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Case of American Airlines and Online Travel Agencies**

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Abstract

We approach the issue of the value of a platform to a seller in a two-sided market where both buyers and sellers multi-home. A seller that loses access to a major buyer platform can potentially incur substantial financial losses. We exploit a recent conflict between American Airlines and two leading online travel agencies (Expedia and Orbitz), which dropped American Airlines fare quotes during the first quarter of 2011. We present a simple model of airline ticket distribution. This model provides a framework to analyze the events that happened in the American Airlines – online travel agency conflict. We analyze price data for the first quarter of 2010 and 2011, employing a simple difference-in-differences identification strategy to evaluate changes in American Airlines' fares. After controlling for across-market heterogeneity, carrier-specific time-invariant effects, and time-specific carrier-invariant effects, American Airlines' fares during the conflict were 2.7-4.2 percent lower than similar fares charged by American's main competitors (United, Continental, Delta, and US Airways). The fare effect is most pronounced in the sub-sample of one-stop itineraries, where competition is stronger, and customers are more likely to have to rely on travel agents – rather than carriers' own web-sites – for flight bookings. In sum, our findings indicate that access to major buyer platforms is considerably valuable to a seller. We estimate that during the first quarter of 2011 the loss of access to the Expedia/Orbitz platforms resulted in over \$50 million reduction in revenue for American Airlines.

Keywords: two-sided markets, value of platforms, online travel agents

JEL: D4; L4; L93

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1. Introduction

This study addresses the question of how much value does a seller derive from participating in a platform in a two-sided market. To address this question, we take advantage of a recent conflict between American Airlines (AA) and two leading online travel agencies (Expedia and Orbitz), which collectively sell about one in six airline tickets on the US market. A dispute between the airline and the travel distributors led to agents not showing American Airlines fare quotes during the first quarter of 2011. At that time, American Airlines was the fourth largest US carrier (based on passenger volume). American's access to a ticket distribution platform was further restricted by Sabre, the largest computer reservation system in the industry, which announced that it would display American Airlines' fares less prominently in its system. American Airlines lawsuit (filed in April 2011 and settled out of court by the time of this writing) alleged that Expedia, Orbitz, and Sabre conspired to restrict access to their ticketing platforms in retaliation for the American's marketing a competing ticket delivery platform for travel agents ("AA Direct Connect"), designed to bypass the existing global ticket distribution systems.

This ticket delivery platform dispute, coupled with the availability of rich price and quantity data, provides a nice natural experiment enabling us to quantify the impact of a ticketing platform on an airline's revenue. Hence, we are able to estimate the value that American Airlines derives from participating in a global ticket distribution platform. We postulate that American Airlines' response to a restricted access to ticket delivery platforms involved (a) offering lower prices to lure customers to its website and make its offers more conspicuous on platforms which continued to display them; and/or (b) lowering prices to counter any display bias imposed by Sabre. Our analysis of the price data during this period yields evidence consistent with American Airlines lowering their one-stop fares by four percent as compared to what it would have charged absent the conflict. We estimate this ticketing platform dispute resulted in American losing over \$50 million in revenue over the first quarter of 2011. This corresponds to 1.6 percent of American Airlines' quarterly total revenue. We have found, however, no evidence to suggest that the dispute has had any appreciable impact on the airline's load factor or route-level passenger volumes.

We note, however, that our analysis of the value of the ticket distribution platform to American Airlines is subject to several caveats. American did not sit idle when their tickets were dropped from the existing distribution platforms, as they took multiple steps to mitigate the potential impact of the dispute on its revenue. During the first quarter of 2011, American initiated several marketing/advertising campaigns to reach its customers and drive traffic to their web site. These include the February 2011 launch of Facebook and Twitter channels, which provided the followers with opportunities to earn additional miles and receive notification of American fare promotions. In March 2011 American offered a million frequent flier miles sweepstakes to customers who watch a testimonial video that promotes the AA.com web site for booking tickets. American also offered incentives (free tickets) for small/medium size California businesses that increased the number of tickets booked through AA.com. Hence our results should be interpreted cautiously. We do not, for instance, suggest that a company can lose access to the two largest online ticket delivery platforms, and they will only experience a 1.6 percent decline in short run revenue. Nor should we interpret our results as implying that disrupting the current structure of the travel services distribution industry will necessarily lead to losses for sellers. Our study does, however,

provide an estimate of the ticket platform value to a seller by showing the lost revenue incurred when access to a platform in a two-sided market is temporarily restricted.

The remainder of the paper is organized as follows. Section 2 provides a brief review of the literature. Section 3 describes the airline ticket distribution platforms along with a simple theoretical model to motivate the empirical analysis. Section 4 describes nature of the dispute between American Airlines and the ticket delivery platforms. Section 5 describes the data analysis methodology, along with a discussion of the results. Section 6 concludes.

2. Relevant Literature

Theoretical literature on two-sided markets is very extensive. Recent papers that provide an excellent overview of these studies include Rysman (2009), Rochet and Tirole (2003, 2006). Generally, two-sided markets are defined as industries where two sets of agents interact through an intermediary or a platform; and decisions of each set of agents affect the outcomes of the other set of agents, typically through a network externality (Rysman, 2009). Due to network externalities inherent in these industries, theoretical studies of two-sided markets have mostly focused on how platforms set access prices for both sides of the market. One important insight that comes from this literature is that a platform might set prices below cost to the more price elastic side of the market, effectively subsidizing participation of the more price sensitive side, hoping to recoup the losses via increased participation – due to the network externality – on the less price elastic side.

Several applied theoretical studies focus on specific two-sided markets. Anderson and Coate (2005) examine advertising in the television industry. In this two-sided market users exert a positive externality on advertisers, while the advertisements create a negative externality for consumers. Reisinger (2012) analyzes a media market model where platforms compete both for advertisers and users, and shows that platforms have positive economic profits even though there is Bertrand competition for advertisers.

Empirical literature on two-sided markets is understandably less developed. Prior empirical studies have focused on pricing and market power in the newspaper industry (other empirical studies of two-sided industries include credit cards (Rysman, 2007) and video games (Derdenger, 2011)). Kaiser and Wright (2006) analyze magazine data from Germany: their results are consistent with magazines subsidizing readers, recouping the corresponding losses from higher advertising revenue. Argentesi and Filistrucchi (2007) examine a structural model of Italian newspaper industry with the aim of estimating the firms' market power. Chandra and Collard-Wexler (2009) find that mergers in the Canadian newspaper industry do not lead to higher prices for either subscribers or advertisers, consistent with their theoretical model. Most recently, Affeldt *et al.* (forthcoming) model effects of a potential merger in the Dutch newspaper industry. Our study thus provides an empirical investigation, which examines two-sided markets from a different angle. Instead of focusing on pricing by the platforms (which remains unobservable to us), we examine an incidence of a seller losing access to an important platform, and evaluate how this affected the seller's revenue.

Previous studies of the travel distribution services industry (Bilotkach and Pejcinovska, 2011; Chen, 2006; Clemons et al., 2002) have compared price quotes across travel agents. These studies did not view travel services distribution industry as platforms in a two-sided market. Bilotkach and Rupp (2013) provide the first empirical analysis of buyer subsidy by a ticket distribution platform in a two-sided market context. Their findings are consistent with the buyer subsidy leading to an increase in seller participation with the platform. The contribution of our empirical study is to determine the value derived by the seller from participating in a platform, an issue not previously addressed in the literature.

3. Travel Agents and Distribution Systems as Platforms

3.1 Institutional Framework

The visual scheme of the distribution of airline travel services appears on Figure 1. An airline sells its tickets either directly (using its call-center and web-site) or via travel agents, by posting fares on one or more Computer Reservation Systems (CRS), which travel agents access to book tickets on behalf of their customers. The CRS's were launched by airlines in the 1970s. Since that time, the CRS companies have taken a life of their own as independent entities. The four major CRS companies are: Sabre (with about 45 percent U.S. market share and over 30 percent global market share), Worldspan (over 25 percent U.S. market share and 15 percent worldwide), Galileo and Amadeus (share of these two systems on the US market keeps declining while they remain larger players on the worldwide arena, with combined market share exceeding 50 percent).

Airlines are currently free to choose which systems to participate in and at what level to do so.² Most U.S. carriers actively participate in multiple systems. An exception is Southwest Airlines, which only participates in Sabre, and does so at a low level³. Consequently, Southwest Airlines consumers can only book tickets directly through the carrier's website, call center, or via some brick-and-mortar agents.

The Internet has altered the travel services industry dramatically. Emergence of online travel agents was a major innovation in this market. Airlines also saw potential in selling their tickets via their own web sites. As late as in 1990s, the brick-and-mortar travel agents sold over three quarters of all airline tickets; with the remaining 25 percent sold directly by the airline operated call centers. By 2002, online travel agents captured about 15 percent of the market from brick-and-mortar agents. The estimate by Citigroup Investment Research, quoted by Forbes, states that in 2005 online travel agents have over 25 percent market share in the airline ticket distribution industry; the airlines still sell about a quarter of all tickets, primarily via their web sites.⁴ In the US Market, the online travel agent segment of the airline ticket distribution market is dominated by the three major players, collectively responsible for over 80 percent of all the tickets sold online by agents: Travelocity (owned by Sabre, currently a privately held company), Expedia (founded within Microsoft in 1995, and an independent publicly traded company)

² 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.

³ The other important low-cost player on the US market, JetBlue Airways, tried emulating Southwest's strategy in its early years. The airline has however since moved to a more traditional model of participating in multiple CRS.

⁴ *Online Travel Gets Personal*, Forbes.com, accessed 02/17/2006.

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).

We should further note that online distribution platforms appear to have achieved a higher degree of penetration into sales of airline tickets in the USA as compared to other segments of the worldwide travel distribution market. Looking at the travel services distribution industry as a whole, online travel agencies currently account for only 11% of the \$1.2 trillion dollars spent on worldwide travel bookings (Salzman, 2013). In addition to the effect online sales have had on the competition on the services distribution market, recent evidence suggests that the internet has had its effect on the airlines' on-time performance (Ater and Orlov, 2012) and capacity utilization (Dana and Orlov, 2010).

In context of two-sided market literature, we consider the four major CRS (also known in the industry as global distribution systems or GDS) platforms. The value of a GDS or travel agent to airlines and travelers is higher the more agents from the other side of the market use a particular platform. Further, travel agents – especially online ones – effectively subsidize the buyer side of the market, by allowing customers to book airline tickets without imposing a booking fee⁵. Airlines have been trying to establish their own ticket distribution platforms (by steering passengers to book travel via the airlines' websites instead of using travel agents) with the aim of reducing their distribution costs. In addition, this strategy makes it more difficult for passengers to directly compare price quotes across airlines (Bilotkach, 2010).

Airlines enter into individual agreements with the large distributors of their services. While small brick-and-mortar agents typically deal directly with a CRS; large on-line agents enter into direct agreements with the airlines. These agreements, which typically span a three to five year period, specify the commission paid by the airline to the travel agents and the conditions for travel agent's access to the airline's seat inventory. While details of the contracts are confidential, the travel research firm PhoCusWright indicates that airlines pay very low commission rates for online airline tickets - ranging from 2% to 3% (Salzman, 2013)⁶. The crucial parameters which affect the structure of commissions paid by the airlines are known in the industry as content and participation.

Content refers to the seat inventory that the airline makes available to the agent. Airlines prefer to offer relatively low level of content to the agents, meaning that carriers seek to keep the lowest fares to themselves rather than selling those tickets via intermediaries. The agents clearly prefer to obtain full access to the airlines' inventory – this is known as full content. In negotiations, the agents offer the airlines commission discounts for full content access.

Participation refers to whether the agents are able to access the airline's seat inventory in real time. When participation is asynchronous, the fare quoted on the agent's first screen may differ – in either direction – from the actual fare upon booking the flight. Clearly, agents prefer real-time participation, since it increases their price reliability.

⁵ Online agents did experiment with charging booking fees to their customers about a decade ago; however, this practice did not last long.

⁶ Salzman further asserts that travel agents' commission for hotel bookings can be as high as 25 percent.

3.2 A Model of Ticket Distribution

In this sub-section we present a simple model of airline ticket distribution, reflecting the main features of the institutional structure described above. We present a model of a seller which multihomes by offering its product via two platforms (its own distribution channel and a travel agent). The tradeoff faced by the seller is that the more expensive distribution channel reaches more potential customers. To reflect upon the conflict we will examine in more detail later on, we will model the platform's reaction to the airline's attempt to reach more customers, demonstrating it might be the platform's optimal reaction to restrict access to the airline's inventory.

Both airline and the distribution platform (travel agent) seek to maximize their profits. To achieve this goal, the platform needs to maximize the number of tickets sold via their distribution channel. The airline also maximizes its profit if it is able to bypass the platform and sell the tickets to customers directly. The airline and distribution platform are thus competitors, both seeking to sell tickets to the same potential customers. By using two distribution channels, the airline multi-homes, as do at least some of the passengers. We do not model the passengers' behavior explicitly, leaving this dimension for potential future research endeavors.

Consider an airline distributing its tickets via both its own distribution center (website) and a ticket distribution platform. The airline has the inventory of $\bar{Q}$ tickets. Without loss of generality, assume that each seat is offered at a different price. Suppose the airline has a predetermined set of fares $P_{min} < \dots < P_{max}$. We further suppose that the seats in the airline's inventory are ranked from the least to the most expensive, so that seat 0 is offered at price P_{min} and seat $\bar{Q}$ is offered at price P_{max} . The cost of distributing tickets via the airline's own platform is normalized to zero; whereas a travel agent charges the airline a commission fee of C monetary units for every seat it sells. Given these considerations, it is natural to suppose that the airline will offer its entire ticket inventory via its own distribution center, and must choose the number of seats that it will distribute through the platform. To simplify the analysis, we will assume an "interior" solution in a sense that it is not optimal for the airline to offer its entire inventory via the distribution platform, and the solution where the airline does not offer any tickets via the agent is also ruled out. Using the terminology from the previous sub-section, the airline offers less than full content to the travel distribution platform.

Given our above assumptions, we can think about the airline's problem as that of choosing the lowest price quote $\hat{P} \in [P_{min}, P_{max}]$ to be offered via the travel agent. Without modeling the passengers' search behavior explicitly, we assume that, quite naturally, a seat offered via two platforms has a higher probability of being sold than a seat offered for sale only through an airline's website.

The game will be played sequentially. The airline moves first by deciding the inventory to be distributed via the platform, which is taken as given by the travel agent in its decision-making process. The agent's choice variable will be the number of passengers that can access the inventory offered by the airline. We are thus making C exogenous to the model. We effectively assume that this commission cost has been previously negotiated between the platform and the airline, and can only be changed at a substantial cost.

Analyzing the game by backward induction, we will begin by setting up the airline's profit function. When the lowest price offered via the platform is $\hat{P}$, and assuming continuous demand function $Q(P)$, the number of seats to be offered via the travel agent can be written as

$$\hat{Q} = f(N_p)Q(\hat{P})$$

In the above expression, N_p denotes the number of customers visiting the platform, and $f(N_p)$ represents the probability of selling a seat via the platform (clearly, $f'(N_p) > 0$). Our above assumption of the 'interior' solution (less than full content) implies $\hat{Q} \in (0, \bar{Q})$. Denoting via $P(Q)$ the inverse demand function, and using $g(N_p)$ for the respective transformation of $f(N)$, we can write the expression for the airline's expected revenue from selling $\hat{Q}$ seats via the platform as:

$$g(N_p) \int_0^{\hat{Q}} P(Q) dQ$$

Now, let us add the airline's own distribution channel to this picture. We have indicated above that the airline will offer its entire inventory via its website. Similarly to the notation above, N_A denotes the number of potential customers visiting the airline's website; and $g(N_A)$ represents the probability that the seat is sold via the airline's website, unconditionally of competition with the platform.

Thus, seats from 0 to $\hat{Q}$ (the higher priced seats) are offered via both the website and the platform, whereas less expensive seats from $\hat{Q}$ to $\bar{Q}$ are only available on the carrier's website. The airline's profit expression can therefore be written as follows:

$$\pi(\hat{Q}) = g(N_A) \int_{\hat{Q}}^{\bar{Q}} P(Q) dQ + [g(N_A) + g(N_p)] \int_0^{\hat{Q}} P(Q) dQ - h(N_A, N_p) C \hat{Q}$$

The first two components of the above expression represent expected revenues; the last component represents total cost. The function $h(N_A, N_p)$ represents the probability that a given seat offered for sale via the platform is actually sold via the platform, and not on the airline's website. The partial derivatives of $h(N_A, N_p)$ have the following properties: $h'_{N_A} < 0$ and $h'_{N_p} > 0$. Further, we assume that second-order cross-partial derivatives of $h(N_A, N_p)$ equal zero. We leave the probability of sale via the platform in the general form rather than using the share of potential customers visiting the platform, since the underlying search and purchase process depends on multiple factors.

To simplify the exposition without much loss of generality, we will use a simple linear inverse demand function $P(Q) = a - 2Q$. After some trivial transformations, the airline's profit function can be rewritten as:

$$\pi_A(\hat{Q}) = g(N_A)[a\bar{Q} - \bar{Q}^2] + g(N_p)[a\hat{Q} - \hat{Q}^2] - h(N_A, N_p)C\hat{Q}$$

This allows us to easily determine the airline's profit maximizing number of seats for distribution via the platform:

$$\hat{Q}^* = \frac{1}{2} \left(a - \frac{h(N_A, N_P)}{g(N_P)} C \right)$$

We next denote $\frac{h(N_A, N_P)}{g(N_P)}$ via $j(N_A, N_P)$, and assume the following properties of the partial derivatives: $j'_{N_A} < 0$ and $j'_{N_P} < 0$. The former property is a direct consequence of h'_{N_A} , and it has an interesting implication: as the airline expands its customer base reach via its website, it also expands its presence with the travel agent. This is stipulated by dropping the marginal cost of selling the tickets via the platform in our model. The latter property means that as the platform expands its customer base, the probability of sale conditional on competition with the airline's website increases slower than the unconditional probability of sale. Intuitively this means that some of the new customers reaching the platform might multi-home and still purchase the tickets via the airline's website. This condition ensures that as the platform expands its customer base, the airline will increase the inventory it offers via the platform, other things equal.

Given these assumptions, we can easily demonstrate the positive relationship between N_P and airline revenue at $\hat{Q}^*$. This relationship ascertains that any action by the platform to restrict customers' access to the airline's inventory will place the carrier's revenue at risk. The relationship between N_P and airline profit at the optimum, however, is ambiguous since the increased coverage of the customer base by the platform increases both the airline's cost and revenue.

We next turn to the incentives confronting the platform. Denoting the platform's cost function as $w(N_P)$; we can write the platform's profit as:

$$\pi_P = h(N_A, N_P) C \frac{1}{2} (a - j(N_A, N_P) C) - w(N_P)$$

We assume that the commission C is exogenous to the model (e.g., the commission agreement has been previously negotiated between the platform and the airline and can only be changed at a substantial cost), so that the platform's main choice variable is N_P . The corresponding first-order condition becomes:

$$F(N_A, N_P) = \frac{\partial \pi_P}{\partial N_P} = \frac{C}{2} \left[a h'_{N_P} - C \left(h'_{N_P} j(N_A, N_P) + j'_{N_P} h(N_A, N_P) \right) \right] - w'_{N_P} = 0$$

We next consider the effect of change in N_A on the platform's optimal choice of N_P . Using, the Implicit Function Theorem, the corresponding expression is:

$$\frac{dN_P^*}{dN_A} = - \frac{F'_{N_A}}{F'_{N_P}}$$

Assuming that the second-order condition for the platform's profit maximization holds ($F'_{N_P} < 0$ at the optimum); the sign of the above expression is determined by the sign of F'_{N_A} . Using the above assumptions that the second-order cross-partial derivatives are zero, following some manipulations, we obtain:

$$F'_{N_A} = -\frac{C^2}{2} [h'_{N_P} j'_{N_A} + j'_{N_P} h'_{N_A}]$$

Taking into account the above assumptions on the signs of the corresponding partial derivatives, we conclude that the sign of F'_{N_A} is ambiguous. Indeed, the first component in the square brackets is negative, while the second is positive. Hence the platform may optimally respond to the airline's attempts to increase its customer base by either increasing or decreasing N_P . Intuitively, increasing N_P has appeal since it compensates for the drop in the probability that the ticket is sold via the platform (due to a higher N_A). On the other hand, the decrease in the ticket's probability of sale will expand the inventory the airline offers to the platform (due to lower marginal cost for the airline), so the platform has an incentive to offer lower coverage which reduces its cost.

In sum, this section presents a stylized framework model of the ticket distribution problem confronted by an airline. Our model reveals two primary findings. First, lower platform coverage will decrease an airline's revenue, yet has an ambiguous effect on profit. Second, in response to an airline's attempt to increase coverage of the customer base via its website, a platform may opt to restrict/reduce a potential customers' access to the airline's tickets distributed via the platform. This is precisely what happened in the American Airlines – GDS dispute – the focus of this study. Of course, our model is stylized, ignores bargaining that might take place between the carrier and the platform, and often does not provide clear-cut answers, however, it is reasonably realistic and provides a framework to analyze the events that happened in the American Airlines – GDS conflict.

4. The Conflict

4.1. Timeline

The conflict between American Airlines (AA) and three main players in the ticket distribution industry was precipitated largely by American's attempt to market "AA Direct Connect" – its own ticket distribution platform, which would link travel agents directly to the American's inventory, bypassing existing Global Distribution Systems. Orbitz and Expedia retaliated against this move by blocking AA access to their platforms and refusing to show the carrier's tickets on their websites. American continues to market "AA Direct Connect"; however, recent assessment by some of the industry experts suggests these efforts have not been fruitful.⁷

Just before Christmas in 2010, American Airlines announced that it was pulling its inventory out of Orbitz – one of the big three online travel agents – upon failing to renegotiate the agreement with the distributor. Shortly afterwards – on the New Year's Day of 2011 – Expedia announced it was removing American Airlines' tickets from its website. Sabre – the owner of the largest Global Distribution System in the United States – notified American Airlines on January 5, 2011 that Sabre "has taken a set of punitive actions against the airline", including "biasing its shopping displays" in its system for American

⁷ "AA's direct connect is a walking corpse", *Travel Weekly*, posted online February 6, 2013.

Airlines fares.⁸ Sabre is the owner of the third largest U.S. online travel agency (Travelocity). Further, many travel agents (both brick-and-mortar and online) use inventory provided by Sabre to book travel for their clients. Sabre also filed a suit against American in early January alleging that the carrier was forcing travel agents to use the AA Direct Connect ticket distribution platform. American counter-sued Sabre on January 10, 2011, alleging exclusionary conduct by the GDS. Two weeks later, January 24, 2011 American and Sabre called a truce – agreeing to put all litigation on hold until June 1st, and both parties agreed to return to operating as they were prior to January 5th in terms of Sabre displays, American Airlines content and economic terms. The issue of the GDS biasing American’s fares, however, re-surfaced later in 2011⁹.

American Airlines’ flight options remained unavailable on Expedia until April 4, 2011, at which time the airline reached an agreement with the company, and the agent resumed selling American tickets. Having failed to reach a deal with Orbitz, American sued its parent company Travelport on April 13, 2011. Eventually, Sabre was also added to the lawsuit. On June 1, 2011, a judge ordered American Airlines to resume selling American tickets via Orbitz. Eventually, American and Sabre settled on October 31, 2012; the American-Travelport case was settled on April 1, 2013. Additionally, US Airways has also filed a similar lawsuit against Sabre, alleging exclusionary conduct by the GDS. Unlike American Airlines, US Airways has not faced exclusion from any of the ticket distribution platforms.

In sum, the timeline of the relevant events is as follows. During the first quarter of 2011, American Airlines’ fares were unavailable for purchase via both Expedia and Orbitz. Between April 4, 2011 and June 1, 2011, customers could purchase AA’s tickets via Expedia, but not Orbitz. After June 1, 2011, all the major online travel agents resumed selling American Airlines’ tickets. During the first and second quarters of 2011, we have reason to suspect that American Airlines’ travel options could have been obfuscated by Travelocity and other agents linked to Sabre.

4.2. Potential Effects and Preliminary Evidence

Given the conflict timeline outlined above, we believe that the largest impact on AA’s sales should have occurred during the first quarter of 2011. Indeed, both Orbitz and Expedia (which comprise more than half of all U.S. online travel agent ticket sales) were not selling American tickets during this time period. While the share of airline tickets sold via online travel agents is difficult to assess; available estimates put it at 25-40 percent¹⁰. Using one-third as a consensus estimate of the online travel agents’ share in terms of the number of trips sold, this suggests that about one-sixth of American Airlines’ tickets were at risk of not being available for purchase during the first quarter of 2011. The total revenue at risk exceeded \$500 million, given American’s average domestic quarterly revenue of \$3.25 billion in 2010. Using the 11% share by online travel agencies of worldwide travel bookings (Salzman 2013) implies that about 6% of American Airlines’ tickets were at risk of not being available for purchase during that same quarter. The total revenue at risk implied by that estimate is about \$200 million. These at “risk” revenue

⁸ American Airlines press release on January 5, 2011, www.aa.com accessed April 2, 2013. For more details of this dispute see “Dogfight Erupts in Plane Ticket Sales”, *The Wall Street Journal*, January 6, 2011

⁹ “Court permits American to seek injunction if Sabre biases fares”, *Travel Weekly*, posted online June 24, 2011

¹⁰ We noted in Section 3.1 an estimate of 25% market share of online agents from 2005, which could have increased since.

figures serve as conservative estimates, given that we are excluding any impact to American's revenue due to three weeks of Sabre's bias in displaying AA flights in January 2011.

The actual extent of damages sustained by American Airlines as a result of this GDS conflict (as measured by the lost revenue) depends on the actions taken by the airline. These could include (a) reducing the number of flights or aircraft size; (b) diverting passengers to the airline's website and agents still offering the carrier's travel options (some large online agents that continued selling AA's tickets include Travelocity and Priceline); and (c) offering lower fares to mitigate the display bias and to sell more tickets via other online agents which continued to list AA fares. In addition, American Airlines could also have diverted potential passengers to AA.com by offering lower fares via this particular distribution channel¹¹. The extent of any adverse impact on AA's revenue would likely vary by city-pair market and depend upon the degree of market competition. In particular, we believe it is important to make a distinction between non-stop and one-stop services, since potential travelers are more likely to be aware of availability of American Airlines' flights on non-stop routes. Frequent travelers will likely know if American serves their home airport, and hence they will be more aware of the non-stop destinations served by this carrier. For example, if a potential traveler knows that American offers a flight from her hometown airport to Dallas, and she needs to book a flight to Dallas, then she will likely seek a fare quote for American's non-stop flight option (and if American is the only carrier offering such a flight, then she will likely visit AA.com to find a quote). In comparison, one-stop markets are more competitive than non-stop routes (descriptive statistics appear in the next section to back this claim). A potential traveler searching for quotes on a one-stop journey on Expedia in the first quarter of 2011 would in most cases obtain several one-stop options (e.g., from Delta, Continental, United, and US Airways), hence reducing the need for the consumer to make a side trip to American Airlines' web-site. When searching for a non-stop flight quote, however, our prospective passenger would in the same situation obtain few or no quotes, which could justify an additional search on AA's website, especially if the passenger knows American offers non-stop service on the route.

An aspect of the travel distribution market, which could work to mitigate the effect of the conflict on American Airlines' revenue, is the existence of the agents that allow prospective travelers to compare fare quotes across different sources. Kayak.com is the most important player of this kind. Even if Expedia or Orbitz do not show American Airlines' fare quotes directly, such quotes will be visible via kayak.com (from which the customer will be taken to AA.com or an agent offering the fare). The extent to which this channel could have mitigated the effect of the conflict is not clear, as there are no reliable publicly available estimates as to how many customers use such agents.

As a first rough assessment of potential effects of the conflict, Table 1 compares operating results of American Airlines with its primary competitors¹² for the first three quarters of 2011. As a basis for comparison we use the corresponding quarters from 2010 to determine the year-over-year percentage

¹¹ It is typical for the airlines to market their websites as the place where customers can obtain their lowest fares.

¹² We defined American Airlines' primary competitors based on the extent of the carrier's multimarket contact with other airlines. See next Section for more details.

changes. We see that AA-GDS conflict appears to have reduced American's passenger numbers, load factor, and revenue. We argue that the impact on revenue is the most noticeable of the three.

Table 1 indicates that AA carried almost two percent fewer passengers in the first quarter of 2011 compared to 2010. During the same quarter, Delta and US Airways managed to increase their passenger count on the US domestic market by 3.6 and 5.1 percent, respectively. The substantial decline in passenger numbers reported by United/Continental is likely related to their merger (completed in October 2010). The combined airline was optimizing its network, getting rid of the redundancies that existed prior to the merger. In the first quarter, American Airlines' load factor also declined (-0.5%), however, this change was in line with its competitors as Delta also registered a drop in load factor (-1.3%), while United/Continental (1.1%) and US Airways (1.3%) both managed slight increases.

On the revenue side, however, we can clearly see the impact of the conflict on American's first quarter of 2011 sales, which grew at a substantially lower rate than its competitors'. American managed to increase quarterly revenue by 4.6%; while its three key competitors registered significantly larger gains ranging from 7.6% (United/Continental) to 11.3% (US Airways). Had AA's revenue grown by the average revenue increase rate of 9.8% registered by its three primary competitors (UA/CO, AA, US), the carrier would have collected \$154 million more in revenue during the first quarter of 2011. This back of the envelope calculation does not however take into account other possible carrier-specific and market-specific effects.

5. Effects of the Conflict on American Airlines' Prices and Revenue

5.1. Data and Methodology

5.1.1. General

The discussion in the previous section of the paper and aggregate data from Table 1 suggests that the American-GDS conflict may have placed a substantial share of American Airlines' revenue at risk. The lower revenue for American is based on aggregate data, which does not include controls for carrier-specific or market-specific heterogeneity. The purpose of this section is to carry out the data analysis with the appropriate controls.

We suggest that American may have used ticket prices to both attract customer traffic to its website and mitigate any display bias applied by the leading GDS (Sabre). Hence the main part of our data analysis involves evaluating the potential price effects of this conflict. Moreover, we also consider the potential effects of this conflict on Americans' load factors and passenger volumes for non-stop flight segments. In either case, the methodological approach we employ involves a difference-in-differences estimator in the context of reduced-form market level fixed effects specifications.

5.1.2. Price Effects

The primary source of our price data is the US Department of Transportation (DOT) Origin and Destination Survey, databank DB1B. The DB1B is a 10 percent sample of actual itineraries, compiled quarterly by the US DOT. Each entry in the DB1B includes fare paid (net of taxes and fees), class of

service¹³, and detailed information on routing, including the marketing carrier (airline that sold the ticket), and operating carrier for each flight segment, distance traveled, and all intermediate airports visited. The destination of the trip is coded through the directional break in an itinerary. For our analysis, we have used DB1B dataset for the first quarter of 2010 and 2011. We consider the first quarter of 2011 as the peak of the conflict between American Airlines and travel services distributors, since this is the period when both Expedia and Orbitz did not provide American fares to potential buyers, and Sabre imposed a temporary display bias for American fares. The first quarter of 2010 is used as the baseline comparison time period to avoid any potential seasonality issues.

We retained both non-stop and one-stop roundtrip single airline itineraries, originating and terminating at the same airport. We re-assigned regional carriers to the corresponding major airlines.¹⁴ Itineraries flagged in the dataset as questionable are dropped. Our dataset includes restricted economy class itineraries (except for Southwest Airlines, which classifies all its tickets as “restricted first class”). The restricted economy classification is used most frequently in the DB1B dataset (over 85 percent of the sample); and restricted economy fares appear to span the expected range of economy class fares rather well. In line with previous studies (e.g., Lee and Luengo-Prado, 2005), we dropped all itineraries with fares of less than two cents per mile (e.g., about \$100 for a coast-to-coast roundtrip ticket) and we only include markets with 100 or more passengers during the quarter.

From the DB1B, we calculated the natural logarithm of passenger weighted average airfares at the airline-quarter-origin-destination level. In situations where an airline offers both non-stop and one-stop services, we computed passenger-weighted mean fares separately for nonstop and one-stop flights. One-stop mean fares were computed without regard to the connecting airport (e.g., American Airlines flights stopping in either Chicago or Dallas hubs – are lumped together for the purposes of computing passenger weighted mean fare for one-stop itineraries).

Our methodology involves estimating the following reduced-form price specification:

$$P_{ikt} = \alpha_i + \beta X_k + \phi X_k C_t + \psi C_t + \gamma Z_{ikt} + \varepsilon_{ikt}$$

Where the dependent variable P_{ikt} is the natural logarithm of passenger weighted airfare charged by airline k on market i at time t ; α_i represent market fixed effects; X_k is the vector of airline-specific effects; C_t is the conflict indicator variable for first quarter of 2011 (when the conflict initially occurred); Z_{ikt} is the vector of control variables; and ε_{ikt} is the error term.

The airline-conflict time interactions are the key variables of interest. Specifically, the effect of conflict on American Airlines’ prices is identified by:

¹³ Services as classified as first unrestricted, first restricted, business unrestricted, business restricted, economy unrestricted, and economy restricted.

¹⁴ To assign regional carriers to major airlines, annual 10K reports filed each year with the U.S. Securities and Exchange Commission by all major and regional airlines are analyzed to identify partnerships. Assignments are subsequently checked for accuracy by cross-checking regional carrier route maps with schedules of their major carrier partners to ensure that routes are properly assigned. The resulting assignments appear in the Appendix.

$$\phi_{AA} - \phi_{competitor}$$

This difference being negative and statistically significantly different from zero constitutes evidence consistent with the conflict having an impact on pricing by American Airlines. In addition to the negative and significant difference between ϕ_{AA} and corresponding coefficient for the carrier's main competitors; we need to verify that the difference $\phi_{C1} - \phi_{C2}$ is statistically close to zero for any pair of competitors C1 and C2 that does not involve AA (e.g., Delta and United).

To identify the airlines that are considered "close" competitors to American Airlines, we use two criteria. First, we suppose that American's closest competitors are network carriers of similar size, operating business models that resemble that of American Airlines. This approach, however, is admittedly not very scientific. For example, Southwest Airlines is the largest low-cost carrier (LCC) in the US market and is a similar size carrier as AA¹⁵, albeit operating under a different business model. More importantly, Southwest Airlines' ticket distribution strategy differs significantly from any other airline in the US market, since this carrier relies predominantly on direct ticket distribution through its website and call center. Hence, Southwest participates in a limited number of global distribution platforms¹⁶. On the other hand, Alaska Airlines is considered a network carrier (with some characteristics of an LCC); however, this carrier is much smaller than American Airlines (or other network airlines operating in the US market).

As the second criterion to identify AA's close competitors, we measure the level of multimarket contact between American Airlines and the seven largest US carriers. We use the DB1B dataset and count the number of airport-pair markets on which both American and another airline offered services in a given quarter. Presence of a single itinerary was sufficient to record "contact" between the two carriers in a market. Results of this exercise are presented in Table 4. Our count reveals that Delta, United, and Continental appear to compete with American Airlines in the largest number of markets. The carrier with the fourth highest level of multimarket contact with American is US Airways. The multimarket contact level of US Airways is substantially behind that for the largest three carriers. Southwest Airlines lags even further. We should however note Southwest Airlines serves several key metropolitan areas (most notably, Dallas-Fort Worth, San Francisco and Chicago) via a secondary airport¹⁷. Hence, our multimarket contact count underestimates the actual extent of competition between the two carriers. We find little multimarket contact between American and JetBlue or Alaska.

Given both the proximity of the carriers' business models and the differences in the recorded level of multimarket contact, we separated American Airlines' competitors into two broad groups: close competitors and distant competitors. For the purposes of our analysis, we consider Delta, United,

¹⁵ In 2011, Southwest carried 110 million passengers; AA and its main regional affiliate American Eagle served 80 million passengers in total.

¹⁶ For example, Southwest Airlines has never offered its tickets for sale via Orbitz, Expedia, or Travelocity.

¹⁷ Primary airports in Dallas, Chicago and San Francisco areas are Dallas-Ft.Worth International, Chicago O'Hare and San Francisco International, whereas Southwest predominantly serves the areas from Dallas Love Field, Chicago Midway and Oakland International airports, respectively.

Continental, and US Airways as American Airlines' close competitors, while all other airlines are classified as distant competitors. Southwest Airlines presents a borderline case. On one hand, it does compete with American on a substantial number of markets. On the other hand, this carrier's business model and ticket distribution strategy differs considerably from that of American Airlines. For the latter reasons, we will group Southwest with the more distant competitors – we will return to this issue briefly later on.

We also note that two of American's close competitors, Continental Airlines and United Airlines, merged in October of 2010 – hence, Table 1 presents a single company-wide entity which combines the operations for the two airlines. In the DB1B data, however, Continental Airlines flights appear under its own flight code until October 2012, when the two carriers' operating certificates were merged. Hence, for the purpose of this data analysis, in all subsequent tables and figures we follow the lead of the DB1B data and consider Continental Airlines' as a separate carrier from United Airlines.

As control variables in our regressions, we use natural logarithms of the airline's market share; Herfindhal-Hirschman index as the conventional measure of concentration; and total roundtrip distance in the itinerary. Note that the coefficient for the distance variable is identified in the market fixed effects specifications involving one-stop itineraries due to these itineraries being routed through different hubs (which provides within cross-section variation in this variable). Endogeneity of market share and market concentration measures are addressed through the conventional instrumental variable technique. We use the instruments suggested by Borenstein (1989), and employed elsewhere in the literature (e.g., Escobari and Gan, 2007).

Tables 2 and 3 present some descriptive statistics of the key variables used in the price regressions. We have a total of about 50,000 airline-market-quarter level observations, with about three-quarters of the sample being one-stop itineraries. The sample contains fares for single-airline itineraries operated by twenty different airlines. To save space, we present a distribution of sample fares for the eight largest carriers in the US market. Table 2 reveals that one-stop markets are less concentrated than non-stop routes. The distribution of sample observations by airlines roughly corresponds to the size ranking of U.S. carriers by domestic passenger volumes. Discrepancies can easily arise due to differences in the extent of airlines' networks, since we include one observation per airline per market per quarter. For example, an airline that carries its traffic on only a few markets will have fewer observations compared to a carrier operating an extensive network, even if the former might serve more passengers than the latter. Table 3 shows that all airlines increased their fares between first quarter 2010 and 2011, at the rate exceeding the change in CPI over the same time period¹⁸. We note that the non-stop mean fares for U.S. Airways were virtually unchanged, registering less than a one dollar increase.

Comparing the percentage changes in American Airlines' fares to those of its competitors, we find only United, Continental and JetBlue exhibit larger percentage increases in mean nonstop fares compared to

¹⁸ Official cumulative US inflation rate in 2010 was 3.2%; whereas airlines in our sample increased their fares by 5-9 percent.

American. Among one-stop itineraries, it is evident that all of American's close competitors increased fares to a greater extent than American Airlines. We find that the relative price changes in American Airlines' mean one-stop fares are similar to those of Southwest, JetBlue and Alaska (all of which we consider more "distant" competitors). Given that three-quarters of the sample involve one-stop itineraries, it's not surprising that we find similar differences in relative growth of American Airlines' fares for the entire sample – American year-over-year fare increases for the entire sample are similar to its more distant competitors (Southwest, JetBlue, and Alaska), while its closer competitors (Delta, United, Continental, and US Airways) register larger fare increases. These findings are consistent with the revenue results reported in Table 1.

5.1.3. Load Factor and Quantity Effects

Information on load factors and passenger volumes on non-stop flight segments is taken from the T100 database of the US Department of Transportation. This database is effectively a census of all commercial flights on the US market. The data is collected monthly at the airline-route-aircraft-type level, and is available for download from the US DOT website. We use data for scheduled passenger operations in the first quarter of 2010 and 2011. The information was then collapsed to the quarter-airline-route level. The same reassignment of regional carriers to the corresponding major airlines was performed as previously employed for the price data.

The methodology we use to evaluate the possible effects of the American – Global Distribution Systems conflict on load factors and passenger volumes of American Airlines is similar to the analysis of price effects. Specifically, we estimate market fixed effects models with natural logarithm of the load factors and passenger volumes as the dependent variables. As before, we implement a simple difference-in-differences estimation strategy. The only control variable used is the route-level Herfindahl-Hirschman Index (HHI); we employ the same instrument as Borenstein (1989) when estimating a two-stage least squares regression. In this analysis we continue classifying American Airlines' competitors into "close" and "distant" groups.

Table 5 presents descriptive statistics for load factors and route-level passenger volumes for the eight largest U.S. airlines over the first quarters of 2010 and 2011. Strikingly, the load factor averages from T100 data reported in Table 5 differ from the load factors found in Table 1. We attribute these load factor differences between the tables to the fact that while Table 1 reports operating results for the parent companies; Table 5 also includes regional affiliate operations by the major carriers. Apparently, the regional airlines' flight load factors are considerably lower. Nonetheless, we conclude that the information in Table 5 indicates that American's conflict with the travel distribution industry had minimal impact on the carrier's load factor. Further, American has been able to increase average passenger volume across its network. We observe substantial disparity across the carriers between first quarter 2010 and first quarter 2011: as average passenger volumes per route declined for Delta and Continental, yet increased for US Airways and JetBlue. Note that declining average here does not mean that the airline itself is in decline – one can get declining mean passenger volumes per flight segment if an airline expands its network to include thin markets, serving these routes with smaller aircraft.

5.2. Results and Discussion

5.2.1. Price Effects

Estimation results for the reduced form price regressions are presented in Table 6. We use market fixed effects two stage least squares estimation, with standard errors that are robust to heteroscedasticity and autocorrelation, since both may be present in the data. Six specifications are presented, two each for the entire sample, and the sub-samples of nonstop and one-stop itineraries. We have made a clear distinction between American Airlines' close and more distant competitors (as defined in the previous section of this paper). Specifications (2), (4) and (6) estimate the carrier-first-quarter-2011 interaction effects (ϕ using the terminology from Section 4) for both American Airlines and each of their four "close" competitors. Whereas specifications (1), (3) and (5) combine all "close" competitors to create a single interaction variable during the conflict period. All specifications also include individual airline fixed effects, which are not reported here to save space.

Table 7 supplements the price regressions presented in Table 6 by providing estimates of differences between American Airlines and Competing Airline Q1 2011 interaction variable ($\phi_{AA} - \phi_{competitor}$) for carriers identified as "close" competitors with American. Estimates of the differences in interaction effects for other carrier pair combinations are also reported. We include estimates for both the entire sample and the sub-sample of one-stop itineraries, based on specifications (2) and (6) from Table 6, respectively. We do not report the corresponding estimates for the sub-sample of nonstop itineraries, since these results do not show any effect of the conflict on AA fares – but then, we have previously outlined that we are skeptical that this effect may be present in this sub-sample. Further discussion of this issue will follow in the next section.

The results from Tables 6 and 7 suggest that, keeping other things constant, American's fare increases were considerably smaller than those reported by its "close" competitors (Delta, United, Continental, and US Airways). This is clearly visible in the sub-sample of one-stop itineraries. From the results reported in Table 7, we see that the differences between American Airlines and competitors' interaction terms suggest that American has significantly lower fares. The size of this effect is 2.7 to 4.7 percent. Moreover, none of the other pairs of carriers had differences that were statistically distinguishable from zero. Results for the entire sample appear consistent with the conflict having an adverse effect of American Airlines' revenue, since all of the relevant $\phi_{AA} - \phi_{competitor}$ differences are negative. However, only two of these differences are statistically different from zero. Further, half of the other carrier pairs $\phi_{C1} - \phi_{C2}$ register significant differences – all of them involve United Airlines, which suggests that United increased its fares by a larger magnitude than its competitors.

Further, to address the point that Southwest Airlines may be considered a borderline case between what we here defined as American Airlines' close and distant competitors; we have re-run all the specifications reported in Table 6, treating this carrier as a close competitor. Results of this exercise are presented in Table A.2 in the Appendix. From that table, we can note two things. First, our main results are not affected by this re-classification of Southwest Airlines. Second, American Airlines' price effect is

quite similar to that of Southwest and exceeds the new set of distant competitors (which now consists of small carriers). Lack of discernible price difference between American and Southwest should not be considered to depreciate our findings, in light of the fact that Southwest Airlines does not distribute its tickets via any of the travel agents involved in the dispute.

Overall, the price regression results paint the picture consistent with our expectations. One-stop markets are generally more competitive than non-stop routes, since consumers have more potential one-stop routing options. Also, as we have discussed earlier in this study, the prospective traveler searching for a price quote on a market without non-stop service will likely obtain a sufficient number of fare options when searching on a platform where American Airlines' quotes are not offered. We have thus expected that we would be more likely to observe the result consistent with the conflict having an adverse impact on American Airlines' revenue in the sample of one-stop itineraries.

Our fare estimations suggest that the American – Global Distribution System conflict in the first quarter of 2011 had an adverse impact on American Airlines' revenue. Our results also imply that the loss of revenue is attributed to one-stop rather than non-stop itineraries. American Airlines' average one-stop fare in the first quarter of 2011 is \$425.78. Our estimation results from Table 7 suggest that absent the conflict American Airlines would have been able to charge up to four percent (about \$17) more for these tickets. Since about 20 percent of American Airlines' passengers in our dataset involve one-stop itineraries¹⁹, and given the passenger counts from Table 1, we infer that three million American passengers were potentially affected by this conflict. Hence losing \$17 per passenger from three million customers translates into a potential revenue impact of \$51.6 million; or about 1.6 percent of American's revenue for the first quarter of 2011. This \$51.6 million revenue loss for American is less than one-third of our initial rough estimate of \$160 million loss presented in the previous section.

5.2.2. Effects on Load Factor and Passenger Volumes

In addition to airfares, we also examine the impact of the American-Global Distribution System conflict on both load factors and passenger volumes. Table 8 presents separate regression results for the entire sample and for the sub-sample of non-monopoly routes (defined as segments with an HHI less than 0.9). We note that even in markets where American Airlines is the only provider of non-stop service the conflict could still have an adverse effect on passenger counts since transfer passengers may be using this flight segment as part of their journey.

Our estimation results in Table 8 indicate lack of any discernible load factor or quantity effects of the conflict on American Airlines. The results for the first quarter year over year (2010/11) time period show that some airlines (Delta and Continental) decreased their load factor beyond the general industry time trend, while another carrier (United) registered higher load factors in the first quarter of 2011. Changes in passenger volumes are largely explained away by market-specific and carrier-specific heterogeneity,

¹⁹ Note that Berry and Jia (2010) document a decrease in share of American Airlines' connecting passengers from about 35% in 1999 to close to 25% in 2006. Since the share of one-stop passengers did not change from Q1 2010 to Q1 2011, this suggests that American has been able to effectively sell one-stop tickets via different distribution channels.

except for Continental Airlines. We attribute the negative and significant coefficient for the Continental-first-quarter-2011 interaction variable in the passenger volume regressions to the effect of its merger with United. As noted above, the merger was completed in October of 2010, so during this transition period some Continental Airlines flights may have been incorporated into United Airlines' network by the first quarter of 2011, and are hence being reported as United Airlines' flights in the T100 dataset. It is our understanding that when these two carriers' networks were integrated, United began the integration process by first incorporating the larger aircraft operated by Continental Airlines.

In addition to load factor and passenger volume regressions reported in Table 8, we have also estimated both route-level flight frequency and average aircraft size specifications. We find very little differences for American Airlines for the year-over-year comparisons for both flight frequency and aircraft size.²⁰ In sum, our analysis failed to detect any adverse effects of this conflict on the number of American Airlines tickets sold. We do note, however, that the previous section indicates that American experienced smaller year-over-year price increases compared to its "close" competitors. This suggests that American Airlines effectively implemented yield management (i.e., pricing) techniques to ensure that reduced visibility of its travel options on the main distribution platforms did not reduce the volume of tickets sold.

6. Concluding Remarks

This study contributes to the literature on two-sided markets. We take advantage of a "natural experiment" in the airline ticket distribution industry to investigate what happens to a seller's revenue when a large seller (American Airlines) has its inventory removed from important ticket distribution platforms (Expedia and Orbitz online travel agents). This enables us to estimate the value of the platform to a seller. Our findings not surprisingly indicate that access to major buyer platforms is of considerable short-term value to a seller. Specifically, we estimate that the ticket distribution dispute during the first quarter of 2011, when American Airlines lost access to the-Expedia/Orbitz platform, resulted in a 1.6 percent reduction in revenue (over \$50 million) for American Airlines. These revenue reductions are attributed to lower ticket prices rather than a reduction in the number of tickets sold. Apparently, the seller's yield management techniques (lowering prices) were successful in attracting buyers to its own platform (airline's website) which mitigated the compound effects of (i) not having fares appear on major ticket delivery platforms (Expedia and Orbitz); and (ii) the alleged display bias introduced by another ticket distribution system (Sabre). Note that we initially evaluated the revenue at risk due to losing access to the key platforms to be close to \$500 million – ten times the realized revenue effect.

There are several caveats that apply to our findings. First, we do not have perfect information in regards to every action taken by both platforms (Expedia, Orbitz, Sabre) and sellers (American Airlines and its main competitors). For example, between January 5 and January 24, 2011 Sabre took punitive actions against American Airlines by implementing display bias towards American Airlines' fares. This analysis assumes that the peak of the American-Sabre conflict coincided with the first quarter of 2011, (the

²⁰ Results are available from the authors upon request.

period when both Orbitz and Expedia failed to display American Airlines' fare quotes). Sabre's actions could have biased American's fare offers, which subsequently would affect other travel agents using this Global Delivery System. Hence we cannot disentangle the fare effects of removing American tickets from the Expedia and Orbitz platforms from the display bias implemented by Sabre. We, however, can confidently state that our baseline period (first quarter of 2010) is free from both access restrictions and display biases.

The second caveat relates to proper interpretation of our findings. Indeed, this study looks at the short-term value of a platform to a large seller. We note, however, that not all large sellers rely on a ticketing platform to the same extent. For example, American and Delta tend to sell a substantial share of their tickets via travel agents, and generally make their entire inventory available to the global distribution systems. On the other hand, Southwest Airlines relies predominantly on its own website to sell the tickets, and does not participate in all of the ticket distribution systems. Hence, the value of the platform to a seller depends on how reliant the seller is on the platform to distribute tickets. Further, a potential alternative explanation of our findings is that instead of American Airlines lowering its prices, AA's close competitors could have increased their fares, knowing that one of the key competitor's options were not reported by some of the distribution platforms. A piece of evidence in support of this suggestion is that American changed its fares in line with its more distant competitors.

Third, some of our data analysis results did not quite confirm our expectations. In particular, we find that this ticket delivery dispute lowered one-stop itinerary fares for American, yet left non-stop American fares unchanged. This result is a bit puzzling since we would expect both sets of fares to be adversely affected by this dispute. We attribute this finding to the more competitive one-stop market where passengers have more available substitutes, so American needed to lower ticket prices to maintain passenger volumes in these markets. The price regression estimates for the sub-sample of nonstop itineraries suggest lower first quarter 2011 fares for US Airways (not American). These findings then are consistent with a conflict of US Airways and the ticket delivery platforms. In fact, US Airways is currently in litigation with Sabre, alleging that Sabre implemented display bias for US Airways tickets.

Fourth, our main conclusion relies on the classification of carriers in the US market into "close" and "distant" competitors of American Airlines. The former group essentially consists of the large network carriers, while the latter includes low-cost airlines and smaller network carriers. While we believe this delineation is intuitive based on both the extent of multimarket contact between American and respective carriers, and/or differences between the airlines' business strategies and reliance on travel services distribution platforms; we should keep in mind that the effect of this conflict on American Airlines' revenue has been identified relative to the other large network carriers rather than the entire universe of airlines operating on the US market. Had we used the universe of airlines as the comparison group, then the stated reduction in revenues would have been considerably smaller.

Finally, we employ a difference-in-differences estimation strategy to quantify the effects of this American-Global Delivery Systems conflict; however, there may also be other changes in the market structure during this time period, which could have produced the observed result. For example, between the first quarter 2010 and first quarter 2011 two large "close" competitors merged (United and

Continental). Our price regressions do not appear to point to any anomaly which could have been related to this event. In addition, American Airlines experienced extreme financial difficulties both during and after the conflict, ultimately filing for Chapter 11 bankruptcy protection in November 2011 – about six months after what we have defined as the peak of the conflict. Hence our difference in difference estimation is unable to separate the conflicting effects of financial difficulty from this ticket delivery conflict. Busse (2002) indicated that airlines under financial stress are more likely to initiate price wars. Yet, if American did start a price war in the first quarter of 2011, we would probably see it more clearly across all the price regressions, not only in the sub-sample of one-stop itineraries. Also, while American did lose about \$250 million in the first quarter of 2011; the carrier finished 2010 in the black. If anything, American would be more likely to have initiated a price war in the first quarter of 2010, immediately after losing \$1.1 billion in 2009.

Overall, our study provides some evidence which suggests that platforms are extremely valuable to a seller in a two-sided market, along with putting a monetary value on platform participation. We find that platforms can inflict considerable damages on sellers by restricting access to buyers. In the case of the dispute between American Airlines and two large platforms (Expedia and Orbitz), we estimate that the restriction of access to these large platforms may have cost American Airlines up to \$50 million in the first quarter of 2011. In an effort to mitigate the financial damages due to the platforms' actions, American likely used yield management techniques (lower ticket prices) to maintain passenger volume since we find no changes in load factors or passenger counts during this ticketing dispute.

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Figure 1. Airline ticket distribution

Table 1 Operating Results of American Airlines and Main Competitors (US Domestic Market)

Indicator	Time	American		United/Continental		Delta		US Airways	
		Value	Δ%, YOY	Value	Δ%, YOY	Value	Δ%, YOY	Value	Δ%, YOY
Passengers	Q1 2010	15,485,273	-1.9%	10,036,924	-7.6%	19,863,748	+3.6%	10,396,613	+5.1%
	Q1 2011	15,185,016		9,271,773		20,583,542		10,930,636	
	Q2 2010	17,051,100	-0.07%	11,243,421	-8.6%	23,480,271	+3.9%	11,542,221	+3.1%
	Q2 2011	16,923,734		10,276,679		24,395,692		11,909,781	
	Q3 2010	16,896,375	+1.0%	11,549,142	-7.2%	24,185,540	+3.5%	11,673,674	-0.1%
	Q3 2011	17,071,982		10,710,121		25,042,992		11,661,808	
Flights	Q1 2010	132,650	-2.0%	81,858	-6.8%	165,843	+2.7%	95,261	+4.8%
	Q1 2011	130,005		76,277		170,422		99,902	
	Q2 2010	133,643	-0.3%	85,911	-8.9%	183,520	+1.7%	100,801	+1.7%
	Q2 2011	133,132		78,243		186,779		102,521	
	Q3 2010	135,507	-0.1%	88,648	-8.3%	190,916	+0.04%	103,048	-2.8%
	Q3 2011	135,398		81,281		191,002		100,143	
Load Factor	Q1 2010	0.79	-0.5%	0.82	+1.1%	0.81	-1.3%	0.81	+1.3%
	Q1 2011	0.78		0.83		0.80		0.82	
	Q2 2010	0.86	-0.2%	0.87	+1.3%	0.87	-0.4%	0.85	+0.8%
	Q2 2011	0.86		0.88		0.86		0.86	
	Q3 2010	0.85	+0.8%	0.87	+1.8%	0.86	+1.3%	0.84	+2.9%
	Q3 2011	0.86		0.89		0.87		0.87	
Revenue, thousand USD	Q1 2010	3,038,501	+4.6%	2,736,886	+7.6%	4,642,172	+10.4%	2,116,504	+11.3%
	Q1 2011	3,181,125		2,944,715		5,124,733		2,355,327	
	Q2 2010	3,410,254	+4.8%	3,262,597	+5.4%	5,411,121	+10.1%	2,401,135	+9.2%
	Q2 2011	3,575,021		3,438,023		5,960,970		2,623,830	
	Q3 2010	3,345,577	+7.1%	3,343,912	+7.0%	5,510,909	+8.4%	2,310,640	+8.1%
	Q3 2011	3,584,428		3,578,115		5,976,645		2,483,836	

Notes:

- Computed based on DB1B data provided by US Department of Transportation
- Operating results for parent companies only – regional carriers not included
- United Airlines merged with Continental Airlines in October 2010; Continental was dissolved in March 2012. US DOT combines the data for the two carriers in both 2010 and 2011.

Table 2 Descriptive Statistics, Price Regressions

Variable	Entire Sample	Nonstop Itineraries	One-stop Itineraries
Price, \$	392.15 (160.50)	371.86 (159.55)	399.60 (160.20)
Market Share	0.1992 (0.3202)	0.5134 (0.4055)	0.0838 (0.1740)
HHI	0.6495 (0.2511)	0.7116 (0.2360)	0.6268 (0.2526)
Roundtrip Distance (miles)	2884.6 (1607.3)	2006.2 (1329.5)	3207.2 (1579.8)
Total Observations	50,212	12,614	37,598
Distribution of Observations by Airlines			
American	0.1394	0.1207	0.1488
Delta	0.1943	0.1684	0.2073
United	0.1650	0.1667	0.1677
Continental	0.1084	0.0745	0.1222
US Airways	0.1531	0.1165	0.1689
Southwest	0.1298	0.2324	0.0970
JetBlue	0.0234	0.0390	0.0185
Alaska	0.0291	0.0529	0.0214

Note: values reported here are un-weighted averages at the airline-market-quarter level. Standard errors appear in parentheses.

Table 3 Mean US Domestic Airfares by Airlines – Restricted Economy Class

	Entire Sample		Nonstop Itineraries		One-stop Itineraries	
	Q1 2010	Q1 2011	Q1 2010	Q1 2011	Q1 2010	Q1 2011
American	396.01 (139.31)	420.75 (138.97)	373.06 (114.87)	402.80 (126.29)	402.49 (144.83)	425.78 (141.94)
Delta	404.62 (162.15)	436.63 (162.58)	430.36 (148.51)	451.84 (170.09)	397.22 (165.14)	432.43 (160.22)
United	394.47 (178.06)	435.51 (189.92)	413.10 (191.42)	467.33 (199.02)	388.55 (173.22)	423.61 (185.04)
Continental	396.38 (162.55)	430.00 (216.20)	428.14 (167.22)	475.10 (199.69)	389.60 (160.77)	420.56 (218.37)
US Airways	412.75 (146.93)	449.78 (147.32)	411.08 (157.15)	411.94 (140.66)	413.17 (144.28)	458.38 (147.47)
Southwest	331.23 (89.28)	351.65 (89.28)	304.74 (85.31)	324.02 (84.76)	353.06 (86.55)	374.82 (86.36)
JetBlue	349.02 (141.95)	376.73 (132.63)	281.15 (69.49)	308.34 (80.83)	399.99 (160.09)	425.10 (140.67)
Alaska	414.61 (223.44)	442.69 (231.60)	361.30 (152.96)	386.21 (174.37)	463.89 (263.66)	487.46 (260.07)

Note: values reported here are un-weighted mean fares at the airline-market-quarter level (standard errors in parentheses).

Table 4 American Airlines Multimarket Contact on US domestic routes

Time	Alaska	JetBlue	Continental	Delta	United	US Airways	Southwest
Q1 2010	296	320	5084	6673	5106	3045	2160
Q1 2011	425	392	4998	7700	5692	3469	2345

Note: The above values represent a count of the directional origin-destination markets in which both American Airlines and the respective competitor offered service. These DB1B data involve only single-airline itineraries.

Table 5 Load Factors and Passenger Volumes by Carrier

	Load Factor		Passengers	
	Q1 2010	Q1 2011	Q1 2010	Q1 2011
American	0.732 (0.190)	0.728 (0.161)	24,624 (49,945)	33,916 (55,949)
Delta	0.729 (0.154)	0.702 (0.164)	35,944 (52,250)	29,489 (49,424)
United	0.645 (0.234)	0.668 (0.216)	22,299 (39,216)	20,954 (37,470)
Continental	0.715 (0.144)	0.718 (0.174)	41,224 (47,672)	22,512 (39,001)
US Airways	0.656 (0.233)	0.655 (0.234)	20,829 (36,557)	28,371 (42,890)
Southwest	0.745 (0.117)	0.764 (0.109)	55,535 (44,977)	57,404 (44,809)
JetBlue	0.751 (0.091)	0.794 (0.078)	41,073 (35,681)	45,199 (37,744)
Alaska	0.622 (0.189)	0.644 (0.212)	23,787 (39,570)	25,866 (42,271)

Note: The above values are computed from T-100 database of the US DOT. Average load factor and passenger counts are calculated at the airline-route-quarter level and include flights operated by parent company and regional affiliates. Standard errors appear in parentheses.

Table 6 Price regressions using two-stage least squares estimation with market level fixed effects – Natural logarithm of average fares for US domestic flights by eight largest carriers (Q1 2010 and Q1 2011)

	All itineraries		Non-stop itineraries		One-stop itineraries	
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	5.1533** (0.0954)	5.1437** (0.0956)	5.5842** (0.0577)	5.5973** (0.0580)	4.7894** (0.1192)	4.7788** (0.1200)
Log(Market share)	0.0529** (0.0021)	0.0530** (0.0022)	0.0117** (0.0022)	0.0124** (0.0022)	0.0922** (0.0048)	0.0929** (0.0049)
Log(HHI)	-0.1516** (0.0239)	-0.1546** (0.0239)	-0.3312** (0.1106)	-0.2949** (0.1118)	-0.1511** (0.0221)	-0.1521** (0.0221)
Log(Distance)	0.0977** (0.0124)	0.0985** (0.0125)	---	---	0.1683** (0.0163)	0.1700** (0.0165)
Non-stop itinerary	-0.1377** (0.0085)	-0.1383** (0.0086)	---	---	---	---
Q1 2011 indicator	0.0218** (0.0069)	0.0279** (0.0061)	0.0374** (0.0157)	0.0539** (0.0118)	0.0281** (0.0088)	0.0290** (0.0082)
AA*(Q1 2011)	0.0436** (0.0088)	0.0376** (0.0081)	0.0476** (0.0196)	0.0317** (0.0159)	0.0221** (0.0111)	0.0211** (0.0106)
(CO or DL or UA or US)*(Q1 2011)	0.0662** (0.0074)	---	0.0440** (0.0153)	---	0.0603** (0.0094)	---
CO*(Q1 2011)	---	0.0520** (0.0102)	---	0.0448** (0.0235)	---	0.0614** (0.0133)
DL*(Q1 2011)	---	0.0571** (0.0079)	---	0.0527** (0.0138)	---	0.0478** (0.0102)
UA*(Q1 2011)	---	0.0789** (0.0092)	---	0.0500** (0.0179)	---	0.0683** (0.0122)
US*(Q1 2011)	---	0.0504** (0.0079)	---	-0.0607** (0.0167)	---	0.0632** (0.0100)
Distant*(Q1 2011)	0.0322** (0.0081)	0.0301** (0.0078)	0.0411** (0.0150)	0.0212* (0.0124)	0.0189* (0.0113)	0.0231** (0.0111)
Adjusted R-squared	0.4149	0.4135	0.7270	0.7327	0.3028	0.3007
Observations	50,212		12,614		37,598	

Notes:

- White robust standard errors appear in parentheses
- Market share and HHI are instrumented as in Borenstein (1989)
- Only includes markets with at least 100 passengers per quarter in DB1B
- “Distant” competitor is an indicator variable for the airlines: Southwest, JetBlue and Alaska
- Each specification includes individual airline dummies(not reported)
- * and ** indicate statistical significance at the 10% and 5% level, respectively.

Table 7 Differences in Airline-Q1 2011 Interaction Coefficients, Price Regressions

(a) All Itineraries

	American	Continental	Delta	United	US Airways
American	---	-0.0144	-0.0195*	-0.0413**	-0.0128
Continental		---	-0.0051	-0.0269*	0.0016
Delta			---	-0.0218*	0.0067
United				---	0.0285**
US Airways					---

Note: Estimated coefficients are based on specification (2) in Table 6

(b) One-stop Itineraries

	American	Continental	Delta	United	US Airways
American	---	-0.0403**	-0.0267*	-0.0472**	-0.0421**
Continental		---	0.0136	-0.0069	-0.0018
Delta			---	-0.0205	-0.0154
United				---	0.0051
US Airways					---

Note: Estimated coefficients are based on specification (6) in Table 6

Coefficient differences are calculated by subtracting carrier-Q1 2011 interaction coefficient for the airline in the row from the corresponding airline in the column. * and ** indicate statistical significance at the 10% and 5% level, respectively.

Table 8 Load Factor and Passenger volume regressions using two-stage least squares estimation with market level fixed effects – US DOT T100 database (Q1 2010 and Q1 2011)

	Load Factor		Passenger Volume	
	All Routes	Non-monopoly routes	All Routes	Non-monopoly routes
Constant	-0.3437** (0.0467)	-0.2106 (1.0478)	10.120** (0.2459)	8.9434 (8.0399)
Log(HHI)	0.2378* (0.1503)	0.2529 (1.5491)	0.9137 (0.7212)	-1.7283 (11.847)
Q1 2011 indicator	0.0194** (0.0093)	0.0158 (0.0153)	0.0398 (0.0440)	0.0150 (0.1100)
AA*(Q1 2011)	-0.0042 (0.0103)	0.0044 (0.0855)	-0.0247 (0.0551)	-0.1312 (0.6554)
CO*(Q1 2011)	-0.0330** (0.0117)	-0.0295 (0.0301)	-0.2386** (0.0915)	-0.4665* (0.2696)
DL*(Q1 2011)	-0.0236** (0.0108)	-0.0254 (0.0409)	-0.0474 (0.0589)	-0.3129 (0.6599)
UA*(Q1 2011)	0.0275* (0.0166)	0.0132 (0.0812)	-0.1036 (0.1049)	-0.0880 (0.3224)
US*(Q1 2011)	0.0045 (0.0136)	-0.0280 (0.0251)	0.0649 (0.0594)	0.0883 (0.1830)
Distant*(Q1 2011)	0.0230** (0.0099)	0.0223* (0.0130)	0.0354 (0.0432)	0.0727 (0.0697)
Adjusted R-squared	0.7970	0.6633	0.7759	0.6033
Observations	5985	2745	5985	2745

Notes:

- Dependent variables are natural logarithms of load factor and passenger volumes, at route-airline-quarter level
- White robust standard errors appear in parentheses
- HHI is instrumented as in Borenstein (1989)
- “Distant” competitor is an indicator variable for the airlines: Southwest, JetBlue and Alaska
- Each specification includes individual airline dummies (not reported)
- * and ** indicate statistical significance at the 10% and 5% level, respectively.

Appendix

Table A.1 Assignment of Regional Carriers

Major Carrier	Regional Carrier
American Airlines (AA)	American Eagle* Executive Airlines* Regions Air Chautauqua Airlines Trans States
Alaska Airlines (AS)	Horizon Air*
Continental Airlines (CO)	ExpressJet Commutair Colgan Skywest
Delta Air Lines (DL)	ASA/ Atlantic Southeast Airlines* Comair* Skywest Chautauqua Airlines ^a Republic Freedom ^b
Northwest Airlines (NW)	Mesaba Airlines Express Airlines
United Airlines (UA)	Air Wisconsin ^c GoJet Shuttle America Trans States Skywest ^d Mesa Chautauqua Airlines Colgan ^e
US Airways (US)	Air Wisconsin Chautauqua Airlines Mesa PSA Airlines Piedmont

Regional carriers that serve multiple majors are assigned based on hub identities.

Notes:

^a Only routes involving cities in Florida and Raleigh-Durham (RDU)

^b Only routes involving Orlando, FL (MCO)

^c Only routes involving Chicago O'Hare (ORD) and Washington Dulles (IAD)

^d Only routes involving Portland, OR (PDX), Medford, OR (MFR), and Eureka-Arcata, CA (ACV)

^e Only routes involving Washington Dulles (IAD)

Table A.2 Price effects with Southwest considered as a “close” competitor of American Airlines

	All itineraries		Non-stop itineraries		One-stop itineraries	
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	5.1495** (0.0957)	5.1459** (0.0957)	5.5843** (0.0577)	5.6082** (0.0592)	4.7843** (0.1193)	4.7793** (0.1200)
Log(Market share)	0.0531** (0.0021)	0.0532** (0.0022)	0.0116** (0.0022)	0.0125** (0.0022)	0.0928** (0.0048)	0.0930** (0.0049)
Log(HHI)	-0.1506** (0.0239)	-0.1534** (0.0239)	-0.3310** (0.1107)	-0.2869** (0.1125)	-0.1490** (0.0221)	-0.1519** (0.0222)
Log(Distance)	0.0984** (0.0124)	0.0987** (0.0125)	---	---	0.1695** (0.0164)	0.1700** (0.0165)
Non-stop itinerary	-0.1382** (0.0086)	-0.1387** (0.0086)	---	---	---	---
Q1 2011 indicator	0.0215** (0.0069)	0.0218** (0.0069)	0.0374** (0.0157)	0.0329** (0.0159)	0.0275** (0.0088)	0.0276** (0.0088)
AA*(Q1 2011)	0.0437** (0.0088)	0.0436** (0.0088)	0.0476** (0.0196)	0.0530** (0.0197)	0.0224** (0.0111)	0.0225** (0.0111)
(CO or DL or UA or US or WN)*(Q1 2011)	0.0613** (0.0072)	---	0.0424** (0.0148)	---	0.0561** (0.0092)	---
CO*(Q1 2011)	---	0.0580** (0.0107)	---	0.0667** (0.0271)	---	0.0628** (0.0137)
DL*(Q1 2011)	---	0.0631** (0.0085)	---	0.0726** (0.0150)	---	0.0491** (0.0106)
UA*(Q1 2011)	---	0.0849** (0.0098)	---	0.0713** (0.0212)	---	0.0697** (0.0127)
US*(Q1 2011)	---	0.0564** (0.0087)	---	-0.0398** (0.0197)	---	0.0646** (0.0106)
WN*(Q1 2011)	---	0.0361** (0.0083)	---	0.0421** (0.0158)	---	0.0245** (0.0114)
Distant*(Q1 2011)	0.0223* (0.0132)	0.0222* (0.0132)	0.0474** (0.0174)	0.0500** (0.0172)	0.0063 (0.0207)	0.0063 (0.0207)
Adjusted R-squared	0.4133	0.4132	0.7271	0.7337	0.3012	0.3006
Observations	50,212		12,614		37,598	

Note: Except for treating Southwest Airlines as a “close” rather than a “distant” competitor of American Airlines, all specifications reported here are identical to those reported in Table 6.