

Distribution of Airline Tickets: A Tale of Two Market Structures

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Abstract

This paper uses evidence from the travel services distribution industry to examine the impact of intermediaries that are supposedly pure distributors on the final price quotes observed by the customers. Simple analysis of incentives allows us to state that the interaction between the airlines and the distributors is likely to be more complicated than what first look at the market structure suggests. We then analyze a sample of fare quotes, collected from the three leading on-line travel agents on fifty large US airline markets. Looking at the lowest fares available, we detect the suspected relationship between the lowest fare quote and the number of travel agents offering same: the fewer agents offer the lowest fare, the higher the fare is, and the effect is more pronounced on those airline markets which are less competitive. Also, we find individual agents appear to discriminate for or against individual airlines when deciding whether or not to report airlines' lowest offered fare quotes. These patterns are consistent with the basic analysis of the airlines' and distributors' incentives implied by the industry structure.

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1. Introduction

The vertical relationships literature has considered situations where both producers and retailers have a degree of market power. On one hand, retailers may have certain freedom in deciding what price to charge to the final consumers. On the other hand, large retailers may also pressure producers (Wal-Mart is a classic example; see also Comanor and Rey (2000) for a formal treatment of this topic). At the same time, producers may pressure retailers via resale price maintenance. The interplay of producers' and retailers' bargaining power, in addition to the structure (both horizontal and vertical) of product and distribution markets eventually determine the sticker price faced by an unsuspecting consumer.

In the end, the final sticker price consumers will observe can be affected by the structure of the distribution market as much as (if not more than) by the competition on the market for the good or service itself. The price you will pay for your next car will be determined not only by how many car manufacturers are out there, but also by how many dealerships there are in your area (other factors, such as your ability to bargain, will also play a role). Toys "R" Us, a major US retailer of (as the name suggests) toys managed to successfully pressure the toy manufacturers, which affected prices consumers ended up paying².

On some important markets, the role of retailers appears to be limited to mere distribution of the product or service, at prices determined by the producers – a rather extreme form of resale price maintenance. The producers use such retailers to ensure that as many customers as possible are aware of the product or service; the retailers make money out of commission paid by producers, or by charging fees to the final customers. One such market is that for distribution of travel related services (airline tickets, hotel rooms, rental cars, etc.). Producers on this market retail their services both independently and via travel agents, linked to the computer reservation systems. Retailers do not specifically mark up the producer's price (they can and do charge consumers some booking fees – see next section for more details). It therefore appears that the role of travel agents on this market is 'technical', so the prices consumer observes should be

² The retailer's conduct was determined illegal by the Court of Appeals; see *Toys "R" Us, Inc. v. FTC*, 221 F.3d 928 (7th Circuit, 2000)

determined only by the competition between the producers. In this paper we challenge this contention and show that in fact the structure of the distribution market matters, both from the theoretical point of view, and as suggested by our data analysis.

Analyzing airlines' and distributors' incentives given the structure of the market, we can suggest the following. First, individual distributors will have a strong incentive to obtain exclusive rights for distribution of the airlines' discounted tickets. Second, the competing airlines can potentially exploit their repeated interaction and presence of the less informed customers to sustain an equilibrium whereby each carrier offers its discounted fares via different distributor(s) than its competitor(s); the fares will then be higher than they would be were all competitors to offer their best deals via all the available channels due to presence of the 'underinformed' consumers. Taken to data, these conclusions will imply that: (a) certain distributors may discriminate for or against certain airlines; and (b) the more travel agents offer the airlines' discounted fares, the better a deal a customer may be able to get.

For the empirical study, we compare last minute fare quotes obtained (nearly simultaneously) via the three leading on-line travel agents (Expedia, Travelocity and Orbitz) for a sample of fifty US airport-pair markets. We collected the data in October-November 2006, twice a week for four weeks. The data analysis revealed some discrepancies in offered airfares across the travel agents (even where the agents were technically linked to the same computer reservation system). We also found that when an additional travel agent offered the lowest available fare, this fare was about 3 percent (\$11.80 on average) lower, holding other things constant. The downward effect of the ticket distribution market structure was more pronounced for less competitive airport-pair markets; this suggests that ticket distributors appear to try getting under the umbrella created by the airlines on the less competitive routes.

Further analysis revealed that individual travel agents appear to discriminate either for or against individual airlines when choosing whether or not to report the lowest fare quotes offered by the carriers, consistent with what analysis of the incentives on the market predicted.

Our results have the following implications. Broadly, we show that the structure of the distribution market should not be taken for granted even where its role appears to

be that of pure distribution, and where retailers simply sell the product at prices set by the producer. Also, our study adds to the evidence that spread of the internet leads to more product differentiation (as suggested by studies by Clay et al., 2002, Baye et al., 2004, and Bilotkach, 2007 for the airline industry) rather than convergence to the law of one price due to elimination of the search cost (evidence to this effect can be found in Brown and Goolsbee, 2002).

Studies offering analysis of samples of offered fares started re-emerging recently (the first such work can be traced to Stavins' 2001 study of price dispersion in the US airline industry); and this literature can be expected to grow at a fast pace in the near future. Among the topics addressed in this literature are price dispersion (Bilotkach, 2006; Escobari, 2005; Escobari and Gan, 2007; Giaume and Guillou, 2006); price dynamics (Piga and Bachis, 2006; Button and Vega, 2007); and fare comparison across booking engines (Chen, 2006; Clemons et al., 2002). The latter two papers are the most similar to our study, and exhibit different results. Chen showed little disparity in fares quoted by the major on-line travel agents (Travelocity and Orbitz) and by the airlines themselves on the New York – Los Angeles air travel market. Her results do suggest structure of the distribution market is important. In particular, fares quoted by a single source in her sample are higher than those quoted by multiple sources. This is the sort of pattern we observe in our sample, for fifty airport-pair markets. Including more markets allows us to also talk about the role of the airline market structure, in addition to that of the distribution market. Clemons et al., however, observed substantial differences in fare quotes across the five unidentified on-line travel agents.

The rest of the paper is organized as follows. Section 2 describes institutional details of the ticket distribution market. Section 3 analyzes airlines' and distributors' incentives in light of the present market structure. Section 4 describes, and Section 5 analyzes the data. Section 6 discusses our results and concludes. List of the airport-pair markets used for our analysis is in the Appendix.

2. Ticket Distribution Market

The visual scheme of distribution of travel services (using the example of airline tickets) is presented on Figure 1. An airline can sell its tickets either directly (using its call-center or web-site) or via the travel agents, by posting its fares into one or several computer reservation systems (CRS), which those travel agents access to make the bookings. Arrangements whereby a travel agent accesses a single CRS are the most common ones; CRS do not normally charge the agents for such access (there is some anecdotal evidence that reservation systems pay the agents that choose them). Prior to 2001, the total price end customer paid for the ticket did not depend on the source via which the ticket was distributed: the airline paid both commission to the travel agent selling the ticket and a booking fee to the computer reservation system involved.

Following the events of September 11, 2001, the airlines (looking for ways to control costs) gradually stopped paying travel agent commissions, so that the agents had to start charging booking fees (which mostly fell in the range of \$5-25 per ticket³) to their customers. Thus, booking the same ticket directly with an airline, one could save \$5-25 as compared to making this very reservation via a travel agent. What is interesting is that given the airlines no longer appear to be paying commission, and given presence of the computer reservation systems, it looks like there is are not direct connections between the airlines and the travel agents. We will return to this issue later in the paper.

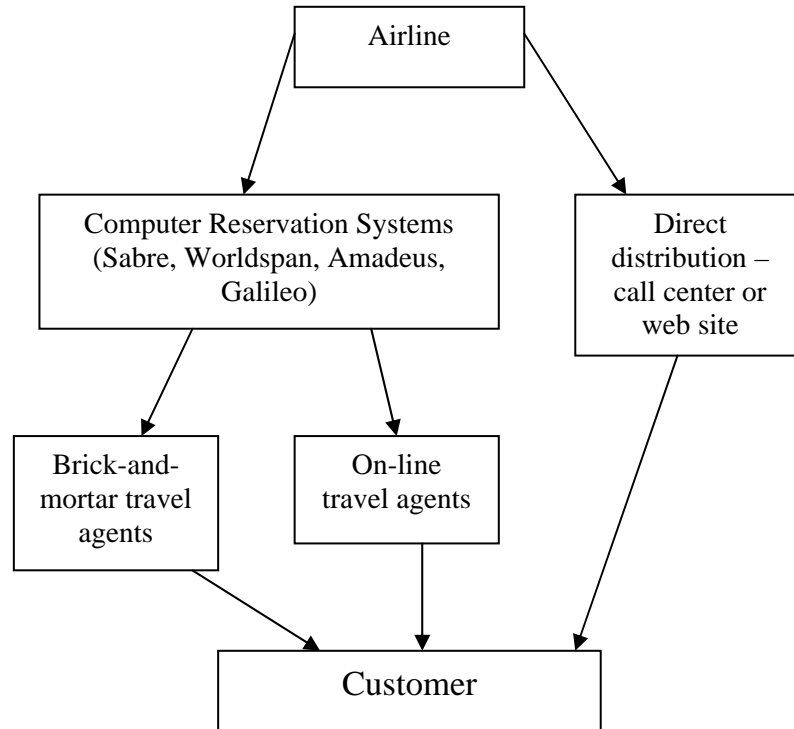
The main difference between the on-line and brick-and-mortar travel agents is supposed to be that with the on-line agent the end customer can observe the search results directly; whereas with the brick-and-mortar agency it is the agent who looks at the screen and communicates available options to the customer. Brick-and-mortar agents are claimed to offer more personalized service; yet, on-line agencies are moving into that territory as well.

Obviously, travel agents are in business of more than mere distribution of airline tickets: they provide a range of travel related services (hotel and rental car reservations; selling vacation packages, etc.) and are able to provide their customers some complementary (and usually free) expert information on travel services providers and/or

³ Some agents (e.g., www.priceline.com) waive booking fees on some itineraries; others may charge different fees depending on the itinerary's complexity.

trip destinations. At the same time, the airlines also are moving in the direction of offering the full range of services one can expect from a regular travel agent⁴.

Figure 1. Airline ticket distribution scheme



For the travel agent to see the airline's fare quote, it must be posted with the CRS this agent connects to. The computer reservation systems were originally developed and owned by the airlines; but have later taken a life of their own as independent companies. On this side of the market we currently have four major players: Sabre (with about 45 percent market share on the US market and over 30 percent on the global market), Worldspan (over 25 percent US market share and 15 percent worldwide), Galileo and Amadeus (share of these two systems on the US market keeps declining while they remain solid players on the worldwide arena, with combined market share of over 50 percent).

⁴ When booking a ticket on an airline's web-site, one now has a possibility of adding a hotel and a rental car to his/her reservation, without leaving the site. Some airlines also offer vacation packages through their (or related) web-sites.

The airlines are currently free to choose which systems to participate in and at what level to do so⁵. Most carriers do participate in multiple systems actively. An exception is Southwest Airlines, which only participates in Sabre at a low level, so that a potential customer will not be able to book this airline's flights via an on-line travel agent linked to Sabre⁶. Another such carrier at the time of our data collection was JetBlue Airways. This airline, however, started actively participating in Sabre in late 2006 and began posting its fares with Worldspan later in 2007. As for the on-line travel agents covered by this study, Travelocity is linked to Sabre, whereas Expedia and Orbitz⁷ are both linked to Worldspan CRS.

The internet has altered the ticket distribution business dramatically. Emergence of on-line travel agents was the major innovation in the industry. Airlines also saw a huge potential in selling their tickets via their own web sites. As a result, in a matter of about three years (from 1999 to 2002) the airline ticket distribution business went from the one dominated by the brick-and-mortar agents who sold almost three quarters of all tickets in 1999 (the airlines sold the rest directly, predominantly off-line) to the one with on-line travel agents' market share of 15 percent, and 10 percent of all tickets sold by the airlines on-line⁸. According to the most recent available estimate by Citigroup Investment Research, quoted by Forbes, in 2005 on-line travel agents have captured over 25 percent market share in the airline ticket distribution industry⁹.

The on-line travel agent segment of the ticket distribution market is in turn dominated by the three major players which are included into our study: Travelocity (owned by Sabre CRS), Expedia (founded within Microsoft in 1995, and an independent publicly traded company since 2005) and Orbitz (started through a partnership of several major airlines in 2001, currently a subsidiary of Travelport, owned by the Blackstone Group – a private equity company). According to the US Department of

⁵ Initial CRS regulation, adopted in 1984, stipulated that an airline owning or marketing a CRS must participate in competing systems. This rule was scrapped in 2004.

⁶ Bilotkach (2007) demonstrates that this strategy allows Southwest Airlines to take advantage of the travelers making their arrangements shortly before the departure.

⁷ Orbitz is also owned by Travelport, an owner of Galileo, the other major CRS. We have however found no indication of direct linkage between the travel agent and this CRS, possibly related to the low market share of Galileo on the US market, where Orbitz operates.

⁸ The numbers are from "Computer Reservations System Regulations: Final Rule", 14 CFR Part 255

⁹ *Online Travel Gets Personal*, Forbes.com, posted 02/17/2006

Transportation¹⁰, in 2002, 28.5 percent of all bookings with on-line travel agents were on Travelocity; 28.7 percent – on Expedia and 21.3 percent on Orbitz, for the total of 78.5 percent of all on-line travel reservations. Assuming the combined market share of these three biggest players remained similar as of current time, we can say that approximately one in five trips are booked via these three big on-line travel agents. Thus, our study encompasses the on-line travel agent industry quite well, and the segment we are looking at is a non-trivial part of the U.S. air travel distribution market.

3. Airlines' and Distributors' Incentives

This section discusses the implications of the structure of the distribution market described in the previous section for incentives of both airlines and distributors (whether computer reservation systems or travel agents). The analysis that follows will make use of the following simple stylized facts about the markets in question. First, an airline sells both discounted and full fare tickets, and a discounted ticket is more likely to sell due to simple law of demand. Second, when searching for a ticket, consumers vary in how informed they are about the available options.

As an illustrative example, consider the case of a single airline and two distributors, with the airline selling both discounted and full fare tickets at exogenously determined prices. Discounted tickets sell with certainty, but full fare tickets sell with probability lower than one (since some consumers' willingness to pay is lower than the price of the full fare ticket). Further suppose the number of tickets is determined outside of our analysis. Assume a distributor receives a fixed fee regardless of the price of the ticket it sells.

Next, suppose consumers are heterogeneous in that some of them observe price quotes only from a single distributor, whereas others are able to observe quotes offered by the airline via both distributors. At the same time, suppose that each distributor is visited by a sufficient number of customers, so that the airline could sell all its discounted tickets via a single distribution channel.

Given that ticket prices and the number of tickets offered for sale are determined outside of our exercise; the airline is interested in simply selling as many tickets as

¹⁰ See "Computer Reservations System Regulations: Final Rule", 14 CFR Part 255

possible. Each of the ticket distributors will be interested in making sure it sells as many of the airline tickets as possible. Next, since the discounted tickets sell with certainty, the airline will not really care via which channel they are sold¹¹. At the same time, each of the travel agents will have a clear incentive to ensure the airline sells as few of the discounted tickets via its competitor as possible. As for the full fare tickets, since those sell with lower probability, the airline will want to retail those via both distribution channel, since overlooking one of the channels will lead to some of the full fare tickets going unsold.

The above thought experiment is a very stylized one; at the same time, it shows an important feature of the way incentives are likely to be structured in the travel distribution industry. Specifically, each of the travel distributors will want to retail as many of the tickets which sell with higher probability as possible; presumably willing to pay the airline for the exclusive retailing right. The airline, on the other hand, may be indifferent between retailing its discounted tickets via only one or both distributors. The situation with the full fare tickets is however different: here the airline will want to ensure that those tickets are sold via as many channels as possible.

Thus, if the above described incentives are at work in this industry, we should expect the following from our data:

- There will be differences in the lowest fare quotes across distributors (stemming from possible exclusive dealing between the airlines and the agents);
- Travel agents may be observed as “preferring” some airlines over the others, consistently reporting an airline’s lower fare quotes while other agents will not do it.

When we introduce competing airlines, focusing on the discounted fares, we can take our thought experiment further, yielding more interesting results. The trick here is that if you are the only airline offering discounted fare tickets through a certain distributor, you can charge higher price to take advantage of the less informed consumers. This is a typical result which emerges in the pure price competition models where some of the consumers do not observe prices charged by both competitors. Such equilibrium can be sustained via repeated interaction among players both across time and

¹¹ This will actually be true (with some qualifications regarding the shares of customers informed about only one of the two distributors) even if discounted tickets sell with higher probability than full fare tickets – details are available from the corresponding author upon request.

markets (e.g., Evans and Kessides, 1994, show importance of the multi-market conduct in pricing decisions in the U.S. airline industry).

The above fact has a very interesting implication for the data analysis. First of all, due to various across-airline and across-distributor heterogeneities, equilibria where airlines only offer their discounted fares via some of the available distribution channels are likely to both be asymmetric in terms of prices, and imply higher price as compared to the cases where all airlines distribute their fares via all the distributors. Such a behavior will likely be manifested via the lowest observable fare quotes. Specifically, where competing airlines will not be offering their discounted fares via all available distribution channels; we may observe the lowest fare quote offered by fewer distributors. Moreover, this lowest fare quote that will be offered by fewer distributors may be higher than the lowest fare quote (other things equal, of course) resulting from competing airlines distributing their quotes via all available outlets. We can therefore anticipate *that more distributors offering the lowest fare will be associated with lower price quotes in the data.*

The exercise we have described here is obviously simplistic, naïve and not formal at all. In fact, we see a multitude of options for trying to formalize our analysis. We have however chosen to stick to a ‘thought experiment’ way of presenting the players’ incentives, since either of the formal models will probably miss some important features of the market structure; also, a formal analysis would ‘lock’ the reader into a particular way of thinking about the firms’ incentives, leading him/her away from the bigger picture, which is what our study is about. Through our thought experiments we are able to outline the basic incentive structure that can be expected from interaction between airlines and distributors of their services. Specifically, when some consumers are uninformed (or differ in their search cost), intermediaries (travel agents) can help sustain higher prices by posting discounted fares selectively. With repeated interaction, these higher prices can be sustained through some form of tacit collusion. We have also been able to formulate some concrete expectations as to how those incentives will likely be reflected in the data.

4. Data Collection and Description

4.1 Collection Process

For this study, we collected fare quotes via the three leading on-line travel agents (Travelocity, Expedia and Orbitz) for randomly selected fifty out of 100 top US airport-pair markets, as measured by the number of passengers traveling non-stop¹². This approach necessarily meant we have included many markets originating at a hub of a major carrier (in particular, Atlanta, Denver, and Dallas-Fort Worth airports). The data collection was centered around the notion of a traveler embarking on a short trip, and making his travel arrangements shortly before the departure. This allows working under an assumption that the traveler's uncertainty about whether or not he is going to fly has been realized. Thus, whether the ticket is refundable or not is beside our hypothetical customer's concern, allowing him to simply search for the best deals available¹³.

Our traveler was assumed to have strong preference for a given airport pair, while willing to accept one-stop flights in either or both directions. We considered the case of directional airport-pair markets, so that, for instance, JFK–Los Angeles market was different from Los Angeles–JFK one. The list of all airport pairs included into our analysis is presented in the Appendix.

We were collecting the fare quotes from October 20 to November 17, 2006. Fare quotes were collected on Tuesdays (for departure on Thursday and return on Saturday of the same week) and Fridays (for departure on the nearest Sunday and return on the following Tuesday). We ended up collecting the data on nine different dates. For each airport-pair market on each day of data collection we attempted achieving near simultaneity of obtaining the fare quotes by launching three browser windows in parallel.

It should be clearly noted here that we were searching for the lowest fare quotes for a given combination of the departure and return days, without giving any regard to the departure time of the flights. We should note, however, that most of the time the lowest available fare quotes are applicable to a number of roundtrip journey combinations, involving flights at different times of the day.

¹² We used T-100 dataset for 2005 to determine what those markets were.

¹³ One may suggest our hypothetical traveler might prefer some flexibility regarding the time of the return flight. However, once the fundamental travel uncertainty has been realized, the problem of purchasing a refundable versus a non-refundable ticket becomes similar to the choice between a lottery and a certain outcome (non-refundable discounted tickets carry the possibility of making a change for a fee).

The data collection process was not, unfortunately, devoid of problems. Due to the computer troubles on our side, we were unable to complete the data collection process on October 20, November 3 and November 7; covering only half of intended markets on the latter date and about 85 out of 100 on the other two. As a result, we obtained 823 date-airport-pair markets observations out of 900. Further, Orbitz web site was down for maintenance at the time of data collection on October 27, meaning we did not observe any fare quotes by this on-line travel agent for that date. On each of the other dates, we were able to obtain offers from each of the three on-line travel agents.

4.2 Descriptive Statistics

Normally, each request for fare quotes to an on-line travel agent results in multiple offers from various airlines, from which a customer selects the most preferred option using (un)certain criteria related to characteristics of an itinerary. Price and convenience (departure time, total duration of the trip and time between flights, if any) are the most obvious such characteristics. Additionally, some customers may be willing to pay a premium for flying with their ‘preferred’ airline. In this study we largely ignore the non-price characteristics associated with various offers and focus on price alone. The main reason for doing so (except for trying to avoid complicating the analysis) is that differentiation with respect to some non-price characteristics of a trip is horizontal (e.g., passengers will have different preferred departure/arrival times); and even where we have vertical product differentiation (e.g., other things equal everyone will prefer to travel non-stop rather than make a stop en route¹⁴), customers will still differ in terms of their willingness to pay for this higher quality.

Thus, let us look at the lowest fare quotes and see if we can observe any difference across the three major on-line travel agents. Before we proceed, it pays to clarify that for all the analysis that follows we rounded the fare quotes to the nearest dollar using conventional rounding rules. This way, \$300.49 and \$299.51 quotes will be considered equal (as they both round to \$300), whereas \$300.49 and \$300.51 quotes will be viewed as different (the first one being rounded to \$300, while the second one – to

¹⁴ We do use a dummy for non-stop flights to control for this.

\$301). We will shortly revisit the issue of treatment of ‘small’ differences between the observed quotes.

Having said this, for an average search the lowest fare quote was offered by 1.4 airlines (with standard deviation of 0.86); the median number of carriers offering the lowest quote is one, with the maximum of five airlines pricing their best offers at the same level. The median number of travel agents offering the lowest fare is also one.

Table 1 presents some basic facts about our sample. From there we can see that Orbitz was least likely to offer the lowest fare quote; and in quite a number of cases (even if we correct for the fact that fare quotes from this on-line travel agent were unavailable on one of the dates) did not even offer the second lowest fare. Expedia and Travelocity offer the lowest fare quote with almost equal frequency – their average lowest fare quotes are similar too. At the same time, the average lowest fare quote for Orbitz is ‘too close’ to that for the other two on-line travel agents, given how infrequently this agent actually offers the lowest fare. A look at Figure 2 explains this puzzle. Specifically, a substantial share (53.7 percent, to be more precise) of differences between the lowest and the second lowest fare quotes is within the range of two dollars. In fact, out of 379 cases where Orbitz offered the second lowest fare quote, it was only \$1-2 higher than the lowest one found through a different travel agent in 341 cases. Thus, if we consider this 1-2 dollar difference (which, given the rounding we used, can mean actual differences from \$0.02 to \$2.98) negligible, Orbitz can be said to offer the lowest fare quote in 396 cases¹⁵, or 54.7 percent of all cases where a quote from this agent could be obtained.

Still, the average difference between the second lowest and the lowest fares across all the data points is \$13.26, or around 3.3 percent of the average lowest fare quote (which is \$393.53 with standard deviation of \$134.45); and in 14.5 percent of cases this difference is above \$20 or approximately 5 percent of the lowest fare quote.

¹⁵ This number obtains by summing 71 and 341, and subtracting sixteen cases where this agent offers both the lowest and the second lowest fare quote.

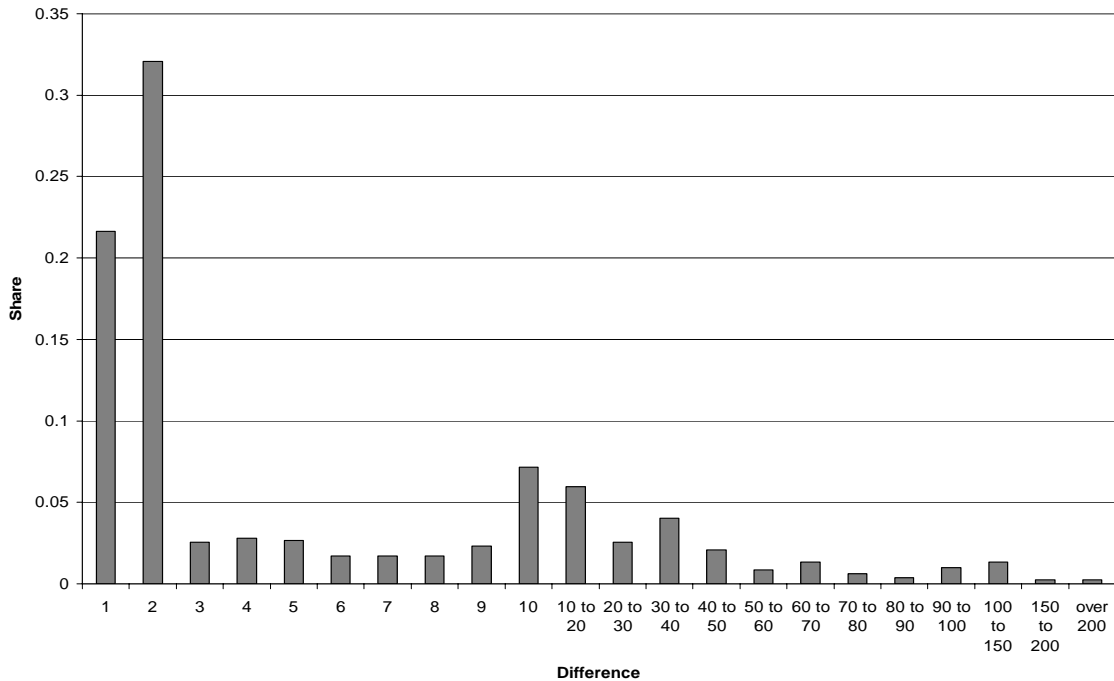
Table 1 Comparison of fare quotes across travel agents

	Travelocity	Expedia	Orbitz
Average lowest fare quote for agent	\$ 407.15 (141.69)	\$ 409.55 (138.74)	\$ 413.38 (147.59)
Cases offering the lowest fare	586	605	71
Share of cases offering the lowest fare	71.20%	73.51%	9.82%
Difference between lowest offered by agent and lowest across the three agents	\$ 10.99 (30.34)	\$ 16.16 (45.48)	\$ 14.62 (31.69)
Cases offering the second lowest fare	282	317	398
Share of cases offering second lowest fare	34.26%	38.52%	55.04%
Cases offering neither lowest nor second lowest	169	132	271
Share of cases offering neither lowest nor second lowest	20.53%	16.04%	37.48%

Notes:

1. Numbers in parentheses are standard deviations.
2. The \$1-2 differences between the second lowest and the lowest available fare quotes are treated as non-negligible.
3. Difference between the lowest offered by the agent and the lowest across the three agents is calculated only for those cases where the agent does not offer the lowest fare quote.
4. Number of cases where Orbitz offers neither the lowest nor the second lowest fare omits the date where the agent's web site was down for maintenance.
5. All percentages for Orbitz are relative to the number of cases this agent was on-line (i.e., omitting the date when www.orbitz.com was closed for maintenance).

Figure 2 Histogram of differences between the second lowest and the lowest fare quotes.



Before we move to a more detailed data analysis, let us see if the raw data can point us to any kind of correlation between the number of agents offering the lowest fare and the level of this fare. The relevant numbers are presented in Table 2 below. As one can see, the rough answer to the question of relationship between the number of travel agents offering the lowest fare and the level of this fare depends on whether we treat differences between the second lowest and the lowest fares in the amount of \$2 or less as negligible. If we do not, then it appears all three travel agents offer the same lowest fare in very few cases. It also appears that the more travel agents offer the lowest fare, the lower the quoted price is. However, if we consider \$1-2 differences between the second lowest and the lowest fares as negligible, the picture changes, even though the lowest fare still appears higher when only one agent offers it. Observe also that treatment of \$1-2 differences between the lowest and the second lowest fares as negligible increases the median number of travel agents offering the lowest quote from one to two.

Table 2 Lowest price quotes versus number of agents offering same

Number of agents offering the lowest fare	Treatment of \$1-2 differences between second lowest and the lowest fares			
	As non-negligible		As negligible	
	Number of cases	Average price (st. dev.)	Number of cases	Average price (st. dev.)
One	413	\$427.35 (134.48)	298	\$464.98 (122.50)
Two	381	\$377.76 (110.73)	264	\$352.00 (120.05)
Three	29	\$141.21 (130.81)	261	\$357.53 (84.50)

Numbers presented in Table 2 above are of course raw. Even though they do suggest there is some association between the observed competition between the travel agents and the lowest fare quote a potential customer can obtain, we need to control for a number of variables to make a more definite statement to this effect. In addition, we have not touched on the issue of competition on the airline markets in question. These are precisely the issues we leave for the next section of the paper.

5. Data Analysis – The Role of Two Market Structures

The aim of our analysis is to understand the relationship between the structure of the ticket distribution markets (leading to the above discussed incentives of airlines and seemingly ‘technical’ distributors that the on-line travel agents supposedly are) and the

fare quotes that the customer observes. We will continue using the lowest available price quote two days before departure (recall this is how far in advance we collected the data) as an indicator of the extent of competition for traveling public's dollars. Table 2 in the previous section of the paper showed there is some raw association between this indicator and the number of travel agents offering this lowest fare. Of course, to be more certain these numbers mean anything, our analysis needs to control for a number of factors raw averages are unable to capture.

We conducted a fairly simple regression analysis using the natural logarithm of the lowest observed fare as the dependent variable. As a measure of intensity of competition between the three on-line travel agents, we use the number of agents offering the lowest fare quote observed. As before, we construct this measure treating the \$1-2 differences between the lowest and the second lowest fares as non-negligible and negligible. We use the airport-pair market Herfindhal index for non-stop flights (calculated using T-100 data) as the (imperfect) measure of competition between the airlines on a route. We did not believe it was necessary to instrument this variable as for the time period we consider the market structure on the airline side can be treated as fixed. In some of the specifications we report below, we also interact this Herfindhal index with the number of travel agents offering the lowest fare.

For our regressions, we dropped the two markets (Oakland-San Diego and Oakland-Burbank), where JetBlue and/or Southwest were the only non-stop competitors. We believed one-stop fare quotes we observed on those markets were rather meaningless (such trips would involve significant time increase, and we could not observe how those quotes compared to the lowest non-stop fares available). This reduced the number of observations at our disposal from 823 to 795.

The controls we used in all regressions are listed below. Variables that we report in the table that follows are:

- Natural logarithm of the lowest non-stop travel time between airports – as a proxy for distance.
- Geometric average of endpoints' income per capita, at the metropolitan statistical area level.

- Temperature difference between the trip's origin and destination for November of 2006 – we use this variable as a measure of the route's attractiveness for vacation travelers.
- Indicator variable for fare quotes for travel to Florida and Las Vegas (conventional vacation destinations).
- Geometric average of endpoints' population, at the metropolitan statistical area level.
- Number of carriers observed offering the lowest fare.
- Indicator for whether the lowest fare is for the non-stop trip in both directions. This variable is also interacted with the shortest non-stop flight time in all regressions.
- Indicator variable for routes within Hawaii – there are two such markets in our list.
- Indicator variables for markets where carriers whose fare quotes we observe compete (at the city-pair market level) with JetBlue Airways and Southwest Airlines.

The following variables are also used in all regressions, but the corresponding coefficients are not reported to save space:

- Airline-specific indicator variables taking the value of one if an airline offers the lowest fare quote. We use seven such variables for major airlines (American, Delta, United, Continental, Alaska, Northwest, US Airways), plus a separate variable for smaller carriers whose fare quotes we observe (Air Tran, Frontier, Midwest, Spirit). For the purposes of this analysis, fares offered by America West were included into US Airways category¹⁶.
- Dummies for different (eight out of nine, naturally) dates of data collection.
- Airline-travel agent interaction variables.
- Thirty-one airport-specific dummies, to control for relevant heterogeneities.

Regression results are presented in Table 3 below. We report six specifications, three for each treatment of small differences between the lowest and the second-lowest fare quote.

¹⁶ The two airlines were at the time in process of finalizing their merger approved over a year ago. However, at the time of data collection we still observed fare quotes by America West Airlines.

Table 3 Estimation with number of travel agents offering the lowest fare

Independent variables	Treatment of \$1-2 differences between second lowest and the lowest fares					
	As non-negligible			As negligible		
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	5.032** (0.169)	5.048** (0.171)	4.913** (0.178)	4.991** (0.164)	5.011** (0.166)	4.922** (0.175)
Log of flight time	0.248** (0.029)	0.248** (0.029)	0.248** (0.029)	0.251** (0.029)	0.251** (0.029)	0.252** (0.029)
Average per capita income	-5.8E-06** (2.3E-06)	-5.7E-06** (2.2E-06)	-6.3E-06** (2.3E-06)	-5.6E-06** (2.3E-06)	-5.5E-06** (2.4E-06)	-5.7E-06** (2.4E-06)
Average population	-7.3E-09** (3.6E-09)	-7.3E-09** (3.6E-09)	-7.1E-09** (3.6E-09)	-7.1E-09** (3.7E-09)	-7.2E-09** (3.7E-09)	-7.2E-09** (3.7E-09)
Temperature difference	-0.0002 (0.0006)	-0.0002 (0.0006)	-0.0002 (0.0006)	-0.0002 (0.0006)	-0.0002 (0.0006)	-0.0002 (0.0006)
Las Vegas/Florida destinations	0.018 (0.040)	0.020 (0.040)	0.025 (0.040)	0.023 (0.040)	0.025 (0.040)	0.027 (0.040)
Hawaiian routes	-0.905** (0.056)	-0.905** (0.056)	-0.887** (0.057)	-0.960** (0.055)	-0.960** (0.054)	-0.951** (0.055)
JetBlue	-0.148** (0.029)	-0.149** (0.029)	-0.146** (0.029)	-0.152** (0.029)	-0.153** (0.029)	-0.153** (0.029)
Southwest	-0.081** (0.028)	-0.082** (0.028)	-0.078** (0.027)	-0.086** (0.028)	-0.087** (0.028)	-0.085** (0.028)
Number of carriers offering the lowest	0.022 (0.019)	0.022 (0.019)	0.021 (0.019)	0.021 (0.019)	0.021 (0.019)	0.018 (0.019)
Non-stop flight	-0.314** (0.049)	-0.314** (0.049)	-0.321** (0.049)	-0.313** (0.049)	-0.313** (0.049)	-0.315** (0.049)
Non-stop flight*Flight time	0.001** (0.0002)	0.001** (0.0002)	0.001** (0.0002)	0.001** (0.0002)	0.001** (0.0002)	0.001** (0.0002)
Number of travel agents offering the lowest fare	-0.062** (0.020)	-0.062** (0.020)	0.035 (0.039)	-0.030** (0.012)	-0.030** (0.012)	0.014 (0.029)
Airport-pair market Herfindhal index	---	-0.031 (0.082)	0.235* (0.131)	---	-0.039 (0.082)	0.113 (0.133)
Herfindhal*Number of travel agents offering the lowest fare	---	---	-0.173** (0.063)	---	---	-0.079* (0.050)
Adjusted R-squared	0.768	0.768	0.770	0.767	0.767	0.767

Notes:

1. Dependent variable is natural logarithm of the lowest fare quote.
 2. Number of observations – 795.
 3. Numbers in parentheses are standard errors.
 4. Treatment of \$1-2 differences as negligible affected measure of the number of travel agents offering the lowest fare.
 5. Results corrected for heteroscedasticity using White robust variance-covariance matrix.
 6. Controls for date of collection, airline-specific dummies, airline-travel agent interactions, and airport-specific indicator variables have been included into all regressions, but are not reported.
- * - significant at 10% level; ** - significant at 5% level

As can be seen from the table above, coefficients on all the control variables are stable across specification and do not depend on whether the small differences between the lowest and the second lowest fare are treated as negligible. The coefficients on logarithm of flight time, JetBlue and Southwest variables have expected signs. The negative and

significant effects of average per capita income and population on fare are somewhat puzzling at first; yet, Bilotkach (2007) obtained similar result when studying determinants of differences in last minute fares quoted by Southwest Airlines and Orbitz. When the fare quote is for non-stop flight, it is about 31 percent lower than that for the one-stop trip; however, this effect is distance (proxied by scheduled flight time for a non-stop trip) dependent. More specifically, reading our regression results we can see that one-stop and non-stop lowest fare quotes are equal for about three-hour flight; and for a five-hour coast-to-coast flight the non-stop fare quote will be about six percent *higher* than same for a one-stop flight. This finding is quite intuitive: for shorter flights, a stop en route entails significant increase in travel time. Therefore, an airline choosing to offer one-stop fares on shorter-haul markets where a non-stop competitor is present, may be inclined to set high prices, both because of higher cost relative to a non-stop competitor and in anticipation of a loyal customer within few miles from earning an award ticket. For longer-haul flights, however, an airline offering a one-stop service becomes an effective competitor to carriers flying non-stop, and prices its tickets lower to attract less time-sensitive travelers.

As for variables we do not report in Table 3, the following facts are worth mentioning. First, fares collected on Tuesdays were typically higher than those collected on Fridays. Second, few airline coefficients turned out significant: Delta Air Lines offered consistently higher lowest fares, whereas quotes by ‘other’ airlines were marginally lower. Airport effects are insignificant to marginally significant. Only Atlanta, Denver, Las Vegas and San Francisco International airports show marginally significant coefficients. These airports are hubs for major airlines and are dominated (Las Vegas to a lesser degree than the other three) by a single airline. We also experimented with including dominant-airline-hub-airport dummies into our regressions. However, the results did not change in any meaningful way, and adjusted R-squared fell marginally. Travel agent – airline interactions are also typically insignificant; however, they are jointly significant, as suggested by conventional F-tests.

Unlike control variables, the variables of interest do change depending on how small differences between the lowest and the second lowest fares are treated. When \$1-2 differences between the lowest and the second lowest fares are treated as non negligible,

first and second specifications suggest that additional agent offering the lowest fare quote will bring same down by over 6 percent (\$24.40 on average). At the same time, we observe strong dependence of this effect on the level of non-stop competition on a given airport-pair-market, as well as the expected positive sign on the Herfindhal index itself.

A perhaps more adequate treatment of small differences between the lowest and the second lowest fares as negligible (resulting in counting more travel agents as effectively offering the lowest fare) yields decrease in the magnitude of the effect of observed competition between travel agents to about 3 percent (\$11.80 on average). As before, we observe that the effect of apparent competition between travel agents is dependent on the level of competition between the airlines. More specifically, specification 6 in Table 3 suggests that for the monopoly airport-pair market an additional travel agent offering the lowest fare brings down this fare quote by almost 8 percent. This is \$31.48 given the observed average for the entire sample and over \$36 given the observed average lowest fare quote for the airport-pair markets in our sample with only one carrier providing non-stop service¹⁷. For a symmetric duopoly, the effect of adding another travel agent is reduction in fare by about 4 percent (again, \$15.74 on average for the whole sample, and \$14.89 on average for the markets with Herfindhal index for non-stop services between 0.4 and 0.6 in our study). The effect for the most competitive non-stop market we have (Atlanta-Denver) is only 2.2 percent (or \$9.65, given the average lowest fare quote we observe on this route is \$438.53).

For deeper understanding of the association between additional travel agent offering the lowest fare quote and the level of the same, the following table presents results of regressions which, instead of the number of travel agents offering the lowest fare quote, used dummy variables for the cases where the lowest fare quote was offered by two on-line travel agents, as well as by two or three agents. This way, we will obtain the ‘marginal effects’ of the second and the third on-line travel agent on the lowest fare quote. Note that in all specifications reported in Table 4 we used exactly the same control variables as in regressions we report in Table 3 above. Moreover, all coefficients on those control variables are very similar in terms of both magnitude and statistical

¹⁷ Disregarding Southwest and JetBlue as possible competitors, as these airlines’ quotes are not observable with the travel agents

significance across all regressions reported in the two tables. Therefore, reporting coefficients on control variables in Table 4 is redundant.

Table 4 Effects of additional travel agents on the lowest fare quote

Independent variables	Treatment of \$1-2 differences between second lowest and the lowest fares					
	As non-negligible			As negligible		
	(1)	(2)	(3)	(4)	(5)	(6)
Two travel agents offer the lowest fare quote	0.034 (0.053)	0.033 (0.653)	0.006 (0.101)	0.052** (0.020)	0.052** (0.020)	-0.041 (0.054)
Two or three travel agents offer the lowest fare quote	-0.099* (0.057)	-0.098* (0.057)	0.045 (0.102)	-0.071** (0.026)	-0.071** (0.026)	0.055 (0.063)
Airport-pair market Herfindhal index	--	-0.033 (0.081)	0.075 (0.091)	--	-0.036 (0.083)	0.052 (0.110)
Herfindhal*Two travel agents	--	--	0.019 (0.151)	--	--	0.170* (0.103)
Herfindhal*Two or three travel agents	--	--	-0.233 (0.146)	--	--	-0.242** (0.107)
Adjusted R-squared	0.768	0.768	0.769	0.767	0.767	0.768

Notes:

1. Dependent variable is natural logarithm of the lowest fare quote.
 2. Number of observations – 795.
 3. Numbers in parentheses are standard errors.
 4. Treatment of \$1-2 differences as negligible affected measures of the number of travel agents offering the lowest fare.
 5. Results corrected for heteroscedasticity using White robust variance-covariance matrix.
 6. The same control variables have been included as those included into specifications reported in Table 3. Coefficients are similar in both magnitude and statistical significance.
- * - significant at 10% level; ** - significant at 5% level

Results for the cases where small differences between the lowest and the second lowest fares are treated as non-negligible do not add much to our understanding of the impact of competition between airlines and travel agents. On the other hand, if we treat the \$1-2 differences between the best and the next best deals as negligible, it becomes apparent that it is the third on-line travel agent that appears to bring in the ‘competition’; and the effect is again more pronounced for less competitive airline markets. It is also interesting to note that the so-called ‘marginal effect’ of the second on-line travel agent is to bring fares up, not down, and more so the less competitive the airline market is.

We have up to now considered the three main on-line travel agents as rather indistinguishable entities. That is, we effectively believed that the agents were offering deals that were similar in non-price dimensions¹⁸. This might actually not be the case.

¹⁸ The only measure of non-price characteristics of the fare quote we did include was the non-stop flight indicator variable.

An author's observations about the on-line ticket distribution business, for example, has led him to conclude that Orbitz tends to offer more option for complex international itineraries; however, a number of those options entailing long layover times (sometimes as long as 20 hours) are not offered by Orbitz's main competitors. It may thus happen that, as an example, the lowest fare offered by one agent involves scheduling which most customers will view as hugely inconvenient – therefore, such an offer may be rejected by most passengers in favor of a more expensive but a more convenient option.

We did mention above that differentiation by the non-price characteristics we did not capture (these may include operating carrier, type of aircraft, departure and/or arrival time) is horizontal, and therefore any 'ranking' of fare quotes by these characteristics we may attempt will necessarily be subjective; not to mention the possibility of the same fare quote being offered for flights departing at different times, operated by different carriers using different aircraft types, etc. It is true that we can rank one-stop trips more objectively by the total duration of the trip (with a caveat that the shortest layover time may not be uniformly the most preferred one due to higher possibility of missing the next flight if something goes wrong with the first one); but here we too may observe (and in fact have observed) the same fares for trips of different duration.

What we can do to capture possible 'agent-specific' heterogeneity is to simply supplement regressions reported in Table 4 above with travel agent dummy variables. The corresponding estimation results are presented in Table 5. Note that the only difference between all specifications reported in Table 5 as opposed to those described in Table 4 is that the former include Orbitz and Expedia dummy variables; all other control variables are the same, and their coefficients are very similar in terms of magnitude, sign and significance to same reported in Table 3.

Table 5 Estimation including travel agent dummy variables

Independent variables	Treatment of \$1-2 differences between second lowest and the lowest fares					
	As non-negligible			As negligible		
	(1)	(2)	(3)	(4)	(5)	(6)
Two travel agents offer the lowest fare quote	0.088 (0.066)	0.087 (0.066)	0.056 (0.106)	0.119** (0.029)	0.119** (0.029)	0.027 (0.060)
Two or three travel agents offer the lowest fare quote	-0.188** (0.074)	-0.187** (0.074)	-0.041 (0.109)	-0.212** (0.051)	-0.212** (0.052)	-0.078 (0.078)
Airport-pair market Herfindhal index	--	-0.031 (0.081)	0.074 (0.090)	--	-0.032 (0.082)	0.054 (0.109)
Herfindhal*Two travel agents	--	--	0.023 (0.151)	--	--	0.167* (0.101)
Herfindhal*Two or three travel agents	--	--	-0.230 (0.146)	--	--	-0.237** (0.106)
Orbitz	0.075 (0.048)	0.074 (0.048)	0.071 (0.049)	0.091** (0.029)	0.091** (0.029)	0.089** (0.025)
Expedia	0.071** (0.030)	0.071** (0.030)	0.068** (0.030)	0.068** (0.029)	0.068** (0.029)	0.068** (0.024)
Adjusted R-squared	0.769	0.769	0.771	0.770	0.770	0.771

Notes:

1. Dependent variable is natural logarithm of the lowest fare quote.
 2. Number of observations – 795.
 3. Numbers in parentheses are standard errors.
 4. Treatment of \$1-2 differences as negligible affected measures of the number of travel agents offering the lowest fare, as well as the travel agent dummy variables.
 5. Results corrected for heteroscedasticity using White robust variance-covariance matrix.
 6. The same control variables have been included as those included into specifications reported in Table 3. Coefficients are similar in both magnitude and statistical significance.
- * - significant at 10% level; ** - significant at 5% level

Comparing results reported in Tables 4 and 5 we see the following. First, in those specifications where the airport-pair market Herfindhal index was not interacted with measures of observed competition between travel agents, the magnitude of the effects of additional travel agent offering the lowest fare quote nearly doubled when we tried controlling for possible travel agent heterogeneity. However, results did not change for specifications where the airport-pair market Herfindhal was interacted with variables measuring competition between travel agents (specifications (3) and (6) in the table). Therefore, if there is a bias due to possible travel agent specific heterogeneity, correcting for it only reinforces our results.

6. Discussion and Conclusions

In this study we examined a sample of airfare quotes with the aim of understanding the interplay of two market structures: those of the airline and the ticket distribution markets. We compared the lowest fare quotes by the three leading on-line travel agents, which together appear to sell approximately 20 percent of all airline tickets on the US market. Moreover, while Expedia, Travelocity and Orbitz dominate the on-line travel distribution business; none of the three can be singled out as a clear leader.

Analysis of incentives implied by the structure of the ticket distribution market suggested the following. First, individual distributors will have strong incentive to obtain exclusive rights for distribution of the airlines' discounted tickets. Second, the competing airlines can potentially exploit their repeated interaction and presence of the less informed customers to sustain an equilibrium whereby each carrier offers its discounted fares via different distributor(s) than its competitor(s); the fares will then be higher than they would be were all competitors to offer their best deals via all the available channels due to presence of the 'underinformed' consumers. Taken to data, these conclusions will imply that: (a) certain distributors may discriminate for or against certain airlines; and (b) the more travel agents offer the airlines' discounted fares, the better a deal a customer may be able to get.

The data analysis suggested that, controlling for various factors, when more travel agents offer the lowest fare quote, the level of same is lower. Initial results suggest that an additional travel agent offering the lowest fare quote will bring same down by \$12-24 on average (depending on how small differences between the lowest and the second lowest fare quotes are interpreted); and this effect is more pronounced for the airline markets that are less competitive (ranging from about \$9 decrease in fare quote per additional agent for the most competitive market in the sample – in terms of non-stop competition; to over \$36 for the market with a single carrier performing non-stop flights). Further analysis revealed, however, that it is the third travel agent that brings the fare quote down; whereas going from one agent offering the lowest fare quote to two we observe *increase* in the price level. Again, the downward pressure of the third travel agent is more pronounced for the airline markets, which themselves are less competitive. That is, we have found the evidence to support the second of the above conjectures.

The supposition that individual distributors might discriminate either for or against the individual airlines, as implied by our theoretical analysis, can be looked into directly. Table 6 reports two indicators of interaction between individual airlines and each of the three main on-line travel agents. First, we show simple correlation coefficients between airline dummies (taking value of one if the carrier offers the lowest fare quote), and the travel agent indicator variables, treating small differences between the lowest and the second lower fare quotes as negligible. We can see from that table that the picture is not exactly random. For example, when American Airlines offers the lowest fare quote, it is more likely to appear on Expedia or Orbitz than on Travelocity; Travelocity, on the other hand, is more likely to report other carriers' lowest fare quotes as compared to other agents. We also computed correlations between the number of carriers offering the lowest fare and individual travel agent indicator variables. Here we can see that fare quotes presented by Orbitz are associated with higher 'diversity' – this agent is more likely to give same lowest fare quotes by multiple carriers.

The second measure we report is so-called 'percent shown', or the share of lowest fare quotes we observe offered by an airline actually offered by a given travel agent. We can see a substantial variation in this measure as well. On one extreme, of all the cases Continental Airlines offered the lowest fare, Travelocity bothered to show it to prospective customers in less than a quarter of instances. On the other end of the spectrum, in nine out of ten cases the lowest fare was quoted by Continental Airlines, we could find it on Orbitz. We can say that Expedia appears to be the most 'objective' agent in a sense that it does not seem to openly discriminate either for or against a particular carrier in any systemic way; whereas Orbitz appears to discriminate against Alaska and to a lesser extent US Airways/America West (or maybe those airlines do not cooperate with this agent closely), while clearly favoring Continental Airlines by showing its lowest fares to potential customers. Finally, Travelocity appears to have better relationships with Northwest and the group we termed Other carriers, while not being eager to show Alaska's and Continental's fares where these carriers offer the cheapest deals.

Table 6 How travel agents present airlines' lowest fare quotes

	Travelocity		Expedia		Orbitz	
	Correlation	Percent shown	Correlation	Percent shown	Correlation	Percent shown
American Airlines	-0.076	62.6	0.157	86.2	0.152	75.5
Delta Air Lines	0.029	74.6	0.061	81.7	0.073	72.4
United Airlines	0.082	78.1	0.063	78.8	0.134	74.9
US Airways/ America West	0.064	74.2	-0.056	69.8	-0.107	51.1
Alaska Airlines	-0.158	41.3	0.065	84.7	-0.138	27.3
Continental Airlines	-0.217	23.5	0.002	73.5	0.117	90.8
Northwest Airlines	0.064	85.7	-0.038	64.3	0.075	81.6
Other carriers (Frontier, Midwest, AirTran)	0.232	89.1	-0.146	61.7	0.019	60.1
Number of Carriers	0.113	---	0.045	---	0.174	---

Notes:

1. In all calculations, small differences between the lowest and the second lowest fare quotes were treated as negligible.
2. Correlations are simple correlation coefficients between the airline dummy variable (taking the value of one if the airline is one of those offering the lowest fare quote) and the travel agent indicator (equal to one if travel agent offers the lowest available fare quote).
3. 'Percent shown' is the percent of cases, where a given travel agent featured the lowest fare quote, when it was offered by a given airline.
4. Measures for Orbitz were computed taking into account the day when the agent's quotes were unavailable due to site maintenance.

To be more confident that numbers reported in Table 6 are not a realization of some random process, we conducted formal pair-wise tests of equality of the above reported correlation coefficients, by airline, for three possible pairs of travel agents (Travelocity – Expedia, Travelocity – Orbitz, and Expedia – Orbitz). To perform the test, we applied the following Fisher transformation to each correlation coefficient r , as follows:

$$Z = \frac{1}{2} \ln \left(\frac{1+r}{1-r} \right) \quad (1)$$

Then, the usual z-test can be applied to the test statistic:

$$z = \frac{Z_1 - Z_2}{\sqrt{1/(N_1 - 3) + 1/(N_2 - 3)}} \quad (2)$$

The resulting values of the above z-statistic are presented in Table 7.

Table 7 Testing for equality of correlation coefficients from Table 6

	Travelocity vs. Expedia	Travelocity vs. Orbitz	Expedia vs. Orbitz
American Airlines	-4.95***	-4.86***	0.85
Delta Air Lines	-0.64	-0.88	-0.25
United Airlines	0.39	-1.06	-1.44
US Airways/ America West	2.40**	3.41***	1.01
Alaska Airlines	-4.48***	0.42	4.06***
Continental Airlines	-4.44***	-6.74***	-2.30**
Northwest Airlines	2.02**	-0.23	-2.26**
Other carriers (Frontier, Midwest, AirTran)	7.62***	4.32***	-3.30***
Number of Carriers	1.36	-1.24	2.60***

Notes:

1. Reported are values of test statistic (2) for pair-wise comparison of correlation coefficients reported in Table 6.

** - significant at 5% level

*** - significant at 10% level

Table 7 shows that the three major on-line travel agents do treat most of the airlines differently. Specifics of the airline-agent (or maybe airline-CRS and CRS-agent) interaction behind the numbers we report can be subject to various speculations; however, what we report above is in line with what we suspected when analyzing airlines' and distributors' incentives.

Here is what such our findings can mean for an average traveler. Suppose you are searching for a ticket on a market where US Airways and American Airlines are the two major non-stop competitors (e.g., Dallas-Philadelphia route). One day, AA offers a lower fare as compared to US Airways. If you search on Travelocity, you will be less likely to observe that lowest fare than if you use any other on-line travel agent. This may not mean AA's fare quote on Travelocity will be higher than same offered by US Airways – all we are saying here is that AA's fare quote observed on Travelocity will be higher than same displayed by Expedia or Orbitz. When US Airways offers the lowest fare on same route, however, the situation will be reversed, and a potential customer looking on Orbitz will observe higher US Airways' fare quote than the one displayed by Travelocity, again based on our results.

Additionally, travel agents may have different policies as far as offering tickets on overbooked flights is concerned (provided an agent itself knows the flight is overbooked). In this case, when one agent chooses not to offer a ticket on such a flight, whereas the other one chooses to show this option to the potential customer, we will get

two agents – even linked to the same CRS – offering different quotes. For such cases to influence our results, however, we would also need most if not all flights between the two cities overbooked on the dates of data collection at the time of data collection, so that such instances would show up as the lowest fare quotes. To be more confident, we have computed correlation between the number of travel agents offering the lowest fare and “price-per-minute” or the ratio of the lowest fare quote to duration of a non-stop flight. Such correlation is indeed insignificant (negative 0.065 when small differences between the best and the second-best fare quotes are treated as non-negligible and positive 0.043 when such differences are treated as negligible).

Our analysis methodology can be criticized on the basis of selection of markets, agents, booking scenario, looking only at the lowest fare quote, and rounding of observed offered prices. In defense, we can say the following. The markets we selected are rather diverse in terms of the airline competition and length of haul. One might wish to see more diversity in terms of market size, but then many studies of the airline industry look at the ‘top’ markets. It is true that many of the markets in our sample involve one or even two major hub airports. Yet, such is the structure of major US carriers’ networks that their non-stop flights are predominantly to/from their hubs. Additionally, we control for airport-specific and airline-specific heterogeneity in our analysis.

It is true that we only looked at three of the available multitude of on-line travel agents. However, the agents covered by our study are the most important players, covering 80 percent of the non-direct on-line distribution of airline tickets in the USA; other agents have small market share compared to Orbitz, Expedia, or Travelocity. In addition, none of the big three agents is itself the dominant player – their market shares are rather symmetric.

Next, we selected the booking scenario we use to avoid running into a major problem associated with choosing to examine fare quotes collected further away from the intended departure date. Specifically, a customer looking at offered prices in advance may be rightly concerned about the possibility of obtaining a refund in case he/she has to cancel the trip after it has been booked (and the airlines, understanding this, might price their offers strategically). Looking at last-minute fare quotes, on the other hand, we can

work under an assumption of no (or at least very little) uncertainty as far as canceling the trip is concerned.

Each query to each of the travel agents yielded multiple options with different price quotes. We believed looking only at the lowest fares offered is justified for two reasons. First, our theoretical analysis allowed us to formulate certain hypotheses as these relate to the lower end of the price distribution. Second, we assumed our hypothetical customer was interested in getting the best deal available – which is reinforced by assuming he was booking travel after it has become certain there will be no need to cancel, so potential refund is not of our traveler’s concern.

Rounding was used for the sake of comparing the fare levels across airlines and travel agents. We realize that rounding as we use it can mean that what we measure as \$2 difference between the lowest and the second-lowest fare quote can in fact be between \$1.01 and \$2.99 difference; but we believe in this case consistent methodology with potential for creating case-specific measures is more justified than consistent measures created using case-specific methodology. On the other hand, by rounding we would treat the \$200.34 fare by one carrier, \$200.45 by the second one, and \$199.60 by the third one as indistinguishable, which appears a more appropriate treatment as opposed to claiming \$199.60 is the lowest fare quote, while \$200.45 – the third lowest.

Next, we have not, as indicated above, used non-price characteristics of fare quotes in our analysis. Also, we chose not to do so since consumers’ preferences over those characteristics are quite likely to be heterogeneous (indicating horizontal rather than vertical differentiation). Besides, we have often observed the same fare quotes for itineraries with very different non-price characteristics. Additionally, we have controlled for the vertically differentiated trip characteristic by including the indicator variable for the non-stop itinerary.

As a final note, this study examined a market where agents from which a consumer purchases the product appear to be acting as mere distributors and not as price-setters; in addition to competing with the producers directly. We nevertheless find that competition between such agents exists (both theoretically and empirically), is an important determinant of the price the potential consumer will face, and interplays with competition between producers of the service in question.

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Appendix – List of Airport-Pair Markets

Anchorage – Seattle	Dallas Fort Worth – Los Angeles
Atlanta – Boston	Dallas-Fort Worth – New York (LaGuardia)
Atlanta – Washington (National)	Dallas-Fort Worth – Orlando
Atlanta – Denver	Dallas-Fort Worth – Miami
Atlanta – Dallas-Fort Worth	Dallas-Fort Worth – Chicago (O’Hare)
Atlanta – Fort Lauderdale	Dallas-Fort Worth – San Diego
Atlanta – Jacksonville	Dallas-Fort Worth – San Antonio
Atlanta – Las Vegas	Dallas-Fort Worth – Seattle
Atlanta – Los Angeles	Detroit – Minneapolis-St. Paul
Atlanta – Orlando	Fort Lauderdale – New York (JFK)
Atlanta – Miami	Honolulu – Lihue
Atlanta – Chicago (O’Hare)	Honolulu – Kahului
Atlanta – West Palm Beach	Houston (Intercontinental) – Los Angeles
Atlanta – Philadelphia	New York (JFK) – Los Angeles
Atlanta – San Francisco	New York (JFK) – Orlando
Atlanta – Salt Lake City	New York (JFK) – San Juan, Puerto Rico
Austin – Dallas-Fort Worth	Las Vegas – Phoenix
Burbank – Oakland	Los Angeles – Seattle
Baltimore – Atlanta	Los Angeles – San Francisco
Dallas (Love Field) – Houston (Hobby)	New York (LaGuardia) – Chicago (O’Hare)
Denver – Dallas-Fort Worth	Miami – San Juan, Puerto Rico
Denver – Los Angeles	Oakland – San Diego
Denver – Chicago (O’Hare)	Chicago (O’Hare) – San Francisco
Denver – San Francisco	Tampa – Atlanta
Dallas-Fort Worth – Las Vegas	Seattle – Minneapolis-St. Paul

Note: Markets selected for the study are fifty airport-pair markets randomly chosen from among the top 100 US airport-pair markets by non-stop traffic in 2006 (Source: T100 Segment dataset, US Department of Transportation)