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645

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Berlin, November 2006

Opinions expressed in this paper are those of the author and do not necessarily reflect views of the institute.

IMPRESSUM

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http://www.diw.de

ISSN print edition 1433-0210
ISSN electronic edition 1619-4535

Available for free downloading from the DIW Berlin website.

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October 2006

Abstract

Using a sample of fare quotes for non-stop travel from New York to London, this paper investigates the dynamics of offered fares as the departure date nears. We find that the general trend is toward fare increase at an accelerated rate as the departure date approaches. Clear differences in price-setting strategies among the carriers competing on a particular route are documented.

Keywords: airline industry, price dynamics

JEL Codes: L93, D21

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1 Introduction

While a substantial amount of research has been devoted to analyzing the airline industry, relatively few facts are known about airline fares at the micro level. Morrison and Winston (1990) find that fares on any given market depend on the degree of competition and deregulation. It is also suggested that there is substantial dispersion of fares in the industry, the degree of which positively depends on competition (Borenstein and Rose, 1994; Stavins, 2001). The literature examining airport dominance initially suggested (Borenstein, 1989; Evans and Kessides, 1993; Berry, Carnal and Spiller, 1996) that within the US market airlines charge higher fares for trips to/from the airports where they have a dominant position. More recent evidence (Lee and Luengo-Prado, 2005) suggests that this apparent 'hub premium' can be explained by the passenger mix on these routes. It is common knowledge that the closer the departure date, the higher the fares become. Travel agents usually advise the public to take trips in the middle of the week because then prices seem to be lower. Yet, the dynamics of changes in fares as the departure date nears has not been studied. Nor is it clear how much less one can expect to pay if one chooses to travel during the middle of the week as opposed to embarking on a trip towards the end of the week.

Also, the above facts mostly tell us about the inter-market comparison of prices and/or average fares. The airport dominance literature suggests that there may be intra-market differences in the ways airlines set their fares. Indeed, Bilotkach (2006) detected that last-minute offered fares on the London-New York market were more dispersed across the airlines as compared to the advance-purchase ones. This paper, taking advantage of modern technology allowing easy collection of offered fares on the internet, both studies the dynamics of offered fares in the airline industry, as well as tests for potential differences in observed prices across airlines on a given route. We thus contribute to filling two important gaps in the literature on airline pricing.

We use the sample of offered fares (a total of over 70,000 fare quotes) on the London–New York route, collected in the autumn of 2005. We have a number of competitors on this market, which allows us to observe not only the general trend in fares as one moves closer to the departure date but also whether the dynamics of fare-setting is

similar or different across the airlines. We find the following (in addition to the well-known fact that tickets for travel mid-week are cheaper and that the price increases as the departure date nears). First, the rate of increase in offered fares accelerates as the departure date nears. Second, there are substantial observable across-airline differences in the dynamics of price changes.

Our paper provides the first evidence of differences across the airlines' price-setting strategies in a given market. The question of the reasons behind those dissimilarities is left open. Yet, it may be important to take the possibility of carriers employing different strategies into account in the future modeling efforts and data analysis exercises related to the airline industry.

The rest of the paper is organized in a straightforward way. Section 2 describes the data, Section 3 discusses results of the data analysis, and section 4 concludes.

2 Data

To address the question of whether or not individual airlines' price-setting strategies are different, we obviously need a market with a good number of competitors to allow for relevant comparisons. We have selected the New York-London route, since on this market we have seven carriers offering non-stop service. Those airlines are: American Airlines (AA), United Airlines (UA), Continental Airlines (CO), British Airways (BA), Virgin Atlantic (VS), Air India (AI), and Kuwait Airways (KU). In addition to those, MaxJet and Eos offer business-class only services between New York's JFK and London's Stansted airports. The market itself is one of the biggest international routes (second biggest after Taipei-Hong Kong market) and is comparable in size to the biggest US domestic markets[1]. The airlines' market shares are rather asymmetric, as evident from the following table, borrowed from Bilotkach (2007). This will allow us to examine not only whether the price-setting strategies are different across airlines, but also if there is any correlation between a particular airline's market share and an observed strategy. In addition to the above-mentioned advantages of using the New York-London route, we must note that one-stop competition on this market is hardly feasible (unlike, for instance,

[1] The number of seats offered on London-New York route (see Bilotkach, 2007) is only about 15% less than those of the biggest US market (Chicago-New York), and is about the same as on the second-biggest route in the US (Houston-Dallas)

on transcontinental routes within the United States), since any connecting service between New York and London will entail substantial increase in travel time (except for maybe service via Dublin or Shannon in Ireland).

Table 1 Market Shares on New York – London Market

Airline	Share of Seats Offered		Share of Passengers Carried	
	July 1999	July 2004	July 1999	July 2004
British Airways	33.7%	34.9%	32.4%	34.1%
Virgin Atlantic	18.0%	24.0%	18.4%	24.6%
American Airlines	17.0%	18.9%	17.5%	19.0%
Continental Airlines	6.8%	8.0%	7.1%	8.4%
United Airlines	11.6%	6.4%	12.0%	6.5%
Air India	5.6%	5.9%	5.8%	5.7%
Kuwait Airways	1.7%	1.7%	1.6%	1.6%

Source: Bilotkach (2007). Only schedules services have been used in calculations

For the purpose of data collection, we use expedia.com – a leading on-line travel company directly linked to several major global distribution systems. This ensures that fare quotes obtained on-line will be similar to those one would get through an 'off-line' travel agent. We collected the data for 60 days, from September 22 until November 21, 2005. The fare quotes were obtained daily, for one-way travel between a New York City area airport (JFK or Newark Liberty, joint airport code NYC) and a London area endpoint (either Heathrow or Gatwick, joint code LON). We sought fare quotes for travel on each of the next 60 days and for the first full week of each of the 4 months following the initial 60-day period. For example, on November 1, 2005 we collected the fare quotes for the next 60 days up to January 1, 2006, as well as the quotes for travel during each day of the first full week of January, February, March and April. Only economy class fare quotes were collected, and we recorded fare quotes for all non-stop flight options offered by expedia.com. This allows us to see if there are any differences in offered fares between the morning, afternoon, and evening departures, other things equal.

One surprising result of our data collection exercise is the discrepancy between the airlines' market shares and the shares of quotes in our sample, as evident from Table 2. This happens due to absence of fare quotes for a number of airlines (most notably British Airways and American Airlines) for dates closer to the departure. The most likely

explanation of this fact is that some airlines fill up their economy class cabin more quickly than the others, either due to the differences in price-setting policies, or because their economy class cabins occupy a smaller share of the aircraft. Moreover, airlines' overbooking strategies can be different: while some carriers may stop posting price offers once a cabin is full, others may continue offering high fares, resulting in overbooked flights. Also, the market shares may not be perfectly correlated with the number of fare quotes observed since different airlines may offer different frequency of service, while carrying the same number of passengers, by using aircraft of different size.

Table 2 Breakdown of Sample by Airlines

Airline	Number of Fare Quotes	Share of Fare Quotes, %	Mean of Fare Quotes	Standard Deviation of Fare Quotes
Air India	9 568	13.03	517.52	303.64
American Airlines	8 693	11.84	779.97	76.12
British Airways	10 990	14.96	770.35	10.86
Continental	10 365	14.11	775.58	79.47
Kuwait Airways	1 985	2.70	753.45	116.59
United Airlines	4 741	6.46	784.61	228.21
Virgin Atlantic	27 102	36.90	445.90	261.06
Total	73 444	100.00	620.03	259.02

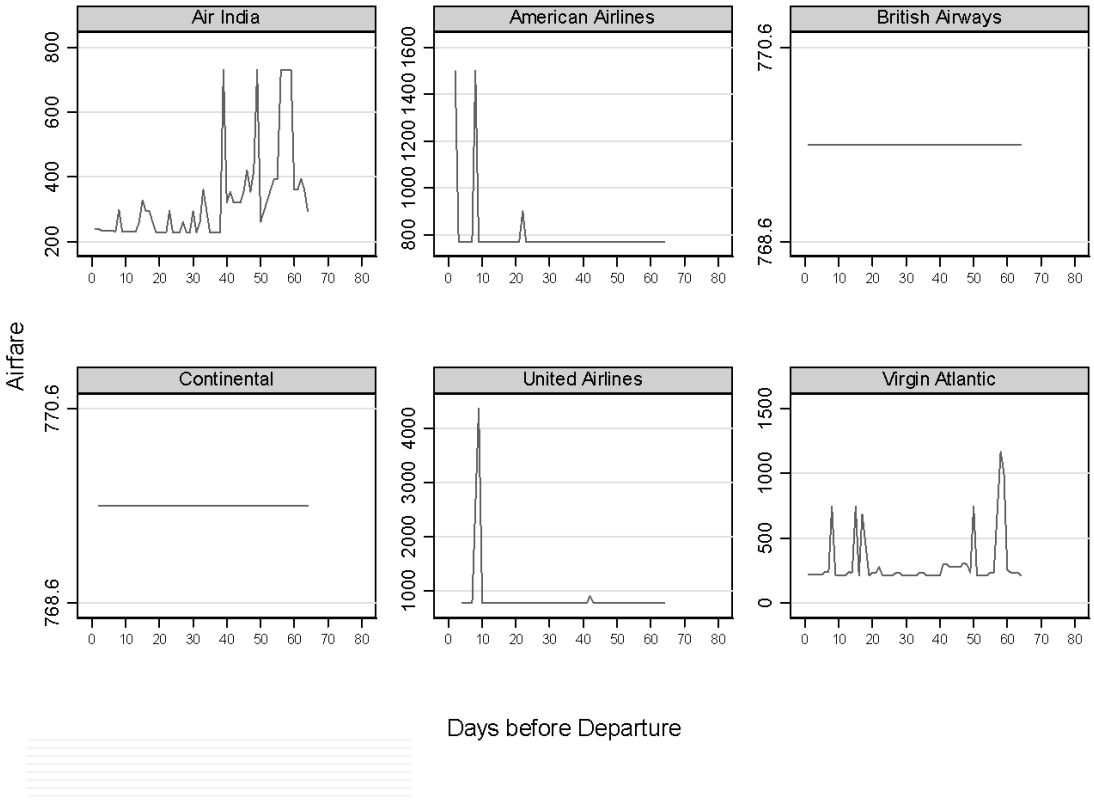
The average one-way fare in our sample (including all applicable taxes and fees) is $620.03, with the standard deviation of $259.02. Of all fare quotes, about 17% are for flights departing in the morning (before noon). An average inquiry yields 14.31 fare quotes, or two quotes per airline, with the standard deviation of 2.79.

If we compare our average offered fare to the same as collected by Bilotkach (2006) for the same market, our data will imply a round-trip fare which is about $150 lower. Yet, Bilotkach's data contain a larger share of last-minute fares as compared to our sample.

Let us look at the snapshot of the raw data. Figure 1 presents the fare quotes of six different airlines (excluding Kuwait Airways), as collected on November 5, 2005. It is obvious that there are discrepancies in the ways the airlines decide on one-way offered fares. For example, while BA and CO offer the same (and almost identical) fares no matter how far in advance you would like to purchase, VS and AI vary their fares to a large extent. It is not, however, clear whether the latter two airlines' strategies are similar

or different. Also note that the figure below represents a snapshot at one of the sixty days of data collection. While some discrepancies are suspected, it is not clear how systematic they are. Yet, Table 2 suggests that the picture we observe in Figure 1 is an accurate representation of the entire sample. Virgin Atlantic and Air India are seen offering one-way fares which are lower than those offered by other carriers on the market; also, the distribution of fares offered by British Airways and Continental Airlines appears the least dispersed.

Figure 1 Snapshot of Raw Data, Collected on November 5, 2005



3 Results

We subjected our data to relatively simple regression analysis. The quoted fare will be the independent variable in all regressions. The following dependent variables are used. First, we include the interval (in days) between the date of obtaining the fare quote and the flight departure date, as well as that interval squared. Second, we use airline

dummies, and interaction of those with interval and interval squared (Air India is the baseline category here). Third, dummies for the day of the week on which flight is scheduled are included (Monday is the baseline). Finally, other controls are the indicator variable for morning departures, purchase weekday[2], and the number of fare quotes collected at the same query as the present fare quote (which can be construed as a measure of competition). We also suspected seasonal differences due to major holidays falling within the range of our data collection; yet, including indicator variables for Thanksgiving week and winter holidays (November 21-27, 2005 and December 19, 2005 through January 7, 2006) did not change the results in any fundamental way.

Table 3 below presents the main regression results. Three specifications are reported, with different combinations of control and airline-specific variables. Table 4 reports results of F-tests for equality of coefficients on airline dummies, as well as those on airline dummy-interval and airline dummy-interval squared interactions; the third specification reported in Table 3 is used as the unrestricted model for the relevant tests.

[2] The day of the week on which the fare quote was obtained.

Table 3 Regression Results

Regressor	(1)	(2)	(3)	*Regressor*	(1)	(2)	(3)
Interval	-1.0650*** (0.0806)	-0.8724*** (0.2311)	-0.8720*** (0.2311)	*Interval * Continental*	-0.5212*** (0.0591)	0.4468* (0.2492)	0.4461* (0.2492)
Interval^2	0.0078*** (0.0003)	0.0066*** (0.0013)	0.0066*** (0.0013)	*Interval * Kuwait Airways*	-0.6007*** (0.0803)	0.0962 (0.4028)	0.0962 (0.4026)
Morning	2.5744 (1.8923)	4.7334** (1.8808)	4.6824** (1.8804)	*Interval * United Airlines*	-0.7066*** (0.0812)	0.0399 (0.3833)	0.0420 (0.3834)
Fare Quotes	-6.5818*** (0.4161)	-6.5538*** (0.4158)	-6.7052*** (0.4177)	*Interval * Virgin Atlantic*	1.2787*** (0.0629)	-0.6333** (0.2597)	-0.6348** (0.2597)
American Airlines	298.0943*** (5.3243)	285.0934*** (8.1013)	285.0233*** (8.1002)	*Purchase: Tuesday*			-3.3718 (2.7144)
British Airways	274.5962*** (5.0457)	244.8598*** (7.4269)	244.8505*** (7.4273)	*Purchase: Wednesday*			-1.8136 (2.8228)
Continental	287.9561*** (5.2906)	263.7706*** (8.1674)	263.7494*** (8.1663)	*Purchase: Thursday*			1.5297 (2.8115)
Kuwait Airways	280.0563*** (7.8623)	262.2774*** (14.6774)	262.2778*** (14.6665)	*Purchase: Friday*			1.9270 (2.8343)
United Airlines	309.5654*** (8.4330)	290.9074*** (14.1164)	290.8016*** (14.1199)	*Purchase: Saturday*			-10.2606*** (2.9016)
Virgin Atlantic	-127.186*** (5.4796)	-84.0164*** (8.1769)	-83.9325*** (8.1762)	*Purchase: Sunday*			-1.8154 (2.7444)
Departure: Tuesday	-20.0384*** (3.2406)	-19.9258*** (3.2328)	-19.8415*** (3.2327)	*Interval*^{2} ** American Airlines*		-0.0030** (0.0014)	-0.0030** (0.0014)
Departure: Wednesday	-19.1992*** (3.2962)	-18.8211*** (3.2919)	-18.8665*** (3.2933)	*Interval*^{2} ** British Airways*		-0.0075*** (0.0013)	-0.0075*** (0.0013)
Departure: Thursday	-25.1144*** (3.1595)	-25.5660*** (3.1492)	-25.4334*** (3.1480)	*Interval*^{2} ** Continental*		-0.0057*** (0.0014)	-0.0056*** (0.0014)
Departure: Friday	-9.4105*** (3.3031)	-9.5210*** (3.2912)	-9.4811*** (3.2899)	*Interval*^{2} ** Kuwait Airways*		-0.0040* (0.0021)	-0.0040* (0.0021)
Departure: Saturday	0.3948 (3.3173)	0.0495 (3.3062)	0.0506 (3.3048)	*Interval*^{2} ** United Airlines*		-0.0043** (0.0020)	-0.0043** (0.0020)
Departure: Sunday	-8.3617** (3.6507)	-7.9833** (3.6467)	-8.1415** (3.6460)	*Interval*^{2} ** Virgin Atlantic*		0.0123*** (0.0015)	0.0123*** (0.0015)
*Interval * American Airlines*	-0.6028*** (0.0592)	-0.0866 (0.2452)	-0.0869 (0.2452)	*Constant*	639.6830*** (9.5469)	634.7646*** (11.0119)	638.9186*** (11.3928)
*Interval * British Airways*	-0.3742*** (0.0576)	0.8511*** (0.2318)	0.8500*** (0.2318)	*Adjusted R-squared*	0.40	0.41	0.41

Notes: Asymptotic standard errors are in parentheses. Price is the dependent variable in all regressions.
The omitted weekday is Monday. The omitted airline is Air India.

*** Significant at 1%.

** Significant at 5%.

Table 4 Pair-wise Comparisons of Airline-Specific Variables

Panel A: Airline Dummies

	American	*British Airways*	*Continental*	*Kuwait Airways*	*United Airlines*
British Airways	0.0000				
Continental	0.0000	0.0000			
Kuwait Airways	0.0831	0.1716	0.9112		
United Airlines	0.6432	0.0001	0.0307	0.1009	
Virgin Atlantic	0.0000	0.0000	0.0000	0.0000	0.0000

Panel B: Airline Dummy – Interval Interactions

	American	*British Airways*	*Continental*	*Kuwait Airways*	*United Airlines*
British Airways	0.0000				
Continental	0.0000	0.0000			
Kuwait Airways	0.5898	0.0224	0.3070		
United Airlines	0.6846	0.0084	0.2074	0.9041	
Virgin Atlantic	0.0002	0.0000	0.0000	0.0371	0.0392

Panel C: Airline Dummy – Interval Squared Interactions

	American	*British Airways*	*Continental*	*Kuwait Airways*	*United Airlines*
British Airways	0.0000				
Continental	0.0000	0.0002			
Kuwait Airways	0.5439	0.0334	0.3262		
United Airlines	0.3949	0.0384	0.3987	0.8856	
Virgin Atlantic	0.0000	0.0000	0.0000	0.0000	0.0000

Note: F-test is used for relevant comparisons. The unrestricted model is specification (3) from Table 3. The reported numbers are p-values.

Table 3 shows the existence of both the general trend in the dynamics of offered fares, and the airline-specific effects. If one looks at the coefficients at the interval and interval-squared variables, it is easy to see that the general trend implied by our sample is for offered fares to hit the minimum approximately 66 days before the flight[3] and increasing afterwards at an increasing rate. Offered fares for travel on Monday and Saturday appear higher as compared to other days (with Tuesday to Thursday departures showing the lowest fares on average). On the other hand, one is more likely to get a better deal searching for flights during the weekend. This is understandable, as we can expect most of the travel arrangements (especially by travel agents and corporate travel departments) to be done during the week. Fares offered for morning flights appear higher too, while the total number of fare quotes (other things equal) is associated with the lower

[3] If we take regression 3 from Table 3, the general trend can be described as $Fare(Interval) = 638.92 - 0.872 * Interval + 0.0066 * Interval^2$, a polynomial reaching the minimum at approximately $Interval=66$.

quoted fare (which is tantamount to the "more competition means lower price" conclusion).

Table 4 shows that there are both similarities and differences in observed dynamics of the setting of one-way offered fares across the airlines. Virgin Atlantic is the only carrier whose coefficients are different from those of the other airlines at least at 5% significance level (regression results suggest that VS coefficients are significantly different from AI's, too). On the other hand, United Airlines' dynamics of price setting appears very similar to that observed for American Airlines, Kuwait Airways, and (to a lesser degree) Continental Airlines. British Airways' and Continental Airlines' observed strategies, however similar they make look at the first glance (see Figure 1), appear totally different once examined more carefully.

Thus, in addition to confirming some of the well-known facts about the dynamics of the price-setting in the industry (i.e. fares are higher closer to the departure date), we can more closely trace the trend of increases in the offered fares (we determined that the general trend is for fares to increase at an increasing rate, as the departure date nears). Also, we have observed rather significant differences in both levels and the dynamics of price-setting across the airlines operating within the same market. Further, there is no apparent link between the carrier's market share and its price-setting strategy. The three major players on the market, American, British, and Virgin Atlantic, appear to employ different strategies; yet, some of the price-setting dynamics we observed for the major players look similar to that of the 'fringe' firms (e.g. American Airlines and Kuwait Airways).

4 Concluding Comments

This paper provides new evidence on price-setting strategies employed by the airline companies. By examining a large sample of fares offered by the airlines operating in the London-New York market, we are able to observe that the apparent general trend is for offered fares (after hitting the minimum about two months before the scheduled departure date) to increase at an accelerated rate. Also, there are differences in observed dynamics of price-setting across the airlines. Furthermore, we are unable to deduce any correlation between the observed across-carrier similarities and differences and the airlines' market

shares. It is interesting to note that Bilotkach (2006), while studying dispersion of the offered fares on the same market, determined that the offered fares for last-minute travel were higher for the airlines with lower market share.

The conclusion that airlines appear to employ different price-setting strategies is very interesting since it sheds light on the interaction between the carriers on a day-to-day basis. If we try linking our results to the theoretical models of strategic interaction between the airline companies, we can say that the carriers' best-response functions appear to be different. Answering the question of which model of strategic interaction our results are consistent with is beyond the scope of this paper; yet, the existence of strategic differences across the airlines studied is an important consideration for future research endeavours.

The easiest ways to criticize our analysis would be by pointing out that we only examine one market and that only one-way offered fares are included. Here we should say that, first of all, the market we selected both has many competitors and the price dynamics we observe here is very unlikely to be influenced by actions of one-stop competitors, due to sheer lack thereof. Second, an exercise in gathering fares for return trips would be a much more tedious endeavour, due to the huge number of such fares offered for any given departure date, depending primarily on the duration of the trip. We would need to necessarily select a sub-set of the return trips, and such a selection would necessarily be arbitrary. It is also possible that the airlines could employ more similar strategies in setting the fares for the return trips than those we observed in our sample of offered one-way fares. We leave this question to future research.

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