Bachelor Thesis

Intertemporal price dispersion for Ryanair and Lufthansa

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Introduction

The low cost airline carrier Ryanair is the second in Europe by number of passengers transported. It is only excelled by a conventional airline, namely Lufthansa. After deregulating the aviation market in the European Union, low cost carriers like Ryanair have thrived. Now they increasingly stand in direct competition with conventional carriers. The main argument for the low cost carriers remains to be the attractive prices for holidays and visits. However, it is a trade off with the additional time and transit cost needed at the satellite airports. Subsequently, price sensitive passengers remain the majority of passengers for low cost carriers. These are usually infrequent flyers that travel on holidays and private visits rather than business related travels. As the target groups are different, we should assume that the airlines use different pricing strategies to sell their flights. Differences in price dispersion between the carriers can be evidence of different levels of price discrimination. We will discuss what the sources of dispersion are and how carriers use them to improve their yields. It seems reasonable, that conventional carriers, which usually frequent all major airports in a country, are rather valued by their quality and frequency of service. Consumer loyalty among frequent flyers is therefore more applicable for network carriers than the low cost counterparts. On the other hand, low cost carriers have to fear no loss of reputation and are free to charge fees and peak load prices to their liking. As more possible factors come into play it is the questions, which of these factors are dominant. Specifically, we analyze how fare prices of Ryanair and Lufthansa compare over a period of 15 weeks which include weeks of changing demand characteristics. In order to draw conclusions, we seek to analyze if Lufthansa's fares are subject to more price dispersion than Ryanair and if which of the proposed effects are observable.

The focus in this paper is on the change that is observed when the same flights are offered at different point in time. More precisely, in order to improve their yield, a carrier can not only charge different prices to passengers on the same flight, e.g. by offering different service-classes that leaves room for self selection, but the airline can also set different prices across time. Therefore there is another dimension to airline price dispersion, which we will refer to as intertemporal price dispersion. The analysis of this is particular interesting to discrimination research. That is, while a carrier's cost variations between different service-classes are high due to extra personnel cost, space on the airplane and weight allowance, in contrast, the *intertemporal* cost difference within a service group is small. The remaining dispersion is thus a type of price discrimination. This paper uses new data to analyze whether

Ryanair or Lufthansa, has more variation in prices across time or intertemporal price discrimination. This will be tested on the basis of flight fares over 15 weeks on 30 different routes.

As we choose the corresponding location for the airports, i.e. each route from Ryanair has a Lufthansa counterpart with the same city of departure and arrival and flight time, the reasonable observer could assume that the fare price fluctuation for the two airlines should not differ on average. And if this were *not* the case, the efficiency of managing the yield is different and price discrimination more prevalent for the airline with higher price dispersion. Thus, our hypothesis is as follows:

Price dispersion, measured as the standard deviation of route [r] by carrier [i], does not differ between the Ryanair and Lufthansa (where r denotes one of the 30 routes and i is denotes the airline, Ryanair or Lufthansa).

The paper will start with the review of the literature of the field. Subsequently, the Ryanair and Lufthansa market will be described and lead to the model and regression results. The last part contains a discussion of the findings, its limitations and room for improvement and finally concludes the research.

Review of the Literature

As a basis for the research, a selection of articles was reviewed. Research on price dispersion in the airline industry has primarily focused on dispersion at one point in time for consumers within airlines servicing a certain route, as well as across airlines. The existence of dispersion is proven by empirical papers, which show that propensity for dispersion differs among the airlines. Interestingly, the difference of fare prices on the same flight, are usually much larger than the difference of the average price of two different carriers for that route (Borenstein & Rose 1994).

With the liberation of the airline market the yields decreased while traffic increased on competitive routes. Fare reductions were particularly observed on short and medium distance flights of less than 1000 miles (Dresner et al. 1996). Yield reductions averaged 38 per cent on the routes of low-cost carrier entry. The findings are coherent with further research, reporting drops of fares of 34 per cent on the routes with the introduction of a low-cost carrier (Whinston & Collins, 1992). Thus, the positive effect on prices through the added competition seems undisputed.

The dynamic airline pricing, or yield management, is subject to uncertain demand and fixed capacity. The yield management is thus quite unique, while somewhat analogue to hotel pricing. McAfee & Velde (2005) find that strategic discrimination by airlines is rather driven by the composition of customer than specific yield management strategies to capture consumer surplus. It is claimed that the way of discriminating is a fair allocation of flights to the degree of the customer's demand.

Same flight dispersion

A considerable amount papers have analyzed the dispersion in the airline industry. Here, dispersion refers to the difference in price that is charged to passengers on the same flight. For instance, it would be reasonable from a yield perspective to charge high prices to business travelers (who are assumed to have a low demand elasticity while the brand loyalty is high), while charging less to attract leisure travelers (who tend to be flexible and thus have a high demand elasticity and low brand loyalty). Contrary to intuition, going from monopoly to imperfect competition, the airline fare prices do not fall as much as they spread, or as they are dispersed. Borenstein and Holmes (1989) claim that increased competition leads the airlines to employ more effective yield management. This increases the price discrimination. Findings indicate that, although competition lowers prices, the firms particularly compete on discount prices. Therefore, competition indeed seems to increase the dispersion of fare prices on the same flight and carrier.

Competition and dispersion

The most notable addition to the above, by Borenstein & Rose (1994), assumes that the degree of dispersion can be predicted by the market structure (monopolistic or competitive), consumer population (low cross-elasticity across brands, e.g. for business travelers, or high cross elasticity across brands, e.g. tourists) and product attributes (presence of frequent-flyer plans granting bonuses). In conclusion, the market structure had the largest effect on price dispersion. An increase in the number of airlines servicing the market fosters dispersion. This is up for debate, as Gerardi & Shapiro find that competition effects price dispersion in a negative way. They claim their findings are in accordance with common macroeconomic theory: A firm that is competing with others cannot use price dispersion since it has to offer competitive pricing. This price-taking role is found in empirics, i.e. newer panel data flight prices between 1993 and 2006, which do incorporate the influence of low-cost carriers (with no service-class distinction, no bundling of flights, no hubs and no connecting flights). With

the new data, the opposite seems to be true, low-cost competition is negatively related to price dispersion.

On the other hand, an increasing amount of flights, or referred to as flight frequency, lowers price dispersion. Furthermore, when a carrier had control over a majority of the traffic at a specific airport, this increased the dispersion for the routes connecting to that airport. Tourist-oriented routes did not show this effect. Overall, it found that price dispersion of passengers on the same flight, or the "*within* carrier" dispersion is high compared to the price dispersion *across* carriers. The ratio is found to be 97 per cent of total dispersion originates within the passenger fares of one carrier. This means that the pricing across carriers is similar in terms of average fare price and most of the variation comes from different service classes.

Airports and competition

The impact of low cost carriers servicing flights on the routes of incumbent firms is subject to vast research. Dresner et al. (1995) review contributing papers[1] and conclude that there is no dispute to the finding that low cost carriers reduce fare prices and increase the number of flights on the routes they service. Importantly, in his research, he assumes and finds evidence that passengers are willing to travel to alternative airports if they can benefit from lower fares that way. This means that a carrier does not just compete with the other airlines flying the same route, but also compete against alternative airports, or the current main hub. The reduced price effect on nearby airports was existent, although to a lesser extent than was the case at the airport of entry. Dresner refers to the fare price decrease at nearby airports as "spillover impact". He suggests that entries of low-cost carriers benefit consumer welfare beyond the improvement on routes, which the low-cost carriers operate directly.

Differences in price variation between carriers on equivalent routes indicate that competition between airports is not perfect. The low-cost carrier's airports are often peripheral to the city and distant to the main city airport. Thus it is assumed to be more costly for the average passenger to use these airports. On the first level, the cost is comprised of transition cost to the peripheral location. On a second level the inconvenience of limited flight time required flexibility. Making fitting arrangements and dealing with waiting times is another form of cost. Generally, all these cost disadvantages can possibly be offset by the lower average cost of the low-cost carrier. If the further buying behavior or demand elasticity were similar and

[1] Graham and Kaplan (1985), Strassman (1990), Windle and Dresner (1995) and Morrison and Winston (1995)

additional cost compensated by lower fares, we should intertemporal price dispersion to be similar for both Ryanair and Lufthansa.

Description of the market and flights

Lufthansa is the largest European carrier by number of passengers transported[2]. As a conventional service carrier it is known for quality and expansive flight schedule. Its hubs are Munich, Frankfurt and Dusseldorf in Germany. On most inter-European flights it operates two types of service classes, i.e. economy and business. Within the economy class, different pricing subcategories exist. These have different pricing schemes and different policy on cancellation fees and flyer-miles, which is presented as divergent of sub-classes. In contrast, Ryanair, whose success has started with the European deregulation in April 1997 (Barrett, 2000) has only one class of service. The frequency of flights differs on the different routes. In the collected data, the busiest routes have two flights per *day* while less dense routes are only serviced by two flights a *week*. Moreover, all flights are direct. This is consistent with the system of cross connecting routes, as opposed to using a hub-and spoke system.[3] The fares are generally lower, but often this comes at the expense of additional transit. Using alternative airports sometimes requires extra time and travel expenses (cf. Dobruszkes, 2006).

Nevertheless, lower fares are also appealing to business travelers, even if it means losing frequent-flyer benefits (Mason, 2001). Ryanair does have a loyalty disadvantage over its lack of frequent-flyer plans and the so-called Travel Agents' Commissions Override programs in their sales plans. According to Borenstein & Rose (1991), the above programs are the main source of airport domination. It follows that Ryanair presumably exerts less dominance at its airports and less room to price-discriminate. Furthermore, Ryanair is limited through its sparse flight scheme. For Ryanair, a two-way ticket, or return ticket, is simply the composition of two-one way-flight fares (which could be booked individually without surcharge). By separating the two legs of the flight in individual products, they are individually comparable to other offers. Hence, due to the possibility to choose different carriers for the individual legs of a two-way travel, we move further towards perfect competition. This system does also make flights more attractive to those who are not willing

[2] Lufthansa GmbH Investor Relations 2010 Verkehrszahlen

[3] This lowers cost by decreasing turnover time at airports.

or able to choose a definite return flight at the time being and for those traveling with multiple consecutive destinations. For these types of consumers, the price is the major factor.

In practice, the booking processes differ and the level of service that is included is considerably different. Concerning the booking process, it is not practically possible to purchase one-way flights over the internet by Lufthansa for competitive prices. Lufthansa charges high prices that do not fluctuate in a way like the return tickets do. Often, they even surpass the price return tickets. Ryanair on the other hand, makes a return ticket a package of 2 flights that could be booked individually without any fees that are not included when booked as a return ticket. However, at Ryanair, the price that is presented at the booking and advertising sites does not include the fees that will be added in the end. They are labeled as booking and administration fees.

Even more substantial is the difference in luggage policy. Lufthansa includes luggage with the presented prices. Thus I one would like it or not, one piece of luggage is included in the purchased flight. Contrasting to this, at Ryanair it is possible to travel merely with carry on luggage when one wishes to save the fees. In order to add checked luggage, a minimum of 20€ are charged. It allows for 15kg of luggage per flight. The option for 20kg cost 30€ per flight. Lufthansa readily accepts up to 45kg without charging a fee.

Furthermore, no meals are served and the seat characteristics are inferior. While room is generally smaller, seats do not recline and equipment and entertainment is more basic (see Barrett, 2000).

The data

Ryanair (RA) and Lufthansa (LH) had 48 matching airport locations at the time of the collection. An airport location refers to the city that is serviced by the airline be it though the main airport or a peripheral airport. When the airports that were used were not identical, Lufthansa serviced the central airport while Ryanair serviced peripheral airports (see table 6). Out of these locations, there were 30 matching routes. To be a matching route several criteria had to be met: The flight from location 1 to location 2 must be on the same day for both carriers. Also, the return flight must be on the same day for both carriers. Furthermore, the flights must be offered for the complete period of the 15 week duration. For 30 routes these criteria could be fulfilled.

Lufthansa does not allow for economic one-way flights to be purchased. The LH policy seems to prefer a set of at least a return flight. The one-way flights are not at comparable prices as they often surpass a return-ticket price. As flights in reality are some days apart to allow for a visit or business trip most flights are chosen at a length of 3 days. 20 flights are therefore Monday – Thursday return tickets which is exemplary of a short stay. To retain the matching dates for both carriers some fares had to be picked at different days however (cf. Routes appendix).

In order to capture the pricing patterns, the dates for the flights should be spread out by a reasonable time span. The busier summer months should be included as well as the slowdown afterwards in September. Thus, a weekly fare was observed for the span of the subsequent 15 weeks. The closest fares collected for were of Sunday 12-06-2011, which was two days after the collection on Friday the 10th. The furthest into the future were the fares for Friday 19-09-2011.

For the collection of the prices, the websites of the carriers were used. There were considerable in the presentation of the prices. The shown prices for LH include luggage and administrative fees while the ones at Ryanair do not. In the case of RA, the fees and luggage costs are only added when the consumer is going through the booking process.

The prices that were added to the different RA fares differ considerably, depending on the currency the flights are accounted in. The currency chosen thereby is determined by the country of initial departure. Out the 7 flights which were not accounted in Euros, the fees for the flights from Stockholm, Sweden were the most expensive (see breakdown of fees, table 4)

Table 1
Ryanair fees by billing currency

original	572 SWE	52 GPP	37,44 LVL	218,4 PLN
in EUR	63,01780	58,49269	52,81571	55,44569

The exchange rates were used as they were on the day of data collection (cf. exchange rate table).

The combined amount of fares and fees were converted into EUR. Of the 30 routes for LH and Ryanair, over a period of 15 weeks 900 observations were collected.

Thus in essence the transformation for Ryanair flights includes adding the cost for 15kg luggage and administration fees for the outward flight and return flight. The resulting price is one observation where Lufthansa's prices are final. Lufthansa differentiates between different

service package, which are differentiated in the fees for canceling or changing the booking. There were additional fees for Lufthansa called Ticket Servicing fees. These applied when booking with credit card instead of the online payment service Paypal. Interestingly these fees were only added for flights denoted in Euros (5 EUR) and British Pounds (4 GBP). Flights originating in Stockholm, Sweden; Riga, Latvia or Rzeszów, Poland did not have any extra booking fees. Hence, for all flights originating in the Eurozone, 5 EUR were added to the return ticket price and 4.50 Euro (4 GPB in EUR) for the flights from London.

At specific times the prices were obviously high. This could be attributed to events that happed in the concerning city. Possible reasons are concerts, expositions, sports events and festivals[4]. Generally, the prices for the typical vacation months of July and August are higher than the prices in late June despite of them being later and further away from the booking date. Contrary to intuition, Ryanair did not change the frequency of its flights for the observed time. It had a weekly schedule that stayed the same throughout the 15 weeks for all routes[5].

On 47 occasions (out of the 450 fares) Lufthansa had a cheaper fare than Ryanair, and one complete route was cheaper on all of the 15 weeks (London – Edinburgh). Contrary to the findings of Piga & Bachis (2006), that conventional carriers often offer lower fares on short notice, here the conventional carrier Lufthansa was never cheaper when booked on short notice (within three weeks), but rather it could occur in the medium to longer term, although rare.

Model and Regression

In order to find a measure for the dispersion, we need to decide which differences in price one wants to capture. Taking the standard deviation of the fare prices allows us to incorporate the change, i.e. fall, in the general price level as the flight dates move away from the date of collection. Furthermore, it equally treats the seasonal rise in late July and August and the week-to-week fluctuation. Hence, as a measure of intertemporal dispersion $\sigma_{i,r}$, the standard deviation σ of route [i] and of carrier [r] is used.

[4] Among these: Tennisfinals in Wimbledon, London (July), Euro Attractions Show, London (September), Festes de Mercé, Barcelona (September), Formula One at Monza, Milan (September

[5] The Ryanair destination Rome is an exception. For the period analyzed It changed airport use between Ciampino and Leornardo da vinci-Fiumicinco

The explanatory variable for dispersion

$\sigma_{i,r}$ denotes the standard deviation for carrier [*i*] and route [*r*].

$$\sigma_{i,r} = \frac{1}{N}\sqrt{\sum_{w=1}^{w=15}(P_{i,r,w} - \overline{P}_{i,r})^2}$$

N is the total number of weeks that were observed. *W* corresponds to the week of the observed fare price *P*.

From table 2 below, we see that the dispersion on competitive routes like Brussels-Milan, Madrid-Frankfurt, Dusseldorf-London, Dusseldorf-Madrid, Barcelona-Milan and Frankfurt-London is rather low. This is in accordance with the suggestion that the low cost carriers' competition leads to less dispersion and steady prices. In order to get a more precise image, an independent variable for competition should be included in the model (e.g. the amount of carriers that offer flights on that route). However, even then it is up to discussion what makes the dispersion low. One could argue that as the main reason for a low degree of dispersion is a low level of prices. For example, if a flight is very short and the cost for the carrier is low, it is unlikely that the absolute dispersion for fare price is high. Certainly, the dispersion would be higher on long routes that are very expensive. Similarly, Ryanair has a lower general price level for its flights (90% of the time it was cheaper than Lufthansa) and would be expected to have lower absolute fluctuation in its prices.

On the other hand, it is possible that the cheaper routes are just that, because the carrier is unable to price-discriminate. Hence the price remains low on average. In case one assumes that, the absolute dispersion creates a bias towards high Lufthansa dispersion, one can use the standard deviation as percentage of the average route cost for that carrier. In doing so, for this dataset, there were few changes. Using the percentage as independent variable leaves the Average Price variable insignificant, which is to be expected. In both cases, the difference of general price level in captured and the t-value of the Ryanair (RA) dummy and its significance are similar.

The cost savings of Ryanair through using alternative airports have to be compensated by the passenger. For instance, the time and cost of transit have to be beard to reach departure. This should not lower the value a consumer attaches to the transport from the city of departure to the city of arrival. Hence, comparing absolute deviations from the average, and using standard deviation, seems reasonable.

Table 2
Standard Deviations $\sigma_{i,r}$

Route *r*	$\sigma_{i,r}$ for Ryanair	$\sigma_{i,r}$ for Lufthansa	Route *r*	$\sigma_{i,r}$ for Ryanair	$\sigma_{i,r}$ for Lufthansa
Brussels-Milan	12,85	63,69	London-Edinburgh	32,34	24,96
Berlin-London	36,99	59,96	London-Hamburg	39,04	70,47
Frankfurt-Porto	50,39	88,13	Dusseldorf-Valencia	40,53	65,13
Dusseldorf-Madrid	28,00	99,27	Dublin-Frankfurt	27,50	80,75
Barcelona-Milan	18,36	37,23	Rome- Dusseldorf	36,79	59,20
Milan-Stockholm	33,98	83,97	Madrid- Frankfurt	40,46	63,01
Dublin-London	18,07	156,61	Malaga-Frankfurt	70,18	108,92
Dusseldorf-London	15,00	32,14	Frankfurt -Bologna	22,74	91,68
Frankfurt-London	30,68	64,44	Stockholm-Frankfurt	63,51	151,96
Frankfurt-Rome	18,97	110,36	Hamburg-Stockholm	26,88	144,44
Venice- Frankfurt	59,36	108,56	Bari-Milan	36,69	55,16
Riga- Frankfurt	47,54	133,91	Rzeszow-Frankfurt	23,35	239,12
Dusseldorf-Palma	42,74	34,46	Stockholm - Milan	34,72	167,91
Milan-Dusseldorf	43,66	70,58	Frankfurt-Edinburgh	29,55	120,04
Palermo-Milan	31,50	65,54	Stockholm-Dusseldorf	59,37	158,79

The model

We use a multiple linear regression with the dependent variable $\sigma_{i,r}$ of dispersion. It takes the following form:

$$\sigma_{i,r} = \alpha + \beta_1 RA + \beta_2 \overline{P}_{i,r} + \beta_3 EUR + \beta_4 SE + \beta_5 DI$$

Therefore price dispersion ($\sigma_{i,r}$)

1. The Ryanair dummy (RA) indicates the fares being from Ryanair (RA=1) or Lufthansa (RA=0).

   This variable will show how much of the variation in $\sigma_{i,r}$ between the two carriers, is left, despite the other independent variables having a correlation with $\sigma_{i,r}$. In a perfect model, this should show exactly how much discrimination one carrier uses in pricing.

2. The average Price (P) per route *r* from carrier *i* is represented by ($\overline{P}_{i,r}$).

We assume that carriers have different costs for different routes. Accordingly, the prices passed on to the passengers vary. If a certain mark-up as a percentage of the price is charged, it will show in this variable. Similarly, if the heights of discounts are oriented to the price level, it will be captured here.

3. The routes which originated in non-Euro countries are distinguished by the dummy EUR. For non-Euro fares, (EUR) will take the value 0. These are flights routes from Riga, London, Rzeszow and Stockholm.

4. The South Europe variable (SE) is a dummy which takes the value 1 for flights that have one or both destinations in Italy, Spain or Portugal. We assume flights to these regions to have a larger than average share of leisure travelers.

5. To approximate the distance for each of the routes, the distance between the city centers was chosen (without regard to their exact location). This is depicted in the variable (DI). This approximates the cost a carrier incurs. In contrast to the average price, the distance variable is independent of yield management and possibly increased prices through better discrimination.

Table 3
Dispersion Regression Results
(Dependent Variable: Standard Deviation)

	Unstandardized Coefficients		Standardized Coefficients		
Variable	B	Error	Beta	t	Sig.
Constant	32,205	18,367		1,753	,085
Ryanair	-22,972	9,179	-,252	-2,503	,015
Average Price	,313	,054	,595	5,823	,000
Euros	-20,018	9,491	-,185	-2,109	,040
South Europe	-3,726	7,995	-,040	-,466	,643
Distance	,000	,008	-,001	-,014	,989

Discussion

The high significance of the Average Price variable leaves room for two interpretations. It is possible a better yield management allows the carrier to achieve higher fare prices. This especially holds, when the passengers have low price elasticity of demand, e.g. business travelers. The carrier can capture more of the consumer surplus through discrimination.

Before illustrating the issue further, it should be stressed, that the different classes of service, e.g. business class and economy, are rather heterogeneous products. Different service classes are constructed strategically and therefore, charging different prices is obvious. It is the goal of having service classes. This type of dispersion does not exist for low-cost carriers, where all the passengers receive economy class or a lower degree service by definition. Therefore, low-cost flights and the airports they use are used by a certain type of passengers, notably those with leisure interest as visiting family or traveling (Elkins 1986). These passengers are price sensitive and can choose the degree of service by choosing the lower service-class as a way of self-selection. Using the lowest offered fares is a defined measure and suitable for comparison between airlines.

This leads to the notion, that tourist oriented routes should be less dispersed than other routes. In the chosen dataset, however, the routes are the same. It is still possible, that the passenger composition leads to an analogous difference for the reason to fly. The main points of distinction between the airlines would be threefold.

a. Firstly, the extra effort to reach an alternative airport which is located outside the main reach of the city it services (in about half the cases an alternative airport was used by Ryanair). From previous research it seems that the competition extends over various airports of one city (c.f. Dresner et al. 1995). Nevertheless, lower fare prices would be needed to make up for this, if the low-cost carrier seeks to attract passengers from the whole city area.

b. Secondly, if the above did not yet distinguish leisure travelers with flexible schedules from business travelers with rigid schedules, there is the important difference of flight frequency. In terms of a business person, that is the availability of a flight at the time that it is needed. For a flexible traveler this has hardly a meaning, as the cheapest flight is usually the most appropriate. Later we will see how Lufthansa internalizes this difference in its price scheme.

c. Thirdly, if we know to what extent the two other factors distinguish the levels of consumer price elasticity that we are dealing with and once we have controlled for these factors, we can see the remaining dispersion that exists. While the flight frequency and airport transit fosters *self-selection*, the remaining dispersion should come from the carrier's *yield management*. That is the way that the carrier prices its flights, to optimally fill the seats with reasonable certainty while charging a high price. In effect then, we can appropriate strategic price discrimination.

Curiously, at Lufthansa, it is sometimes the case that the lowest sub-category of economy class is not available (anymore). At an early point in time there are always Economy Saver tickets available. Moving closer to flight date, the cheapest economy tickets may be gone. The price sensitive buyer will have to upgrade to one of the other economy categories (Economy basic and Economy flex). At this point it should be mentioned, that there is no difference in service between these categories. They only have different prices and policies for rebooking and canceling fees. For most passengers, these categories should have no added value, and are really just different prices that include a bonus for the buyer.

The alternative for the price sensitive buyer is to look for other flight times on the same date or a nearby date. With this strategy, by adding another way of self-selection, Lufthansa has a way to fill their airplanes more evenly and certainly. If this type of dispersion can classify as strategic discrimination is debatable. That is, because Lufthansa has the freedom to alter the amount of Basic Economy seats that are "available for self-selection". This pricing strategy has another effect, namely that the same-flight price dispersion that is mainly done through classes is shifted into an intertemporal price dispersion problem across similar flights with the flight time as a trade-off. In contrast, this close net of options to choose from is not available at Ryanair, which makes it clear, that the offers are only suitable for a small portion of the consumers. This has as an effect, that the amount of customers, where the time is "just right" is a much smaller portion than that of Lufthansa.

In table 3 we see that the Ryanair dummy variable is significant. This is in accordance with the points brought forth above, about the differences in taking advantage of low demand elasticity. In that sense, the notion of Gerardi & Shapiro (2009) seems to hold. From what we can see, there is no basis to believe that the existence of Ryanair would increase dispersion. Quite the opposite seems to be the case. Through its "same price for all" set-up that is not

convenient for set up; through the possibility to buy single flights individually and with its simple competition on the serviced routes, it improves the prices for flexible travelers in a direct way. Indirectly it may reduce the aggressiveness of the yield management for the higher-price and high frequency segment as well, as less certain amounts of consumers are there to cover fixed cost in a safe way. Further research on the interconnectedness of same-flight dispersion (different service-classes) and intertemporal dispersion (price fluctuation between different flight times) could help us understand more about seasonal prices and why there may be explanations for the limited effort of the carrier side to smooth out prices (i.e. frequency of flights did not change on the routes, while the prices have a seasonal trend).

The coefficient for Average Price is positive and significant at 1 per cent. This is expected as the dependent Variable "Standard Deviation" measures absolute levels of deviation from the mean price instead of relative deviation. Choosing a relative standard deviation term, (i.e. Standard deviation divided by the average route price (i,r)) the Average Price coefficient becomes insignificant.

The South Europe variable is not significant. It is intended to distinguish routes that have a higher share of holiday travelers. However, an unexpected effect arises for the variable of Euro-denoted flights, which is significant in the regression. The dummy for routes originating in Euro countries (vs. the routes that originate in London, Riga, Stockholm and Rzeszow are thus more dispersed than the ones that stay within the Euro zone. At this point it should be mentioned, that the both flights are denominated in Euros when it when the originating airport is within the Euro zone, and both are denoted in foreign currency when the outward flights start outside the Euro zone. This holds true for both carriers. A possible reason for this effect is that the currency conversion hampers the comparability of the prices and hampers competition on these routes.

The dummy for the distance does not help to predict the dispersion in our model. However, can be an indicator that the dispersion is not oriented to the carrier's cost of a flight (which is assumed to be correlated strongly with cost). This means that the dispersion is likely not a type of "mark-up" rate over carrier's cost.

After all, the Ryanair dummy variable shows that the intertemporal dispersion of Ryanair and Lufthansa is not the same. At 5% significance, the regression says that the average combined return flight price on average moves around by 23 more Euros above or below the average price on the route than is the case with Ryanair. In the light of the market structure and

pricing strategy that was discussed this seems less surprising than would be initially thought. But what does the existence of Ryanair mean to the consumers? The additional competition brings about a low cost alternative which besides the opportunity to chose among more carriers, is likely to have an effect on the prices of competitors (cf. Dresner et al. 2006). Since price as well as dispersion is lower, it is reasonable that dispersion for the conventional carrier is lower as well. This is so in two ways: Firstly, for flexible consumers, the advantage of competition is most apparent as the limited flight times are appealing. Lowering the price would also decrease the level of fluctuation the customers are subject to, and reduces uncertainty. Secondly, Lufthansa may have less means to discriminate inflexible passengers when is less certain that fixed costs can be covered with economy class passengers.

Limitations and fields of improvement

The model is highly simplified. The variable for dispersion ($\sigma_{i,r}$) just captures the deviation from the average value that exists in one route of one carrier. That means there is no further breakdown of the intertemporal dispersion. Therefore we cannot distinguish between the different reasons the price dispersion which we should like to. One issue is the increase in prices as the flight date moves closer to booking date. Another is the strength of a seasonal effect in the popular vacation weeks. An appropriate advanced model should fit a polynomial regression to the course of the prices throughout the 15 weeks. The overall fare price of all flights, plotted against time, has a local minimum after four weeks, followed by a local maximum in the popular vacation weeks in the end of July and a flattening of price trend in the last weeks. A quartic regression seems approximate to approximate the general trend. The residuals should serve as a more precise basis to observe intertemporal dispersion that is independent of the general or market trends. Then three separate values for intertemporal price dispersion would provide better insight into estimating strategic discrimination. For instance, this would allow us to determine if the Euro-denominated fares are fluctuating less than their foreign currency counterparts (e.g. through simpler yield management and less discrimination), or if the price trend is flatter (e.g. caused by more flexible consumers who are not likely to pay high premiums for short-term bookings).

Furthermore, the data availability for the model is very limited. Observing the frequency of the flights per route could be telling as the Lufthansa flights are just one out of a spectrum of flight times that day. Thus, the more times that are available per day, the more likely there is to be a fitting time for a traveller with low flexibility and high propensity to pay a premium

for timely transport. From previous research (Borenstein & Rose, 1994), it seems frequency reduces dispersion. But when one company offers a high frequency schedule, it can charge premiums for times which are only serviced by themselves and no other carrier.

Moreover, the prices used in the database were collected on the basis of finding the lowest fare of the day. This is representative, assuming a flexible consumer who has no preference over times. For Ryanair the times were very limited and those relatively normal times were the same every week. At Lufthansa however, the times could fluctuate by 16 hours or more on the same day. If we had to chose a certain time each week, or a time window, both the general price level of the flights, as well as the dispersion should increase. Hence, in case a consumer is needing specific times to fly, the fluctuation of prices may lay well above the 23 Euro difference to Ryanair. Therefore, the dispersion figures are arguably underestimated for Lufthansa flights.

Moreover, the number of flights is limited to the overlapping routes. This bears the advantage that airlines' cost and location specific events have similar effects on the prices on both carriers. However, some disadvantages exist. Some routes contain airports that are dominated by Lufthansa. For instance, Dusseldorf and Frankfurt airport while others are not. In contrast, the alternative airports like Frankfurt Hahn and Dusseldorf Weeze are mainly serviced by Ryanair and a few, two or three, other low-cost carriers with complementing destinations. This lack in airport dominance leads to lower consumer loyalty and taking advantage thereof (c.f. Borenstein 1991).

Furthermore, the reason that Ryanair choses to services these exact routes may be due to the very characteristic of high dispersion found in the route prices (which could be used to proxy potential for profit) and may produce positive bias in the data. Thus, choosing overlapping routes does not necessarily provide us with a good sample over the average dispersion. Having available large amounts of prices (Piga and Bachis (2006) use about 650 thousand flights) would provide a good basis for dispersion analysis.

Conclusion

This paper gives proof of significant differences in intertemporal dispersion of the prices that Ryanair and Lufthansa charge. The collected data includes all routes (30) that Lufthansa and Ryanair have in common and capture how the prices of the future flights over the next 15 weeks are dispersed. Lufthansa's prices fluctuate by 22.97 Euros more than do Ryanair's fare

prices. Flights that were billed in non-Euro currencies (originated in non-Euro countries) were more dispersed that the ones billed in Euros.

Factors that drive dispersion are observed and should be tested empirically. The frequency of flights, the amount of competition and the type of consumers need to be included in the model to see if the difference remains. It is not possible to conclude that Lufthansa's pricing strategy allows for more strategic discrimination. However, given the market it serves it uses more price discrimination than Ryanair.

Appendix

Table 4

Breakdown of Ryanair fees

Currency	EUR	SEK	GBP	LVL	PLN
Luggage	20	220	20	14,40	25,20
Administrative Fees*	6	66	6	4,32	84,00
Total (for 2 flights):	52	572	52	37,44	218,40
Converted into EUR	**€ 52**	**€ 63,02**	**€ 58,49**	**€ 52,82**	**€ 55,45**

* This fee is waived when a Master Card Prepaid was used for payment. This discount is ignored.

Table 4 depicts the fees that were charged per two-way flights of Ryanair. These are subject to fluctuation through exchange rate changes.

Table 5

Exchange Rates
(Currency conversion on 10-06-2011)

	SEK	GBP	LVL	PLN
1 Euro	9,07680	0,88900	0,70888	3,93899

For the price conversion of flights originating in non-Euro countris, the exchange rates in table 5 were used.

Table 6
Common destinations
Ryanair, Lufthansa(April 2011)

City (airport, if in common)	Ryanair airport	Lufthansa airport
Austria		
Graz		
Klagenfurt		
Belgium		
Brussels*	Brussels Charleroi	Brussels National
Croatia		
Zadar airport (only seasonal service)		
Denmark		
Billund		
Estonia		
Tallinn (Lennart Meri)		
France		
Marseille (Marseille Provence)		
Nice (Cote d'Azur)		
Germany		
Berlin*	Schoenefeld	Tegel
Bremen		
Frankfurt*	Hahn	Frankfurt
Munich*	Memmingen	Munich
Dusseldorf*	Weeze	Dusseldorf
Hamburg*	Lubeck	Hamburg
Ireland		
Dublin*		
Italy		
Ancona (Ancona-Falconara)		
Bari (Karol Wojtyla)*		
Bologna (Guglielmo Marconi)*		
Cagliari (Cagliari-Elmas)		
Genoa (Cristoforo Colombo)		
Milan*	Bergamo	Malpensa
Palermo (Punta Raisi)*		
Pisa (Galileo Galilei)		
Rome*	Ciampino, Leornardo da Vinci-Fiumicinco	Leornardo da Vinci-Fiumicinco
Trieste (Friuli Venezia Giulia)		
Turin (Turin-Caselle)		
Venice (Marco Polo)*		
Verona (Villafranca)		
Latvia		
Riga (Riga International)*		
Lithuania		
Vilnius (Vilnius International)		
Malta		
Luqa		
Poland		
Gdansk (Lech Walsea)		
Katowice	Katowice	Pyrzowice
Poznan (Poznan / Lawica)		
Rzeszow (Rzeszow-Jasionka)*		
Wroclaw (Copernicus)		

*part of common routes, used in data

Table x continued
Common destinations
Ryanair, Lufthansa(April 2011)

City (airport, if in common)	Ryanair airport	Lufthansa airport
Portugal		
Faro		
Porto (Francisco de Sá Carneiro)*		
Spain		
Barcelona (El Prat)*		
Madrid (Barajas)*		
Malaga (Pablo Ruiz Picasso)*		
Palma de Mallorca (Son Sant Joan)*		
Valencia (Manises)		
Sweden		
Gothenburg (Gothenburg City / Ladvetter)	Gothenburg City	
Stockholm*	Stockholm-Skavsta	Arlanda
United Kingdom		
Birmingham		
Edinburgh*		
London*	Gatwick, Luton, Stansted	City, Heathrow
Manchester		
Newcastle upon Tyne		

*part of common routes, used in data

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