $\varphi_i$, the transportation costs $\lambda$, the difference of the consumers preferred horizontal attribute $a_j$, the products horizontal attribute $b_i$ and the price of the product $p_i$. Every product can thus be represented by the two attributes $\varphi_i$ and $b_i$. One feature of the specification of such a utility function is the independence of both attributes. Furthermore, transportation costs or (horizontal) preference mismatch is linear and could also be specified to be quadratic, i.e. $\left(a_j - b_i\right)^2$. The interesting question is how firms will differentiate their products in terms of both, the vertical and the horizontal dimension. Neven and Thisse (1990), Economides (1989, 1993), Vandenbosch and Weinberg (1995) and Degryse (1996) show

in their papers that products are either maximal differentiated with respect to their vertical attribute and minimal with respect to their horizontal attribute, or vice versa, which is also called the "min-max principle". The outcome depends on the intensity of preferences in one dimension relative to the other. Thus, if the preference for the vertical attribute is strong enough, relative to the horizontal attribute, there will be maximum vertical and minimum horizontal product differentiation. This is also in line with the findings of Ansari et al (1998), who considered two- and three-dimensional, horizontal product differentiation using the Hotelling model. They found that there may be multiple equilibria yielding maximum differentiation in only one, two or all three dimensions, which again depends on the consumers preference intensity. Hence, it seems, that there may be also maximum vertical and horizontal differentiation simultaneously as long as the preferences for both dimensions are strong enough. Shaked and Sutton (1987) have reconsidered their finiteness property in the light of a two dimensional model. They show that a weak finiteness property may well exists even when firms are allowed to differentiate in a vertical and horizontal dimension. The mechanism would be that not the level of fixed costs relative to market size determines market concentration, but the deliberate sinking of additional fixed costs, which shifts the technology frontier upwards. Or in Sutton's own words: *"If it is possible to enhance consumers willingness to pay for a given product to some minimal degree by way a proportionate increase in fixed costs (with either no or only a small increase in unit variable costs), then the industry will not converge to a fragmented structure, however large the market becomes"* (1991, p. 47; see also the review article by Bresnahan, 1992, p. 142). Another interesting, two dimensional model for product differentiation has been developed by Launhardt (1885). This model is essentially a predecessor of the Hotelling duopoly game described before. Since Launhardt analysed 'classic' location theoretic problems, that is, he considered location of firms in geographic space, he examined a case where firms had access to different transportation technologies. Thus, the transportation costs (or costs of preference mismatch) are allowed to be different among firms. Ferreira and Thisse (1996) show that by using this framework, horizontal and vertical characteristics can be modelled. In such a framework the location of the firm would represent the horizontal dimension and the (now) variable rate of transportation costs would represent the vertical dimension. Ferreira and Thisse (1996) analyse the price setting of the firms and investigate the outcome when firms are allowed to set their transportation costs strategically. They affirm the min-max principle and show that there is minimum vertical differentiation when firms are located near the opposite ends of the street and that there is maximum vertical differentiation when firms are located near the centre. Although the approach by Ferreira and Thisse (1996) is very innovate and attractive, it has do deal with the known problems of the Hotelling framework, i.e. the non-existence of equilibrium for some locations. The greatest drawback is however, that the model does not include income or willingness to pay for quality. If that was added, there might eventually be a strict preference for the high-quality good that provides the firms with an incentive to engage in maximum differentiation in the vertical dimension (an extended review of the Launhardt model will be provided in Appendix A).

Research in the field of product differentiation has also focused on the welfare effects of product differentiation (Lancaster, 1975; Spence, 1976; Dixit and Stiglitz, 1977; Carlton and Perloff, 2005) and on the effects of international trade on and from product differentiation (Krugman, 1980; Helpman, 1981; Schmitt, 1995; Bernhofen, 2001; Clarke and Collie, 2003; Beath and Katsoulacos, 1991, chapter 9). The results on the welfare effects of product differentiation are very mixed. Product differentiation can either lead

to excess differentiation or to too less differentiation and an optimum is achieved only by coincidence.

There has also been work conducted on the relationship between imperfect information and product differentiation, which was conducted by Stahl (1982), Wolinsky (1984) and Ireland (1985). The issue is also adumbrated in a book by Lancaster (1979) and a paper by Perloff and Salop (1985).

Product differentiation also immediately raises the issue of multi-product firms. Firms may have incentives to produce two or more goods simultaneously if economies of scope are present, demand can be increased due to increased product variety and firms might use product differentiation for strategic purposes, for example as an entry deterrence strategy. Workings by Panzar and Willig (1981), Bailey and Friedlaender (1982) and Baumol at al (1982) emphasise that even in the absence of economies of scope, firms might produce several products if consumers have a demand for variety and a higher willingness to pay for that variety or have diverse preferences. It is also highlighted, that the incentive for one firm to produce several products is lowered by the presence of economies of scale, yet strengthened by the presence of economies of scope and that product differentiation can be a strategic substitute if perfect price discrimination is not possible. Phlips and Thisse (1982) point out that a firm can extract surplus by offering several products and it is visible in practice when firms offer products in bundles or packages. An excellent survey on multi-product firms in relation with product differentiation has also been published by Mañez and Waterson (2001). Here, the models developed by Katz (1984), Gilbert and Matutes (1993) and Canoy and Peitz (1997) are of particular interest, since they put the issue of multi-product firms in the context of two-dimensional (horizontal and vertical) models for product differentiation.

Latest research has also pushed forward the introduction of discrete choice models in the context of product differentiation. Anderson et al (1989, 1992) and Berry (1994) are among those who have pioneered this development. In a nutshell, these models observe consumer choice and make, through econometric methods, inference about consumer demands for different attributes. Utility is viewed as a random variable and hence, such models are stochastic models. Furthermore, they are able to incorporate horizontal and vertical models of product differentiation as well as spatial and representative models.

## 3. The Parameters of Differentiation for Airlines

Now that the theoretical background is developed the question must be asked, how airlines are principally able to differentiate their products and what the characteristics of a typical airline product are. This is essential, since only if the actual choice parameters are known, the models of product differentiation can be applied.

The first difference that comes into mind is certainly the distinction between Low Cost Carriers (LCCs) and Full Service Airlines (FSAs). The latter are also called flag carriers or network carriers, yet, will be called FSAs throughout. The FSAs were the incumbent airlines prior to the liberalisation process in many countries. Although some airlines operated a linear network structure, the dominant choice was that of a hub-and-spoke network structure. This ensured broad geographical coverage with many frequent flights to a large number of destinations. Adding one 'spoke' to the network creates a large number of new connections. Additionally, the FSAs offered a high service level, including high frequency of flights, a large number of destinations (including all destination through code sharing and alliances), a high level of airport services (such as airport lounges), a large number of check in counters at the airports, location of the

airports (close to bigger cities), a high level on-board service (free meals and on-board entertainment, high seating comfort (including seat pitch and width of the seats), two or three class aircraft configuration (with differing levels of on-board and airport services and seating comfort), availability of last minute check-in, punctuality[3], availability of frequent flyer programmes, availability of fully flexible tickets, no limits to weight of baggage to check-in for free, cleanliness of the cabin, friendliness of staff on-board and also at the airport, highly qualified on-board staff (e.g. multi-lingual flight attendants) and also a higher ratio of cabin crew to number of passengers.

LCCs on the other hand operate out of a point-to-point structure with a clear focus on value based passengers. The LCCs can achieve a much lower cost base and thereby are able to offer much lower fares by decreasing the complexity that the FSA model has inherent. The biggest advantage of LCCs is that they have a homogenous fleet, mainly B-737- and A320-type aircraft. Furthermore, LCCs have outsourced a lot of activities. They are also mainly low cost, because they are offering a much lower service level. LCCs have generally lower frequency of flights, a limited number of destinations (no code sharing or alliances), a standard level of airport services, a minimum number of check in counters at the airports, inconvenient location of the airports (generally at big distances to bigger cities), a low level of on-board service (no free meals and no on-board entertainment), low seating comfort, single class aircraft configuration, no availability of last minute check-in, limited availability of frequent flyer programmes (if any), no flexible tickets, strict restrictions on limits to weight and number of baggage to check-in for free, low qualified on-board staff and a minimum ratio of cabin crew to passengers. A good survey of LCC and FSA product characteristics can also be found in Lawton (2001, pp. 38f).

The above dealt mainly with the service level. Another important source for product differentiation is that of route selection. While FSAs may offer a broad geographic coverage, the LCCs are also increasingly filling gaps in the geographic space. In the past, LCCs have not primarily engaged the FSAs directly on their routes, but have created new routes. In many cases these new routes might have been more or less good substitutes for established ones, for example, for some passengers the Frankfurt Hahn - London Stansted route is a more or less good substitute for the Frankfurt - Heathrow route. In other cases a LCC route might even be more sensible compared to a FSA route that would involve transferring. For example, while it is possible to fly with Lufthansa from Bremen to London, this route always involves changing planes at Frankfurt. A LCC will fly directly to London Luton or London Stansted airports, for example, resulting in a reduced travel time[4]. It can also be seen that LCCs are not or very rarely engaging in direct competition with each other. In the German low cost market for example, only six per cent of all LCC routes are operated by two LCCs. Only on two out of 426 routes three LCCs are operating (DLR, 2006). When comparing the routes of Ryanair and easyJet there are, except for a very few tourist destinations (e.g. Palma Mallorca and Rome - Madrid), no routes these two carriers would operate at the same time. EasyJet has in 2004 competed directly with Ryanair on the London Gatwick - Cork route and two other connections to Ireland, yet easyJet withdrew from these routes in summer 2006.

This leads to the conclusion that a very important source of product differentiation comes in the form of

[3] Although, very often, FSAs have worse punctuality records than LCCs, which is partly because they fly from uncongested airport have no transferring passengers.

[4] This is because Bremen is much closer to London than Frankfurt and flying via Frankfurt would constitute a considerable detour.

route differentiation. This seems to hold especially among LCCs, yet also to some extent among LCCs and FSAs. Even if two (or more) LCCs operated the same route they would still have the opportunity to engage in differentiation by departure time (that is assuming that service levels are considered the same, which would be an additional source of differentiation). On the Rome - Madrid route, for example, which is operated by Ryanair and easyJet, Ryanair departs from Madrid at 16:10, easyJet at 7:30. From Rome Ryanair departs at 13:10, easyJet at 10:25. Both airlines fly once a day. It seems to be reasonable for LCCs to differentiate their departure times as good as possible since they have little else to differentiate when they operate the same route and when they offer a similar overall service level.

LCCs also try to operate out of new and different airports and thus, the airport choice is a variable of product differentiation, too. The most notorious example of a LCC seeking new opportunities in airports in Europe is certainly Ryanair.

Ryanair looks predominately at costs and tends to choose very remote airports. At the same time they also choose airports which are close to bigger agglomerations, and which have an airport themselves. Frankfurt Hahn might not be the best example as it is 140 kilometres away from Frankfurt. Better examples are London Stansted airport, Ryanair's main base with 88 destinations, 40 km from London's city centre, Brussels Charleroi airport (21 destinations, 46 km from Brussels), Hamburg-Lübeck airport, (6 destinations, 65 km from Hamburg), Bratislava airport (5 destinations 69 km from Vienna), Girona airport (38 destination, 85 km from Barcelona) and Eindhoven airport (7 destinations, 120 km from Amsterdam). Ryanair also pushes the airport to high turnaround times, which is necessary to maintain a low cost base for Ryanair. This is another reason why Ryanair seeks for remote airports, since they are generally not congested and can guarantee short turnaround times and also short taxiway times, which is yet another criteria for Ryanair. Utilisation of their own aircraft is another factor which Ryanair carefully considers in its airport choice and the airline is everything but reluctant to withdraw from routes should they turn out being not profitable, which was the case for example with flights from Erfurt, Groningen and Klagenfurt.

Ryanair might be an extreme example of a LCC regarding airport choice, the main demands for other LCCs are nonetheless, not that different. As Barrett (2004) points out, uncongested, main airports in big agglomerations have an incentive to welcome LCCs, since they can be easily added to the existing operations. They impose only little extra complexity to the airport operations, because they fly only point-to-point journeys, have no interlining passengers and usually less baggage to handle. They can warrant quick turnaround times and offer usually reduced landing charges.

There are also differences in terms of the business model of LCCs and FSAs and there is also an irrefutable tendency towards airlines that depart from the "typical" LCC business model and increase their overall level quality, frequency of flights and fly increasingly out of bigger cities. Air Berlin could be considered an airline with such a hybrid business model and an intermediate quality level. Henceforth, carriers with a high overall quality are called FSAs, carriers with an intermediate quality level are called Hybrid carriers (HCs) and all airlines with a low overall quality level will be called LCCs. The tables below show price differences and frequencies of selected European carriers. It can be seen that there are a lot of differences among LCCs.

**Table 1 Average prices of selected European airlines in 2006**

| Carrier | Average ticket price in Euros[5] |
|---|---|
| British Airways | 279.43 |
| Lufthansa | 253.34 |
| Air Berlin[6] | 73.99 |
| easyJet | 66.17 |
| Ryanair | 41.19 |

*Source*: own calculations based on annual reports of the airlines

**Table 2 Frequencies of selected carriers**

| Carrier | Average frequency per route and day[7] |
|---|---|
| DBA | 2.8 |
| Air Berlin[8] | 1.7 |
| Ryanair | 1.2 |
| easyJet | 1.2 |
| Germanwings | 1.1 |
| HLX | 0.8 |

*Source*: own calculations based on statistics by DLR (2006)

## 4. Synthesising a Framework

Since it is the aim of this thesis to show what the economic theory of product differentiation can contribute to the discussion, it will be necessary to develop a framework and to built a bridge between the economic theory of product differentiation and the airline industry. Now that we have both, the theoretic background and an overview of the actual differentiation parameters, it is possible to classify and connect these parameters with the theory. The actual application of the theory to the parameters will be carried out in the next section. This section is to clarify the definitions and the classification into horizontal and vertical product parameters.

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[5] Calculated from 2006 annual reports based on passenger revenues (excluding ancillary revenues) divided by the number of passengers of that respective airline.

[6] Including DBA (see also footnote 8).

[7] Data is calculated from number of flights and number of routes on a reference week in July 2006 for flights departing or arriving in Germany.

[8] Because of the take-over of DBA, results for Air Berlin are mixed. In the first quarter (Q1) 2006 average price was € 73.02, from the interim report for the first term 2006 average price was € 82.86. From the report on Q3 2006 an average price of € 91.25 was calculated. DBA was included in the financial reports of Air Berlin from September 2006.

We saw that airlines are differentiating their products by airport choice. This can be put in a spatial context and should therefore be treated as horizontal product differentiation. Since airports cannot be moved around, airlines have a choice of fixed locations in geographic space. Only when new airports are built, or former military airports are converted, the choice patterns change, but again these new airports will also be fixed. Since geographic space is not uniform and population is necessarily concentrated, the standard Hotelling-type models will not apply, since their main assumption was that consumers are evenly distributed. The models will need to be adapted for concentrated consumer populations. It should also account for differing regional economic idiosyncrasies of the respective locations, particularly income, since bigger agglomerations tend to have bigger, high income populations than rural areas. The application of such models will also have repercussions and implications on the issue of airport competition and product differentiation of airports. To some extent vertical attributes might also be considered regarding airport choice of airlines and regarding product differentiation of airports. There might not be much where one could think of characteristics with which airports are differentiated, except for location, access time and average air fare. Some distinctions however do play a role, especially when typical LCC airports and FSA airports (particularly the FSA's hubs) are compared.

Such models will however only be applicable if flights on the same route are considered. Although some general implications could be made without such an assumption, it is a necessary one, because two different airlines flying from two different airports to two different destinations are not differentiated products they are *different* products and completely unrelated. Only where two routes are really substitutable such models can be applied. For example, when they are between the same geographic areas, i.e. the same travel markets. Between Hamburg and London the routes Hamburg-Lübeck - London Stansted and Hamburg - London Heathrow can be viewed substitutes and here, models of product differentiation can be applied. The question thus is, how substitutable such alternatives are and the answer will likely differ for different consumer segments, since time-sensitive and price inelastic passengers might not be willing to travel to remote airports whereas time-insensitive and price elastic passengers are.

Whenever, a FSA and a LCC operate the same route the level of quality comes into play. This feature is a vertical attribute and thus, models which include vertical product differentiation are needed. The level of quality also comes into play when the FSA and the LCC fly passengers between the same geographic areas or in the same markets. In this case models that encompass both, vertical and horizontal product differentiation are needed. If the FSA is operating a route with its LCC subsidiary and its mainline, models the include the aspect of multi-product firms must be employed.

Summing-up, it can be stated that the quality attributes are vertical attributes. The question of airport choice and substitutability of routes relates to horizontal attributes. It is hard to tell whether the vertical or horizontal attributes are dominant. I believe that if prices for a flight with a FSA and a LCC were the same, everyone would most likely rank the flight with the FSA higher. Willingness to pay for quality, however, differs. Although most consumers would prefer low travel times to their airports an increasing number of passengers is willing to travel far distances to remote airports if ticket prices are low enough. Horizontal attributes that relate to the airline or the aircraft cabin should play a minor role. It is by no means of any significance whether the seats in the aircraft are blue or yellow. When it comes to location, especially airport location, there might well be horizontal attributes. The horizontal attribute of airport choice can be put in a spatial context.

## 5. Applications and Implications

After deregulation in the USA and Europe, air passenger transport saw the rise of LCCs. Particularly of interest is the emergence of the LCCs that were established first, which are Southwest Airlines in the USA and Ryanair in Europe. These carriers positioned themselves on the lower end of the quality range, offered a simple product, no frills, low frequencies, etc. In section 2 the model of pure vertical product differentiation was introduced, which explained that the upper and lower quality products need to be sufficiently far away (in terms of quality) if the products were to coexist in the market. Reisinger (2005) already studied such an entry game for the airline industry, that has all the style of a model of vertical product differentiation. The model he used was one of sequential entry, which seems to be a reasonable assumption for the airline industry. The game was a three stage game, where firm 1 first chooses quality, then firm 2 chooses quality and in stage three both firms compete in prices. Furthermore, he considered entry of the LCC into the same route markets as the FSA, since otherwise the issue of product differentiation would not arise in the first place. Reisinger (2005) also used quality in very general manner and described quality as all the factors that make up the flight quality. The result is that the first mover chooses the high quality product, and the entrant the low quality product.

The reason for LCCs to establish their products on the lower end of the quality range is straightforward. To avoid intense price competition with the incumbent airlines the LCCs differentiated their products sufficiently far away from that of FSAs in terms of quality, which is the only strategic variable for differentiation in models of pure vertical product differentiation. This generated new demand (or activated latent demand) and some passengers substituted away from FSAs to LCCs. Reisinger (2005) also points out that, since a fraction of passengers in that market might need connecting flights to an onward destination some passengers keep with the incumbent FSA, because it offers a large network with connecting flights. Moreover, consumers in the market need to be sufficiently heterogeneous in terms of their willingness too pay for quality or income, respectively. The theory (and also Reisinger's model) suggested that the producer of the high quality product makes higher profits than the producer of the low quality product, which cannot be observed in the airline business. LCCs were generally more profitable than most of the FSAs and they were less vulnerable to cyclical fluctuations (see Appendix B). There is no general conclusion for the airline business that FSAs are making higher profits than LCCs, which is contradictory to what theory would suggest. However, the suggestion that the FSAs would make higher profits than LCCs was largely because in the theoretical model production costs were ignored, which would explain the mixed results on profitability. Another explanation for the profitability of LCCs come from the restrictive assumption of evenly distributed consumers along the characteristics space. This must not be true in reality and consumer distributions can change considerably in different markets. For example, if a distribution of preferences looks something like in Figure 2 it is no longer true that having the high quality product automatically means having the most lucrative product. Figure 2 is an adapted presentation of a vertical street where the population, marked by a dotted line, is higher for the low quality product, i.e. there are more consumers with a low willingness to pay for quality. Firms A and B would not locate at the opposite ends, but in the centres of the peaks of the population distribution[9]. If firms A and B had the same mark-ups, firm B would make higher profits, because it is located in the higher populated area of the preference space.

[9] Provided that, at the given distance between A and B, income is sufficiently distributed, i.e. provided that $Y_A > 2Y_B$ holds.

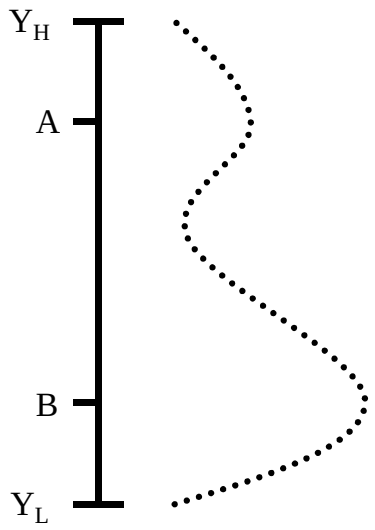


**Figure 2**

**Vertical product differentiation with uneven consumer distribution**

This model can also provide an explanation of why LCCs are less prone to cyclical fluctuations than FSAs. One reasonable explanation is of course that LCCs are much more flexible than FSAs, since they can cut routes or frequencies more quickly and can cut labour costs faster. Considering a demand shock that affects general income levels and thus also the willingness to pay for airline services results in a shift of demand from FSAs to LCCs, a slower decline of overall passenger numbers for LCCs compared to FSAs, or both. This is because passengers or no longer able to pay the high fares of FSAs and therefore, in a demand side shock, the demand for LCCs is more stable than it is for FSAs.

In section 3 it was stated that LCCs and FSAs differentiate their products also by their choice of airports. Furthermore, LCCs look at travel markets instead of services between two particular airports. The Launhardt model does provide a theoretical explanation for the choice of remote airports by LCCs. Figure 3 below shows, in a stylised fashion, the case of the Frankfurt market with the two airports Frankfurt (FRA) and Frankfurt-Hahn (HHN). The model considers a flight to the same destination (or, in the case of another multi airport region, the same region) and thus, the passenger has a real choice between FRA and HHN.

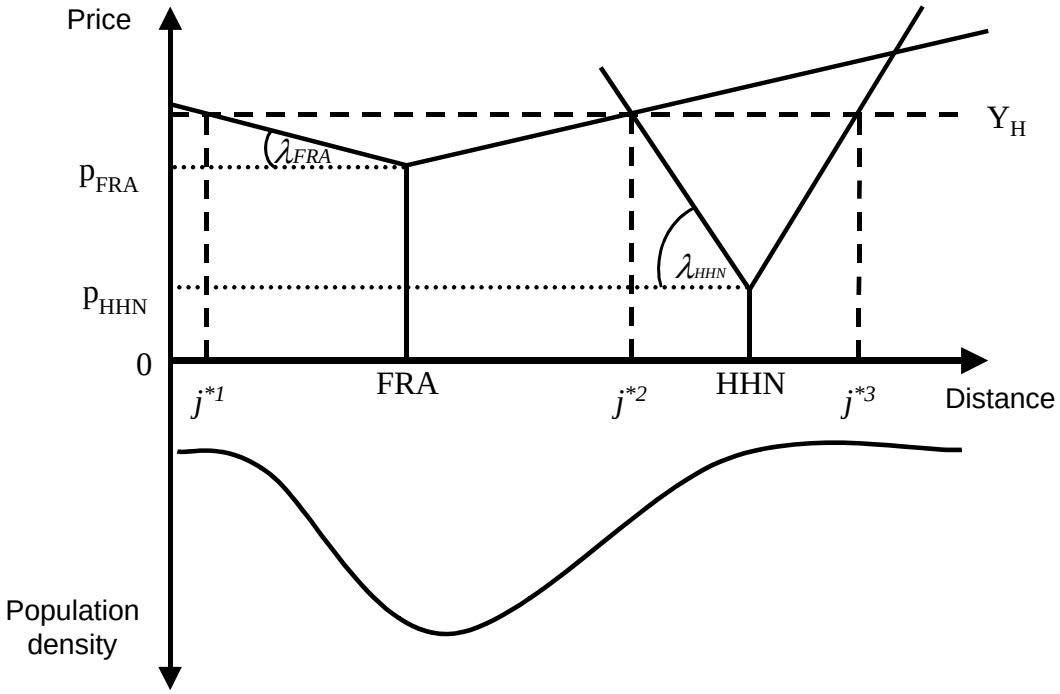


**Figure 3**

**Explaining airport choice in the Frankfurt market**

The figure above is a typical Launhardt model with a few modifications (for an extended review on the Launhardt model see Appendix A). The assumption of evenly population distribution is relaxed and the axis population density is added, which here shall only roughly reflect that population around FRA is much denser than around HHN. FRA is the main hub airport for Lufthansa and has virtually no LCC traffic. HHN instead is the main base for Ryanair in Germany and handles only LCCs. Thus, without loss of generality, it can be assumed that the quality parameter $\lambda_i$, is lower at FRA than at HHN ( $\lambda_{FRA} < \lambda_{HHN}$ ) [10]. It can also be assumed that the prices (i.e. ticket prices) at FRA are higher than at HHN ( $p_{FRA} > p_{HHN}$ ). Furthermore, an upper bound on the willingness to pay ($Y_H$) has been introduced that a) avoids that the reach of the airports increases constantly b) avoids that FRA steals from HHN's hinterland and c) for ease of discussion runs through the intersection of FRA and HHN at $j^{*2}$, which ensures that there is only one marginal consumer between the two airports [11]. Additionally, the locations of FRA and HHN cannot be changed, i.e. they are not a strategic variable for airlines or airports, since airports cannot be moved.

What can now be seen from Figure 3 is that there are three marginal consumers. $j^{*1}$ and $j^{*3}$ at the opposite ends mark the left and right ends of the catchment

[10] As a reminder: In the models of vertical differentiation the quality parameter was denoted $\varphi_i$. The Launhardt model is an adaptation of the Hotelling model, where $\lambda_i$ was the rate of substitution (or transportation costs), which was the same for all firms. Here a lower $\lambda_i$ indicates a higher quality and therefore lower mismatch costs, since the high quality product is always preferred.

[11] Only if $Y_H$ was lower, there would be two marginal consumers between FRA and HHN.

areas of the two airports. Consumers left of $j^{*1}$ and right of $j^{*3}$ are withdrawn from the market. $j^{*2}$ is located between the two airports and he marks the marginal consumer that is indifferent between flying from FRA and HHN. It can also be seen that, at given qualities, prices at HHN need to be sufficiently low enough in order to gain market share. If the prices at HHN increased, its catchment area would shrink. In this case the introduced $Y_H$ prevents $j^{*2}$ from shifting to the right and thereby increasing FRA's catchment area. If $Y_H$ was higher $j^{*2}$ would shift right. Furthermore, the catchment area (in terms of space) for FRA is higher than that of HHN.

This theoretical explanation can actually be observed in reality and it has some implications. The farther away from the population centre an airport is there lower its prices must be in order to attract some passengers from the population centre, assuming there are fixed, but different qualities. The airport in the population centre has not only a larger catchment area (in terms of space) it has also a higher market share, because population in that catchment area is higher than around the remote airport. In 2006 FRA handled 52.8 million passengers, while HHN had 3.7 million passengers. That the major airport has higher passenger number can be observed for several other multi airport regions, like London or Paris, even if transfer and transit passengers were subtracted from the passenger numbers of the main airports. FRA has however the problem that it has a smaller originating market that other European hubs. This is partly, because Germany has a polycentric city system. Countries like France, Spain and England are mono-centric countries and economic activity and population is concentrated in the capitals of these countries and hence, the hub airports of these countries have much higher originating traffic. Another implication is that if airports can reduce their access time, for example through a high speed rail connection or a bypass to a motorway, they can actively influence the airport choice of consumers. A reduction in access time would translate in the model as a decrease of the quality parameter $\lambda_i$. Alternatively, and maybe even more reasonable, instead of distance, the horizontal axis could be labelled travel time. Then, a reduction in access time would translate in the model as a shift of the remote airport towards the population centre. It is also reasonable to assume that a FSA would not move operations to HHN. The catchment areas would be about the same if a FSA would be located at HHN, since the $\lambda_i$ would decrease and $p_i$ would increase and there would be only a minimal change. The small catchment area together with the low population in that area would mean that the FSA could not attract enough passengers to fill their aircraft. The choice of FRA by FSAs is on the other hand also because they need a large airport with maintenance facilities and complex terminals for transferring passengers. Thus, the choice of FRA is driven by organisational needs as well as demand-side factors.

The model does, however, also have some shortcomings and there are a few things the model cannot explain. For example, in this model it might be desirable for Ryanair to move operations to FRA. In this case it would only have a slightly smaller catchment area, but in a larger population centre and thereby have a higher market share. The problem is of course that FRA is largely slot constrained and has very high airport charges. This would not fit into Ryanair's business model and it could not offer low ticket prices if it flew from FRA. Thus, the choice of Ryanair for HHN over FRA is also driven by the fact that the airline wants low airport charges and an uncongested airport. Even if that might be so, any LCC would still need very low prices to get a large market share and the model shows that LCCs can gain market share by choosing the remote airport once the main airport is congested, too expansive, or both. The model is furthermore only applicable, if flights between the same markets or

airports are considered. The Frankfurt - London market is a good example since both destinations are multi airport regions. Ryanair flies from HHN to London Stansted and Lufthansa from FRA to London Heathrow. The model can also not deal with different perceptions of airline quality. Some consumers might actually put a higher $\lambda_i$ on flights with Ryanair, which would induce such a consumer to travel even greater distances to the remote airport. Thus, the model cannot explain why some passengers, even left of $j^{*2}$ would choose to travel to HHN or to say it in other words, it cannot explain why there are overlapping catchment areas. It could be that this is because of the fact that the Launhardt model does not include different willingness to pay for quality (or different levels of income). The travel market must be heterogeneous in terms of income. It is however not possible to add a lower bound of income (i.e. $Y_L$) to the model. The problem in the Launhardt model is that the parameter $\lambda_i$ is a mixture of a quality parameter and an indicator of transportation costs or substitutability, respectively. Hence, the only way to deal with this shortcoming would be through an adaptation of $\lambda_i$. This could be done in such a way that $\lambda_i$ is multiplicative linked with the income parameter $Y_j$. In that way, $\lambda_i$ would not be a fixed value, but rather a continuous band of $\lambda_i$ s.

So far the discussion implicitly assumed that there would be only two distinct qualities in the airline market. It was however stated that more and more LCCs are departing from the typical LCC business model and increase their level of quality. Table 1 showed that there are differences in terms of average ticket prices among airlines. Table 2 provided evidence that the average frequency of the airlines also differs considerably. Table 3 below shows evidence from the German route between Hamburg airport (HAM) and Munich airport (MUC). The two airports are located in big agglomerations, which are important centres of economic activity, with a high level of income. Furthermore, MUC is the second hub for Lufthansa, after FRA. Both airports handle mostly FSA traffic and levy high charges, yet they do have some LCC traffic. Neither HAM nor MUC are heavily congested or slot constrained. This makes them an ideal route on which FSAs and LCCs, or in this case HCs, can compete for passengers. Although the Hamburg region has a remote airport (Hamburg-Lübeck), Munich does not. There would be potential for a route from Hamburg-Lübeck airport to MUC, though it has not been established so far. There are three airlines which operate the HAM - MUC route. These are Lufthansa, Air Berlin[12], and Germanwings. The latter is partly owned by Lufthansa, which makes this a route where the Lufthansa acts like a multi-product firm that competes against a HC. The linear distance between Hamburg and Munich is approximately 611 kilometres. Alternative modes of transport are by train and car. The fastest train journey takes about 5.5 hours and costs 119 Euros[13]. The journey by car takes about 6.5 hours and costs approximately 410 Euros[14].

[12] The route was formerly operated by DBA, which was taken over by Air Berlin and completely integrated into Air Berlin. That is, aircraft have been repainted and the corporate design been changed, so that no associations can be made any more, that this flight was once offered by DBA.

[13] *Source*: Deutsche Bahn. Standard one way fare ("Normalpreis").

[14] *Source*: ADAC. Based on one person in a middle class car with an average of 15.000 kilometres p.a. and total costs of 53 cents per kilometre (journey distance by car is about 774 kilometres).

**Table 3 Basic product features in the HAM - MUC market**

| | Average price in Euros | Daily frequency † | Flexible tickets | Frequent flier program | Free of charge amenities ‡ |
|---|---|---|---|---|---|
| Lufthansa | 253.34* | Up to 15 | Yes | Yes | Yes |
| Air Berlin | 73.99* | Up to 9 | Yes | Yes | Yes |
| Germanwings | 46.59** | Up to 3 | Yes | Yes | No |

*Source*: own compilations

*Notes*: * see Table 1; ** *Source:* DLR, 2006; † frequencies are usually lower at weekends; ‡ e.g. newspapers, snacks and drinks, on-board entertainment etc.

The emergence of hybrid carriers (HCs), such as Air Berlin, can be explained with the model of pure vertical product differentiation, where it is possible to have several qualities in the market. The fact that there are three distinct qualities in the HAM - MUC market suggests that the consumers are sufficiently distributed in terms of their income in that market. Furthermore, airport capacity is available on both sides of the market. The market could also be analysed with the model by Canoy and Peitz (1997), which is a model of multi-product firms. The route connects two important economic centres of Germany and hence there is a large share of business travellers. Furthermore, the catchment areas of HAM and MUC are very large in terms of the population living in these regions[15] and thus there is also a large potential of leisure travellers. In other words, there is sufficient consumer heterogeneity on both sides of the route. It can therefore be concluded that the degree of vertical product differentiation in a given market is limited to the availability of airport capacity in and the socio-economic idiosyncrasies of that market. This means that there will only be several different qualities on a route if there is ample airport capacity in both markets and the degree of consumer heterogeneity is sufficiently large at both ends of the market, which, most likely, will only be the case in big urban regions.

Another interesting topic that can be studied is, in how far the product differentiation of airlines has impacts on the product differentiation among airports. There is an interplay between the vertical differentiation in the airlines business and the differentiation in the airport business when there are several airports in a big population centre, which can be seen in London, Paris and Berlin. These regions have airports that specialise on one type of traffic (LCC or FSA; sometimes purely business travellers). On the aeronautical side LCC airports have to meet the demands of LCCs, such as quick turnaround times, no air bridges and low landing charges. FSAs demand of their airports that they can handle large amounts of passengers at peak times so that the transferring passengers can be processed quickly. They also need large maintenance facilities at their hub airports, because of their heterogeneous fleet. Such differences in the demand for airport services of LCCs and FSAs are quite well established and recognised in the literature (see for example Barrett, 2004). Obviously, if the airlines have a low cost business model, the airports must operate on a low cost base as well.

There are however also impacts on the non-aeronautical side of airport differentiation. To an extreme case this can be observed at the London airport

[15] The region of Hamburg has approximately 4.3 million inhabitants, the urban region of Munich has about 4.6 million inhabitants. The actual numbers might differ, since there is no official borderline for an urban region.

Heathrow in Terminal 4. A passenger who is hungry for a burger cannot find any typical fast food franchise, like McDonalds or Burger King[16]. Instead in Terminal 4, and also at the other terminals at Heathrow airport, shops of Austin Reed, Cartier, Caviar House, Chanel, Christian Dior, Gucci, Hugo Boss, Swarowski, Versace and outlets of Garfunkel's and Harrods can be found. All these are brands of very expensive luxury jewellers, clothing and perfume shops. Of course there are not only such luxury shops at Terminal 4. Boots, WHSmiths, Borders, Costa and HMV are British stores that can typically be found on the high-street. Yet, there is surprisingly no McDonalds or any other fast food supplier in that terminal. Instead there are only restaurants. The only high-street food supplier in Terminal 4 is Pret-a-Manger, which sell sandwiches. The reason for this big share of expensive shops can be found in the passenger profile of the airport and also, ultimately, of the airlines. As said above, Heathrow airport handles FSAs only and thus, the passengers of that airport have generally a high willingness to pay and a high income, which can be seen in the consumer profile of Heathrow airport (see Appendix C). Heathrow airport might be an extreme example, nevertheless, there seems to be a tendency that the non-aeronautical differentiation among airports is affected by the airlines that bring in passengers of a certain profile. Airports that have a mixture of LCC and FSA traffic are thus also likely to have a mixed tenant structure that accounts for both types of passenger profiles. It might however also lead to confusion and it might be rendered inappropriate if there are shops for high-income consumers and low-income consumers at the same time. For example, a five-star restaurant next to a McDonalds would look rather peculiar. Separated terminals for FSA and LCC traffic makes not only sense in terms of the aeronautical efficiency, but also the non-aeronautical concepts can be developed separately and luxury tenants are more likely to be found in terminals that handle FSA traffic only. Separate terminals for LCCs and FSAs can be found, for example, at Amsterdam Schiphol and Bremen airports. In the cases of Amsterdam and Bremen there are no alternatives nearby[17], which is why these airports handle both types of traffic. In these cases there should be product differentiation along the terminals. In the case of Heathrow airport, the LCC airport Stansted is much closer and therefore product differentiation is much more likely to occur among these airports rather than between terminals at the respective airports. As product differentiation becomes more important among airlines, it must also become increasingly important for airports. This would be done to lesser degree to relax price competition[18], but rather to fully exploit the non-aeronautical, and also the aeronautical potential of airports. The development would also highlight the increasing importance of Total Quality Management (TQM)[19] at airports, that can only be executed in co-operation with airlines. LCCs have already been pushing airports to fulfil their needs and FSAs will also want to put forward investments for high quality facilities and terminals that cater their needs. Quality measurement at airports is pointed out in Graham (2003, chapter 4) where it also mentioned that there is an increasing focus on quality at airports. Consumers do not distinguish between airlines and airports when they value the product and hence, airlines and airports must work together to ensure a

[16] There is actually a Burger King at the international terminal of Terminal 1.

[17] Eindhoven airport is 120 km from Amsterdam and can be considered the LCC alternative for Amsterdam.

[18] Eindhoven, Stansted, and also HHN are owned by the companies that own and operate the major airport in that regions. These companies are: Schiphol Group (51% share), BAA and Fraport.

[19] The key concepts of TQM were first presented by Feigenbaum (1951).

seamless travel experience for their passengers. Some US airports might have an advantage in that respect since there terminals are operated by airlines.

## 6. Summary and Outlook

I have shown in this paper that the economic theory of product differentiation is relevant for the airline industry and that it can explain a lot of the changes that have happened and are happening in the business. It explains the rise of LCCs and also of HCs. It also explains why LCCs choose remote airports and what implications this choice has for airport choice of passengers. It has also been explained that the product differentiation of airlines has some implications for the product differentiation of airports. It was shown that the vertical segmentation is considerable importance and that many airlines differ in overall quality. One of the major conclusions from the investigations in the paper is that the vertical differentiation in a route market will be limited to the availability of airport capacity and the socio-economic characteristics of the route market.

I have given examples from the European market, yet I believe that the same observations can be made in other markets as well. The Brazilian market, for example, has already seen the rise of an LCC that is now dominating the market. The Asian airline market is currently also experiencing fast growth rates of LCCs. The models and the implications provided should be applicable to other world markets and the same observations should be made there.

I believe that the fragmentation of the vertical dimension in the airline industry will take place around the world once markets are liberalised. I also believe that the airline industry will evolve into an industry that offers many different qualities and that essentially mature markets will be characterised by a fragmented industry structure in terms of airlines that offer distinct qualities. This will also have implications for airline marketing. Since the product features of airline will become more and more important, FSAs and also HCs will need to focus on the product attributes they offer and they need raise awareness that there are differences in quality among airlines. Passengers will not be willing to pay FSA fares for LCC products if they are available on the same route. Airlines themselves can and will further segment their product within their overall quality range, either on a route level or by offering airline subsidiaries that serve different market segments, such as Lufthansa does with Germanwings, Lufthansa CityLine and Lufthansa PrivateJet along with its mainline.

It also reasonable to assume that, in the future airlines will increase their overall quality. In the case of the HAM - MUC route, described above, the LCC, Germanwings, provided already some features that are not usual for LCCs, such as availability of flexible tickets and frequent flier programs. It could well be that FSAs increase their quality by providing onward taxi services or transport to the airport, or both. Emirates, for example already provides such a service for its first and business class passengers. Yet even beyond that, further features, that might enhance the quality of the airline product are imaginable.

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## Appendix A

The model developed Launhardt (1885) is essentially a predecessor of the Hotelling duopoly game. Since Launhardt analysed 'classic' location theoretic problems, that is, he considered location of firms in geographic space, he examined a case where firms had access to different transportation technologies. Thus, the parameter $\lambda$ (which is a parameter for substitutability in the Hotelling model) is allowed to be different among firms. Ferreira and Thisse (1996) show that by using this framework, horizontal and vertical characteristics can be modelled. In such a framework the location of the firm would represent the horizontal dimension and the (now) variable $\lambda_i$ would represent the vertical dimension. Figure 4 depicts a simple model where firm A offers the high-quality product at location A and firm B offers the low-quality product at location B. The length of the street is normalised to 1.

It can further be seen that $p_A > p_B$, which is however compensated by lower unit transportation costs, i.e. $\lambda_A < \lambda_B$. Thus, in this model, lower unit transportation costs are an indicator of higher quality and consumers are more willing to accept higher distances on the horizontal dimension for acquiring a better product. In Figure 4 there are two marginal consumers who are indifferent between buying the product from firm A and B. All consumers between $j^{*\prime}$ and $j^{*\prime\prime}$ will buy the product from firm B, all consumers left of $j^{*\prime}$ and right of $j^{*\prime\prime}$ will buy A's product. Moreover, it can be seen that firm A 'steals' consumers from the hinterland of firm B, which is made possible through the lower transportation costs. This would imply that a higher quality can compensate for a high mismatch in the horizontal dimension, albeit this might not be an equilibrium outcome.

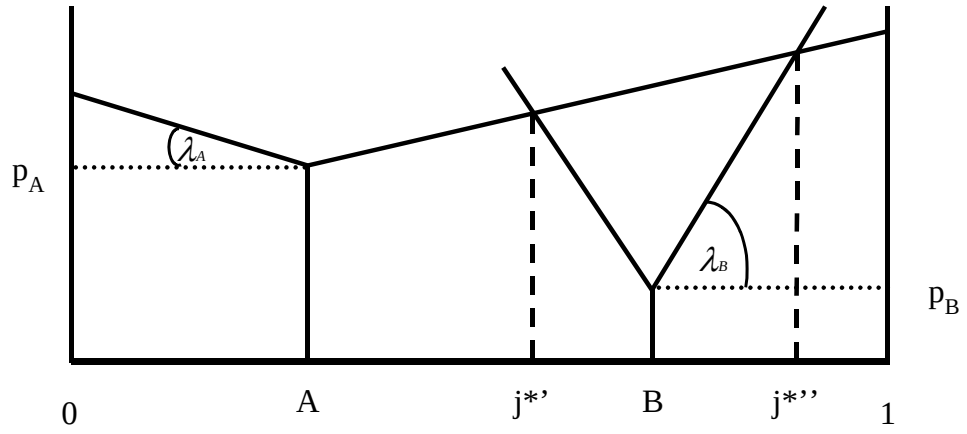


**Figure 4**

**A simple Launhardt location model with two firms**

*Source*: own illustration, adapted from Launhardt (1885) and Ferreira and Thisse (1996)

In this model the essence of (pure) vertical differentiation can also be depicted. If in Figure 4 both firms had the same location and the same prices ( $p_i$ ) the firm with the lowest transportation costs ( $\lambda_i$ ) gets to serve the whole market.

Appendix B

**Table 4 Profit and loss in the US Market**

| | *Net income or loss in million US Dollar* | | | | | |
|---|---|---|---|---|---|---|
| | *2001* | *2002* | *2003* | *2004* | *2005* | *2006* |
| AMR/American | - 1,462 | - 3,511 | - 1,228 | - 761 | - 861 | + 231 |
| UAL/United | - 3,357 | - 3,212 | - 2,808 | - 1,644 | - 21,176 | - 23 |
| US Airways | - 1,170 | - 1,646 | - 666 | - 89 | - 537 | + 304 |
| Delta | - 1,027 | - 1,295 | - 896 | - 5,198 | - 3,836 | n.a. |
| Northwest | - 423 | - 798 | + 236 | - 848 | - 2533 | - 2,835 |
| Continental | - 95 | - 451 | + 38 | - 363 | - 68 | + 343 |
| America West | - 148 | - 430 | + 57 | - 90 | n.a. | n.a. |
| Alaska Air | - 43 | - 388 | + 8 | - 15 | - 6 | + 304 |
| Southwest | + 511 | + 241 | + 442 | + 313 | + 548 | + 499 |

*Source:* Doganis, 2007

**Table 5 Profit and loss in the European Market**

| | *Net income or loss in million US Dollar* | | | | |
|---|---|---|---|---|---|
| | *2001* | *2002* | *2003* | *2004* | *2005* |
| Lufthansa | - 567 | + 681 | - 1,120 | + 551 | n.a. |
| Air France | + 137 | + 120 | + 110 | + 2,048 | + 1,112 |
| BA | - 81 | + 112 | + 237 | + 656 | + 785 |
| KLM | - 140 | - 416 | + 28 | (merged with Air France) | |
| Iberia | + 48 | + 152 | + 118 | + 229 | + 469 |
| Alitalia | - 813 | - 248 | - 587 | - 1,000 | - 199 |
| Swiss | - 203 | - 659 | - 527 | - 122 | - 140 |
| SAS | - 103 | - 14 | + 241 | - 220 | + 32 |
| Ryanair | + 135 | + 240 | + 243 | + 344 | + 370 |
| easyJet | + 55 | + 72 | + 52 | + 74 | + 75 |

*Source:* Doganis, 2007

Appendix C

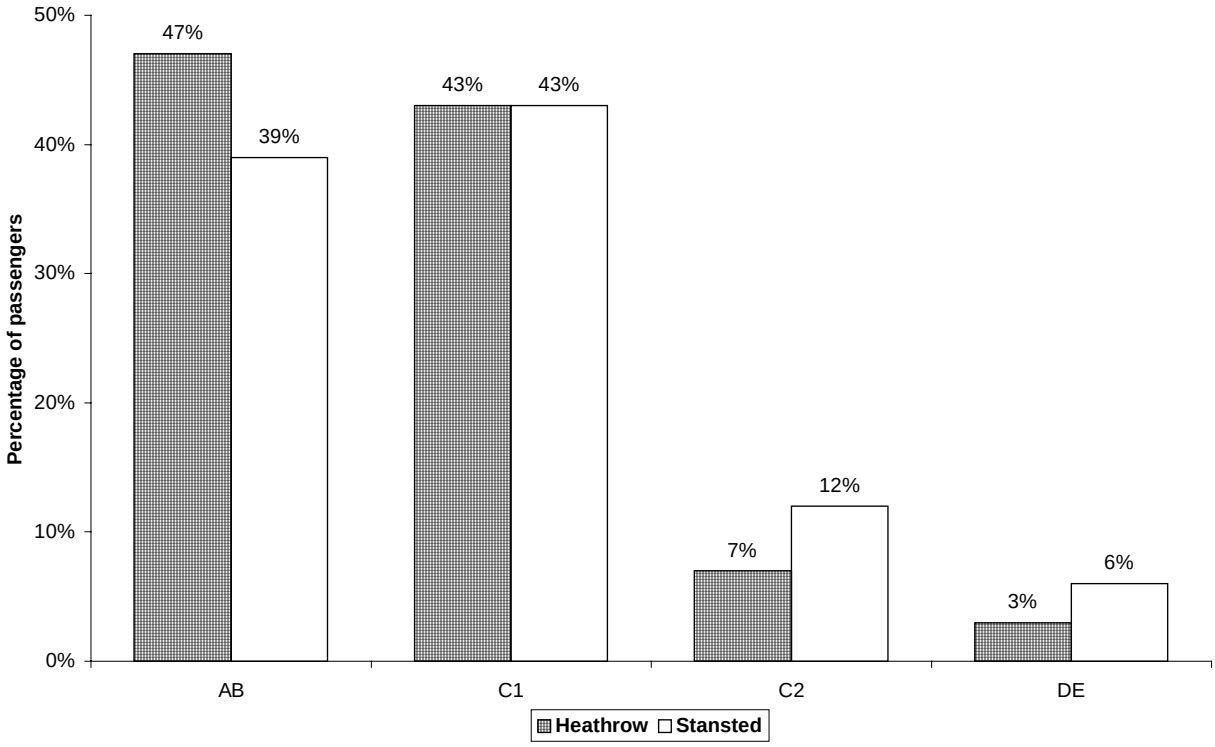


**Figure 5**

**NRS social grades at Heathrow and Stansted airports**

*Source*: own illustration based on data from BAA.com

The figure above shows the NRS social grades of Heathrow airport in comparison to those of Stansted airport, which is one of the LCC airports in London. The NRS social grade system is used in the UK for demographic classification. The system was originally developed by the National Readership Survey and is now commonly used in market research. The grade A stands for upper middle class and is represented by doctors, solicitors and company directors. B stands for middle class and there are, for example, teachers and middle managers in it. C1 is the lower middle class represented by junior managers and office workers. Manual workers and shop workers are in the working class, which is denoted with D. Casual labourers and state pensioners are given the grade E, which stands for underclass. The grades are usually grouped like in the figure above. The group AB represents about 25 per cent of the UK population, C1 29 per cent, C1 21 per cent and DE 25 per cent.