Mergers and Organizational Disruption: Evidence from the US Airline Industry*

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Abstract

Merger-specific efficiencies alleviate anticompetitive concerns of horizontal mergers. However, organizational challenges inherent in mergers pose a threat to achieving these efficiencies and could negatively impact the merged firm's productivity and market outcomes. We separately measure the organizational and strategic effects of mergers on quality provision using administrative data from the US airline industry, leveraging an industry-specific regulation. We find that organizational challenges (e.g., combining workforces) cause a long-lasting and significant reduction in the quality supplied by a merged firm. In contrast, strategic effects (e.g., market strategy) have a minor impact on quality. Also, we find that a merger can reduce the performance of both merging firms. Our results suggest that antitrust authorities should consider a merger's organizational challenges in their review process.

Keywords: Organizations, mergers, organizational consolidation, efficiencies, airlines

JEL classifications: L1, L22, L41, L93

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1 Introduction

Horizontal mergers in concentrated industries lessen competition and make consumers worse off unless merger-specific synergies (e.g., cost reduction, reorganization of production, scale economies) create sufficiently large efficiency gains (Williamson, 1968; Farrell and Shapiro, 1990). Merger-specific efficiencies have been at the center of horizontal merger cases, and they have been estimated for mergers in many industries including cotton spinning (Braguinsky et al., 2015), beer (Heyer et al., 2009; Ashenfelter et al., 2015; Grieco et al., 2018), and freight railroads (Chen, 2021), among others.

The possibility of merger-specific *inefficiencies* that cannot be attributed to changes in market power has received less attention from economists. Along these lines, Eliason et al. (2020) document a post-merger decrease in product quality in the US dialysis industry. Another source of merger-specific inefficiencies are the organizational challenges faced by merging firms: they must consolidate diverse work forces, labor contracts, physical capital, technology systems, and other factors affecting the merged firm's productivity and product offerings. A successful organizational consolidation is crucial to realize merger-induced efficiencies, and to avoid inefficiencies.[1]

Isolating the impact of merger-specific organizational challenges on productivity and performance is difficult because a merger simultaneously affects both strategic incentives and the organization (Rose and Sallet, 2019). Horizontal-merger regulations in the US airline industry, however, provide a unique opportunity to separate the merger effects that come from a change in strategic incentives from those that come from organizational disruption, so we can separately identify the impact of each effect on firm performance. Specifically, these regulations create a time gap between the merger's approval date and the date when the merging firms can consolidate and operate as a single entity.[2] Airlines internalize "strategic" effects (e.g., changes in market structure, as well as strategic synergies associated with the merger) immediately after the merger approval date. Some months after this date, the merging airlines can consolidate as a single entity, at which point they experience an "organizational

[1]Examples of failed mergers due to organizational challenges include New York Central and Pennsylvania Railroad (1968), AT&T and NCR (1991), HP and Compact (2001), Sprint and Nextel (2005), AOL and Time Warner (2007), and Daimler and Chrysler (See, e.g., Lys and Vincent, 1995; Badrtalei and Bates, 2007; Harrington, 2013). See, also, https://hbr.org/2018/10/one-reason-mergers-fail-the-two-cultures-arent-compatible.

[2]Any (new) air carrier in the US must first obtain authorization from the Department of Transportation (DOT) and the Federal Aviation Administration (FAA). https://www.transportation.gov/policy/aviation-policy/licensing/US-carriers

disruption" effect.

We use administrative data from the US airline industry on the on-time performance of millions of flights over a decade. Specifically, we study three major airline mergers that took place in the last decade: US Airways–America West, Delta–Northwest, and United–Continental. Numerous statements in the popular media are consistent with post-merger difficulties.[3] In May 2011, Richard Anderson, Delta's former chief executive, commented on the challenges created by airline mergers, "Everybody had come to the conclusion that these things are too big, too complex and too unwieldy to manage."[4] In November 2012, nearly two years after the United and Continental merger was approved, Jeffery A. Smisek, United's former chief executive, commented, "The integration of two airlines takes years. It's very complex."[5] Darryl Jenkins, Chairman of the American Aviation Institute, said, "I have never seen an airline merger go smoothly." Anecdotal evidence supporting these claims include reports that the integration of the reservation system of both United–Continental and US Airways–America West caused a series of delays and cancellations[6], as well as reports that differences in both labor contracts and work culture caused productivity disruptions following the US Airways–America West and Delta–Northwest mergers.[7] Reports also suggest an increase in consumer dissatisfaction following some of the recent airline mergers.[8]

Our econometric analysis is based on a differences-in-differences design, where we compare the change in the merging airlines' on-time performance (treatment) with the change in the on-time performance of the rest of the industry (control). We also find similar results using alternative control groups as a robustness check. Our main finding is that challenges during the organizational consolidation can significantly lessen quality. Our estimates suggest a 22 percent increase in carrier delays (i.e., delays that could have been avoided by the carrier) after the merging firms begin to consolidate. Moreover, we find that strategic effects are modest relative to organizational effects.

We also explore how the organizational disruption effect unravels over time, finding that it

[3] Also, see Hansson et al. (2002) for a review of the complex process of merging airlines.

[4] http://www.nytimes.com/2011/05/19/business/19air.html?_r=0

[5] http://www.nytimes.com/2012/11/29/business/united-is-struggling-two-years-after-its-merger-with-continental.html

[6] http://usatoday30.usatoday.com/travel/flights/2007-03-05-us-airways-monday-update_N.htm and http://www.economist.com/blogs/gulliver/2012/03/united-continental-merger

[7] Kole and Lehn (2000) and http://www.post-gazette.com/business/businessnews/2006/04/02/Cultures-actually-clash-in-US-Airways-America-West-merger/stories/200604020236

[8] See, for instance, http://www.nytimes.com/2015/09/15/business/despite-shake-up-at-top-united-faces-steep-climb.html

peaks shortly after the merging firms begin their consolidation (a 100 percent increase in carrier delays) and fades over the course of approximately two years. However, we find that the post-merger organizational disruption may even permanently lessen quality—e.g., the United-Continental merger.

Also, we find that a merger does not always improve on-time performance relative to the on-time performance of the individual merging firms before the merger. In fact, in the United-Continental merger, we find that United converged to Continental's relatively worse pre-merger on-time performance. These results suggest that a merger will not necessarily lead to the "best of both worlds" in terms of post-merger performance. A conservative back of the envelope calculation shows that the organizational effect on carrier delays resulted in a $870 million dollars loss.[9]

If mergers frequently result in poorly consolidated organizations, then antitrust authorities should carefully consider the likelihood of a successful integration when evaluating them (Ravenscraft and Scherer, 2011; Scherer, 2006). The justification for imposing remedies or blocking a merger that shows signs of a turbulent integration follows the same logic of allowing mergers that reduce competition but show evidence of merger-induced efficiencies. In fact, the theory of merger analysis assumes that merger-induced efficiencies are immediately in place after the merger, which is unlikely if the merging companies struggle consolidating their organizations.

There are several reasons why an antitrust authority may want to block a merger where firms will not successfully integrate. If a rocky integration prevents efficiency gains from realizing, antitrust authorities would be overestimating efficiencies if ignoring the possibility of organizational disruption. At a minimum, antitrust authorities should consider how likely are the firms to integrate successfully, and how long that will take.[10] Our analysis of the airline industry is one example of how complex integration can be. Additionally, the merging firms only partially internalize the consumer harm caused by organizational disruption. Since consumers choices are limited under imperfect competition, the consumer harm will only partially be reflected on prices.

Our policy message is for antitrust authorities to take preventive measures to avoid consumer

[9]This estimation combines our estimates with delay costs estimates in Ball et al. (2010).

[10]Also, antitrust authorities should be aware of manager's overconfidence on the likelihood of successful integration (Malmendier and Tate, 2008). Moreover, Leccese et al. (2022) develop a theory showing that when the merged firm is privately informed about the size of the efficiency, they may strategically choose not to pass the efficiency gain to consumers.

harm caused by organizational disruption effects. Antitrust authorities could, for instance, request merging firms to submit detailed plans on labor contracts harmonization, technology systems, plans to deal with "soft" elements such as corporate culture, and other factors affecting the likelihood of a successful integration. Antitrust authorities could also coordinate with industry-specific institutions, such as the US Department of Transportation in the case of airlines. Thus, not only should the reduction of competition and the lack of efficiency gains be reasons to impose remedies or block mergers, but also the feasibility of actually merging.

Related Literature. Our work contributes to the body of empirical work studying the impact of mergers on market outcomes (see, e.g., Miller and Weinberg, 2017; Igami and Uetake, 2020; Miller et al., 2021; Prager and Schmitt, 2021). In particular, we relate to the set of papers evaluating merger-specific efficiencies (or inefficiencies). These studies have documented cost efficiencies in the US beer industry (Ashenfelter et al., 2015; Grieco et al., 2018) and the US freight railroad industry (Chen, 2021), but have also documented post-merger decreases in service quality in the US dialysis industry that cannot be explained by changes in market power (Eliason et al., 2020). Blonigen and Pierce (2016) find little evidence that mergers increase productivity on average for firms across all U.S. manufacturing industries.

Our contribution is to measure the relative impact of strategic (or market power) and organizational disruption effects in explaining the impacts of mergers on market outcomes. Other researchers have studied the impact of airline mergers on market performance and quality provision from other angles. Borenstein (1990) studies the Northwest Airlines–Republic Airlines and Trans World Airlines–Ozark Airlines mergers and presents evidence of price increases and service cutbacks on routes where the merging partners had both operated prior to the merger. Similar results for these mergers are presented in Werden et al. (1991). Kim and Singal (1993), Peters (2006), and Kwoka and Shumilkina (2010) also present evidence of price increases caused by these and other airline mergers. Carlton et al. (1980) measure how mergers benefit consumers by increasing the number of city pair combinations with single-carrier service. Borenstein and Netz (1999) study how competition affects departure time differentiation both before and after deregulation. Dai et al. (2014) study the relationship between competition and price dispersion in the airline industry. He et al. (2022) investigate how a change in the terms of service of one airline impact equilibrium prices. Shi et al. (2021) explore whether airlines pricing is affected by sunk costs. Mazzeo (2003) studies the relationship between competition and on-time performance, presenting evidence in favor of more frequent and longer delays on routes with only one airline providing direct service. Prince and Simon (2014) and Chen and Gayle (2019) study how mergers affect the availability of non-stop flights and on-time performance, respectively.

The effect of organization on firm performance is a longstanding question in the management and organizations literature. Stahl and Voight (2004) and King et al. (2004) perform a meta-analysis of the impact of cultural differences on post-merger performance. Industry-specific examples of this relationship include Lodorfos and Boateng (2006) (chemical industry), Saunders et al. (2009) (hotel industry), Buono et al. (1985) and Buono and Bowditch, 2003 (mutual savings banks). Given the prevalence of unsuccessful mergers, some researchers have investigated how to preempt post-integration difficulties (e.g, Graebner et al., 2016; Buono and Bowditch, 2003).

The rest of the paper is organized as follows. Section 2 describes the merger activity in the US airline industry and presents anecdotal evidence on the various mergers effects. Section 3 presents the data used for the empirical analysis, and Section 4 our econometric model. In Section 5, we present results that quantify a prolonged quality reduction caused by the merger and, lastly, in Section 6, we conclude.

2 Mergers in the US Airline Industry

The US airline industry has gone through several mergers in recent decades. As a result, 11 of the biggest US airlines in 2004 (measured in terms of revenue) have consolidated into 6 airlines.[11] Our analysis focuses on three recent mergers: US Airways and America West, Delta and Northwest, and United and Continental.[12]

Regarding the US Airways–America West merger, the Antitrust Division of the US Department of Justice (DOJ) argued that the merger would not reduce competition and stated that "integration of airlines with complementary, end-to-end networks, like those of the merging firms, can achieve efficiencies that benefit consumers."[13] Regarding the Delta–Northwest merger, the DOJ stated that "the Division has determined that the proposed merger between

[11] Over the last decade, the US airline industry has also experienced technological improvements, bankruptcies, and new regulations.

[12] Other recent deals, excluded from our analysis due to limited post-merger data, are the mergers between Southwest and AirTran (in 2011) and American and US Airways (in 2014).

[13] https://www.justice.gov/archive/atr/public/press_releases/2005/209709.htm

Delta and Northwest is likely to produce substantial and credible efficiencies that will benefit US consumers and is not likely to substantially lessen competition."[14] Finally, United and Continental transferred "takeoff and landing rights (slots) and other assets at Newark Liberty Airport to Southwest Airlines Co." in response to the DOJ's competitive concerns.[15]

There are two key dates in the timeline of airline mergers, where the merging firms transition from separate entities to a single airline. The first date is the merger approval date (or merger date), which is when the merging airlines become jointly owned.[16] After this date, the airlines may coordinate their choices about pricing, network structure, infrastructure, and other strategic dimensions. The second is the date when industry regulators (i.e., DOT and FAA) issue the merging airlines authorization to consolidate operations as a single entity (see footnote 2) The time gap between these two dates can be longer than a year.

2.1 Organizational Disruption Effects

The operation of the airline industry relies heavily on the coordination of multiple technological systems. Airlines must have reliable systems for communications, ticketing, flight scheduling, employees (pilots, flight attendants, suppliers) information, maintenance, weather forecast, air traffic control, security, etc. All of these systems must operate in unison for the airlines to be productive, and to provide a timely and reliable service to its customers. Consolidating two airlines requires harmonizing all of these systems, which is a major organizational challenge that may threaten firm performance. Because these challenges are inherent to the process of consolidating organizations, they should only impact on-time performance after the date when industry regulators authorize the merging airlines to consolidate. Despite taking preventive steps to avoid problems, all of the mergers we examine suffered the consequences of unforeseen issues during their integration processes. We call these *organizational disruption* effects.

[14] https://www.justice.gov/archive/opa/pr/2008/October/08-at-963.html

[15] https://www.justice.gov/opa/pr/united-airlines-and-continental-airlines-transfer-assets-southwest-airlines-response

[16] The term "merger approval" is used because most airline merger proposals are scrutinized by antitrust agencies due to potential competitive concerns before being approved.

US Airways and America West (2005)

The day-to-day management of the former US Airways and America West remained, for the most part, independent until 2006 when consolidation began. Almost three years after the approval of the merger, pilots originally working for US Airways unionized and confronted those who originally worked for America West. The newly formed airline could not settle on contracts for all pilots due to disagreement over the new seniority system.[17]

Apart from these cultural differences, on March 4th, 2007, US Airways and America West combined their reservation systems. The airlines chose to implement the system used by America West (*EDS/SHARES*). The transition was not smooth; the interaction between the reservation system and the ticketing stations at the airports failed, creating chaos at the airports, long waiting lines, and passenger frustration.[18] It has been argued that the reservation system used by US Airways (*SABRE*) would have been a better alternative.[19]

Delta and Northwest (2008)

After the merger approval in October 2008, the airlines' operations ran separately—i.e., each airline used its own flight-codes, reservation systems and crew—until they received a single operating certificate from the FAA on December 31st, 2009. Delta implemented the technological changes in stages and hired extra staff in anticipation to potential system crashes. The final Northwest flight took off in January 30, 2010. After this date, all flight reservations were managed by Delta's website.[20] By the end of the first quarter of 2010, Delta and Northwest's systems were fully consolidated.

Similar to what happened after the merger between US Airways and America West, two different work cultures clashed in the Delta–Northwest merger. Flight attendants belonging to Delta and Northwest continued working on separate contracts long after the merger. Delta's flight attendants did not want to unionize, while Northwest's flight attendants wanted to be represented by a union—as they had been unionized for 63 years before the merger took

[17] http://www.phoenixnewtimes.com/news/warring-us-airways-and-america-west-pilots-have-the-merged-company-in-a-real-tailspin-6393697. See also http://cdn.ca9.uscourts.gov/datastore/opinions/2015/06/26/14-15757.pdf

[18] http://usatoday30.usatoday.com/travel/flights/2007-03-05-us-airways-monday-update_N.htm.

[19] http://viewfromthewing.boardingarea.com/2014/01/27/american-us-airways-choose-better-reservation-system-process-combine-take-two-years/

[20] http://aviationblog.dallasnews.com/2010/02/delta-reservation-systems-take.html/

place.[21] After voting in July, 2010, flight attendants failed to unionize and their representatives accused the airline of "intimidation tactics." On the other hand, Delta and Northwest preempted potential problems by reaching an agreement with their pilots *before* the merger was approved. Initially, Northwest pilots opposed the merger because they were concerned about the change in seniority rankings after the merger. However, in August 2008, the airlines and their pilots reached a collective agreement, which provided more confidence about the prospects of the merger.

United and Continental

The United–Continental merger showed more problems during the consolidation stage than the US Airways–America West and Delta–Northwest mergers. Most of the problems were caused by the integration of the computer systems. In February, 2011, United grounded 96 aircraft for maintenance checks causing a series of delays.[22] A few months later, on June 17, 2011, a computer system failure caused nation-wide delays, affecting thousands of travelers.[23] Perhaps to prevent further problems, on March 3, 2012, United adopted Continental's reservation and computer system, which according to some experts, was older and less efficient.[24] There were unforeseen issues in the integration of the reservation and computer system, which resulted in delays (e.g., days after the change, Chicago O'Hare's on-time performance dropped to 16%).[25] There were problems in kiosks and call centers, and the website collapsed.[26] As a consequence of this inefficient system, the booking and ticketing process was slow and a series of computer glitches continued causing flight delays long after the integration. On August 28, 2012, United experienced a network outage of over two hours, causing at least 200 delays and cancellations.[27] On November 15, 2012, a problem with the communication system caused hundred of delays across the country and several cancellations.[28]

[21] http://www.cbsnews.com/news/delta-flight-attendants-reject-unionization-following-northwest-merger/ and also see http://labornotes.org/blogs/2010/11/flight-attendants-lose-delta

[22] http://dailycaller.com/2011/02/15/united-temporarily-grounds-96-aircraft/

[23] http://www.nytimes.com/2011/06/18/us/18united.html

[24] The chosen system was called *SHARES*, which is claimed to be inferior to *FASTAIR*. http://upgrd.com/fozz/shares-vs-apollo-an-in-depth-look.html

[25] http://www.economist.com/blogs/gulliver/2012/03/united-continental-merger

[26] http://www.farecompare.com/news/united-airlines-asks-for-patience-with-ongoing-computer-glitches-weekend-flight-delays

[27] http://www.cnn.com/2012/08/28/travel/united-airlines-system-outage/

[28] http://articles.chicagotribune.com/2012-11-15/business/ct-biz-1116-united-outage-20121116_1_jeff-smisek-charlie-hobart-reservation-system

In addition to problems with the computer systems, labor relations have been difficult after merger.[29] Up to this day, more than 5 years after the merger, flight attendants do not have a uniform contract. Flight attendants of former United and Continental work as separate groups, generating internal labor frictions. This lack of coordination creates challenges in scheduling crews and flights causing flight delays.[30]

2.2 Strategic Merger Effects

Mergers change strategic incentives along multiple dimensions: prices, on-time performance, network structure, capital accumulation, etc. The date when a merger is approved is the first date when these new incentives come into force, because common ownership aligns incentives regardless of whether the merging airlines have combined their operations. We document a series of events that reveal a change in behavior among merging airlines immediately after the merger's approval date, and call these *strategic merger* effects.

In the next section, we show evidence that merging airlines changed their on-time performance as well as the number of routes they served immediately after the merger approval. In the Online Appendix, we also show the merging airlines' made changes to their stock of ground equipment, aircraft utilization, and aircraft fleet immediately following the merger.[31] This evidence suggests that the merging airlines did in fact take actions to internalize the change of incentives after the merger approval date. These effects, although important on their own, are not the main focus of this paper.

3 Data and Variables

We collected on-time performance data from the DOT's Bureau of Transportation Statistics (BTS). The data are available beginning in January 1995 and cover scheduled-service non-stop domestic flights in the US by major air carriers.[32] The DOT requires that these carriers

[29] http://www.denverpost.com/2013/09/06/united-airlines-is-one-big-company-but-not-yet-one-happy-family/

[30] http://www.nytimes.com/2016/06/17/business/years-after-united-merger-flight-attendants-work-for-two-airlines.html

[31] See Section B of the Online Appendix.

[32] Carriers required to report on-time performance to the BTS are those that have at least 1% of the total domestic scheduled-service passenger revenues.

report on operations to and from the 29 US airports that account for at least 1% of the country's total domestic scheduled-service passenger boardings; however, all reporting airlines voluntarily provide data for their entire domestic systems.

The data contain general information for each flight—flight number, date and time, carrier, aircraft (tail number), origin airport, destination airport, and distance—as well as information on the timing of each flight—scheduled departure time, actual departure time, scheduled arrival time, actual arrival time, among other variables. The data also contain a number of on-time performance measures, such as departure and arrival delays and cancellation information. The departure delay is calculated as the difference between the scheduled departure time and the actual departure time and, likewise, the arrival delay is calculated as the difference between the scheduled arrival time and the actual arrival time.

Since June 2003, carriers are also required to report the reason for a flight delay or cancellation. The reasons for delays or cancellations are classified into five categories: air carrier, extreme weather, National Aviation System, late-arriving aircraft, and security. For delayed flights, airlines report the number of minutes of the total arrival delay that are attributable to each category. The first category is the most relevant for our analysis, since it identifies circumstances within the airline's control that cause delays—e.g., maintenance or crew problems, aircraft cleaning, baggage loading, fueling, etc—and it reflects an organization's ability to provide quality.

We use the BTS on-time performance data from January 2004 to December 2013, which cover all flights starting two years before the US Airways–America West merger until two years after the United–Continental merger (see Table 1). The data for this period contain information on 66,153,753 flights. We assign a flight-code to each flight—which is a unique combination of an airline, origin, destination, day of the week, and hour of the day—and restrict the sample to flight-codes that appear at least 10 times in the sample period to be able to control for flight-code fixed effects in our econometric models. This restriction reduces our sample size to 65,427,075 flights (98.9% of the original sample size), which are classified into 630,407 flight-codes.[33] Similarly, we drop date–destination airport combinations to be able to include date–destination airport fixed effects in our analysis, leaving us with 65,240,227 flights (98.6% of the original sample size).

[Table 1 about here]

[33] 146,231 observations have missing on-time performance data.

Our variable of interest is the arrival delay *caused by the carrier* (which we call "carrier delay"). This variable is not reported for flights with total delay time shorter than 15 minutes, although the total delay time is reported for all flights.[34] We deal with this missing data problem for flights with delays shorter than 15 minutes in two ways. As a first alternative, we assume that no part of the delay was caused by the carrier, i.e., we assign a value of zero to the variable "carrier delay" for the flights with delays shorter than 15 minutes. We call this new variable the "minimum" carrier delay. As a second alternative, we attribute the full delay to the carrier, i.e., we assign a value total carrier delay to the variable "carrier delay." We call this new variable the "maximum" carrier delay. Note that since we observe the carrier delay for flights delayed by more than 15 minutes, we do not need to impute any information for these flights when defining the variables minimum and maximum carrier delay. We use minimum carrier delay as our main dependent variable, as it is more conservative. However, we show that our results are robust to using either of these two definitions of carrier delay.

We also consider alternative measures of on-time performance in our analysis. We construct the variable "travel time," which is the time elapsed between the scheduled departure time and the actual arrival time.[35] This measure has the virtue of being robust to airline manipulation, as it has been argued that airlines may manipulate scheduled flight times to minimize the risk of delays (Prince and Simon, 2014). Other on-time performance variables we consider are cancellations caused by the carrier ("carrier cancel") and delays caused by a late aircraft ("late aircraft"). Finally, we consider other measures of quality: the number of mishandled bags (from the BTS) and the number of consumer complaints (from the Aviation Consumer Protection Division, DOT), which are available at the airline–month–year level. As a robustness check, we repeat our analysis using these alternative measures of quality provision. Table 2 presents summary statistics for all the dependent variables used in our analysis.

[Table 2 about here]

Table 3 reports summary statistics for delays (measured as minimum carrier delay), the number of flights, and the number of routes (i.e., defined as an origin and destination combination). We report these statistics for the industry as a whole as well as for the merging airlines. For each of the mergers, we separately report these statistics for the period before the merger approval (Column 1), the period between the merger approval and the combining

[34] BTS calls a flight "on-time" when the delay time is shorter than 15 minutes (Forbes et al., 2015).

[35] In our database, travel time is calculated as actual elapsed time plus departure delay.

of operations (Column 2), and for the period after the merging firms combine operations (Column 3). We use the date when the merging airlines begin jointly reporting on-time performance data to BTS as a measure of the date when the merging airlines combine their operations (see Table 1). We choose this date because it marks the beginning of organizational consolidation.[36]

Table 3 shows that for the first two mergers (US Airways–America West and Delta–Northwest), the share of delayed flights, the average delay, and the average delay of delayed flights decreased after the merger approval and then increased after the merging airlines combined operations. For United–Continental, the delayed flights and the average delay increased both after the merger approval and after the combining operations, although more abruptly after the latter event. Figure 1 adds to this analysis by showing the distribution of delays caused by the carrier both one year before the merger approval date and in the second year after the merger approval date—where the latter period captures both strategic and organizational disruption effects. The figure shows that the post-merger distributions first-order stochastically dominate the pre-merger distributions. These patterns in Table 3 and Figure 1 jointly suggest that the mergers had a negative impact on firm performance.

[Table 3 about here]

The data also provide us with an opportunity to describe the evolution of market structure. Using the distance of each flight, we construct airline market shares based on total distance covered in a year. Figure 2 shows a ranking of airlines by their market shares in 2004 (before the mergers) and in 2013 (after the mergers). The figure shows that the combined share of the four largest carriers increased from 2004 to 2013, which is consistent with industry consolidation. In terms of the impact of the mergers on route-level competition, the last two rows of Table 3 report the number of routes where the merging airlines had overlap before their mergers. Using two alternative criteria, we show that the merging airlines had little overlap before their mergers (i.e., in less than 4% of the routes served by the merging airlines), which is consistent with the DOJ claims on the competitive implications of these mergers.[37]

[36] In all mergers, the merging airlines start to jointly report on-time performance on the same day or before the date when the FAA approves the single operating certificate, and also before the airlines integrate their reservation systems. We consider an alternative measure for the date when the merging parties combine operations when discussing robustness in the results section.

[37] The first of these rows reports the number of routes where the merging airlines had overlap in every

[Figure 2 about here]

4 Econometric Model

Our econometric analysis is based on a differences-in-differences design, where we compare the change in the merging airlines' on-time performance (treatment) with the change in the on-time performance of the rest of the industry (control). In Section 5.3 we change the control group as a robustness check. The simplest formulation of our econometric model is

$$\text{Delay}_{ardt} = \beta \cdot \text{after}_d \cdot \text{merged}_a + \phi \cdot \text{after}_d + \gamma \cdot \text{merged}_a + x'_{ardt}\mu + \epsilon_{ardt}, \tag{1}$$

where Delay_{ardt} is the carrier delay for the flight operated by airline a, covering route r (defined as an origin airport–destination airport combination), at date d, and time t. after_d is an indicator variable that takes the value 1 if the date of the flight is after the date of the merger, merged_a indicates whether the airline that operates the flight is one of the merging carriers, x_{ardt} is a vector of controls, and ϵ_{ardt} is an error term clustered at the route level. β is our main coefficient of interest, as it measures the change in on-time performance of the merging airlines after their merger.

While the coefficient β in equation (1) measures the overall change in the merging airlines' on-time performance, it does not separate strategic effects (i.e., effects that take place after the merger approval) from organizational disruption effects (i.e., effects that take place only after the merging firms combine operations). As mentioned previously, we use the date when the merging airlines begin jointly reporting on-time performance to the BTS as our measure of the date of organizational consolidation, since it is the earliest in a series of integration milestones (see footnote 36). In Table 1 we show the merger approval dates, the date when the merging airlines start jointly reporting on-time performance data, and the integration of reservation systems dates for each of the three mergers. Given that the date of the combining of operations is later than the merger approval date, we can separately identify the strategic effects and organizational disruption effects using indicator variables for each of these dates

month prior to the merger, while the second reports the number of routes where the merging airlines had overlap in at least one month prior to the merger.

with

$$\text{Delay}_{ardt} = \sum_{i=s,c} \beta_i \cdot \text{after}_d^i \cdot \text{merged}_a + \sum_{i=s,c} \phi_i \cdot \text{after}_d^i + \gamma \cdot \text{merged}_a + x'_{ardt}\mu + \epsilon_{ardt}, \tag{2}$$

where s stands for merger approval date, and c for the date of the combining of operations. β_s and β_c are our coefficients of interest. β_s captures the change in on-time performance of the merging airlines after the merger approval date; β_c captures the incremental effect of on-time performance after the merging airlines have combined operations. We interpret β_s as the coefficient measuring strategic effects, and β_c as the coefficient measuring organizational disruption effects.

In the vector x_{ardt} we include flight-code and date–destination airport fixed effects, where a flight-code is defined as a carrier–origin–destination–day-of-week–hour-of-day combination (e.g., Monday 9AM flight from ORD to MIA operated by AA). The flight-code fixed effects measure systematic differences across flights in on-time performance. Controlling for flight-code fixed effects is key, as airlines modify their network of flights over time, which could make it difficult to measure the impact of a merger on quality. For instance, if two merging airlines dropped flight-codes with poor on-time performance after their merger, one would conclude from a simple before-and-after comparison that the merging airlines increased their on-time performance after the merger. However, that post-merger on-time performance effect would at least in part be driven by the airlines dropping poor-performing flight-codes. By including the flight-code fixed effects, we measure the impact of the merger on on-time performance relative to the systematic performance of each flight-code, which is robust to changes in the network of flights. That is, even if there is a change in the composition of flights, our estimates for post-merger effects would be zero unless the merging airlines change their on-time performance at the flight-code level. Lastly, the date–destination airport fixed effects absorb idiosyncratic shocks specific to a destination airport on a given day, which may include weather, congestion, or other factors affecting on-time performance.

We estimate these differences-in-differences models for each merger separately and also pooling all the mergers together. In the latter case, $\text{after}_d \cdot \text{merged}_a$ takes the value 1 for flights operated by any airline that has been part of one of the three mergers. For ease of notation, we label the mergers as *UA* (US Airways–America West), *DN* (Delta–Northwest), and *UC*

(United–Continental). Our models then become

$$\text{Delay}_{ardt} = \beta_s^m \cdot \text{after}_d^{m,s} \cdot \text{merged}_a^m + \sum_m \phi_s^m \cdot \text{after}_d^{m,s} + \xi_{ark(d)h(t)} + \tau_{dest(r)d} + \epsilon_{ardt} \tag{3}$$

and

$$\begin{aligned}\text{Delay}_{ardt} =& \beta_s^m \cdot \text{after}_d^{m,s} \cdot \text{merged}_a^m + \beta_c^m \cdot \text{after}_d^{m,c} \cdot \text{merged}_a^m + \\ & \sum_m \phi_s^m \cdot \text{after}_d^{m,s} + \sum_m \phi_c^m \cdot \text{after}_d^{m,c} + \xi_{ark(d)h(t)} + \tau_{dest(r)d} + \epsilon_{ardt},\end{aligned} \tag{4}$$

where $m \in \{UA, DN, UC, \{UA, DN, UC\}\}$, $\xi_{ark(d)h(t)}$ is a flight-code fixed effect (i.e., an effect specific to flights operated by airline a, in route r, in day of the week k, at hour of the day h), and $\tau_{dest(r)d}$ is a date–destination airport fixed effect. We do not include the term $\gamma \cdot \text{merged}_a$ since these variables are absorbed by the flight-code fixed effects. We treat the merging airlines as a single airline throughout the period of study when defining the flight-codes.[38] When analyzing each merger separately ($m \in \{UA, DN, UC\}$), we restrict the sample to 5-year periods around each of the mergers (see Figure 3). When pooling all the mergers, we use the entire dataset. In the pooled case, we define $\text{after}_d^{m,c}$ ($m = \{UA, DN, UC\}$) in equation (4) as an indicator that takes the value 1 until two years after the date of the combining of operations of m, and $\text{after}_d^{m,s}$ as an indicator that takes the value 1 starting from the merger approval date until two years after the date of the combining of operations.

[Figure 3 about here]

Finally, we study the dynamics of the impact of these mergers on on-time performance. To analyze these patterns, we estimate the month–year level time-effects on carrier delay using the following equation

$$\text{Delay}_{ardt} = \beta_{my}^m \cdot \tau_{my(d)} \cdot \text{merged}_a^m + \xi_{ark(d)h(t)} + \tau_{dest(r)d} + \epsilon_{ardt}. \tag{5}$$

β_{my}^m in equation (5) measures the differential performance of the merging airlines with respect to the rest of the carriers in a given month–year. We make use of the estimates for β_{my}^m to measure the length and magnitude of organizational disruption effects, as well as to argue

[38]The term $\phi \cdot \text{after}_d$ is not necessarily absorbed by the month-year fixed effects because after_d is defined at the date (i.e., day) level.

that there are no pre-trends that may compromise the interpretation of our differences-in-differences results.

Similarly, to analyze post-merger organizational synergies we decompose the merger effects by the identity of the airline that operated each flight before the merger (equation 6). Distinguishing between airlines allows us to measure the evolution of the relative performance of flights operated (or formerly operated) by each of the merging airlines, study whether the on-time performance of the merging airlines converged, and whether they converged for the better or worse.

$$\text{Delay}_{ardt} = \beta_{my}^{m1} \cdot \tau_{my(d)} \cdot \text{merged}_a^{m1} + \beta_{my}^{m2} \cdot \tau_{my(d)} \cdot \text{merged}_a^{m2} + \xi_{ark(d)h(t)} + \tau_{dest(r)d} + \epsilon_{ardt}. \quad (6)$$

5 Results

5.1 Measuring Post-merger Organizational Disruption

How do mergers impact the every-day business of the firm? Are these effects temporal or permanent?

Figure 4 shows estimates for equation (5), where we estimate the differential performance of the merging airlines with respect to the rest of the industry over time. Except for the United–Continental merger, there are no noticeable on-time performance changes between the dates of the merger approval and the combining of operations. However, after the merging airlines combined operations, on-time performance worsened in all cases, suggesting a negative impact on the merging airlines' quality. At the peak of the effect, the average carrier delay was 3 to 4 minutes greater than that in the pre-merger period (i.e., about 100 percent of the industry average). The figure suggests that the organizational disruption effect lasted between 1 to 2 years for these merging firms, after which most airlines returned to their pre-merger on-time performance levels. The exception is United, which experienced a permanent decrease in its on-time performance.

The figures also show no pre-trends in the months before the combining of operations that may affect the interpretation of our results in the Delta–Northwest and United–Continental mergers. For the US Airways–America West merger, we observe a pre-merger negative trend that may affect our strategic effect estimates for that merger. However, even if we restrict attention to the Delta–Northwest and United–Continental mergers, our results for the relative magnitude of strategic and organizational disruption effects below remain unchanged.

[Figure 4 about here]

Table 4 summarizes our estimates in Figure 4 using a regression analysis with fewer parameters. Column 1 shows estimates for equation (3), where we measure the impact of mergers on on-time performance using a single post-merger indicator that takes a value of 1 starting from the merger approval date. This exercise provides a measure that combines both post-merger strategic and organizational disruption effects and can be interpreted as the overall effect of a merger on quality. When analyzing each merger separately, we find heterogeneous effects. After the US Airways–America West merger, the merging carriers improved their on-time performance by 0.4 minutes or 12 percent of the industry average, which suggests efficiency gains. The impact on quality for Delta–Northwest was negative, with an average increase in delays caused by the carrier of 0.31 minutes or 9.3 percent of the industry average. For the United–Continental merger, we find that the merging airlines on average reduced their on-time performance by 0.54 minutes or 18 percent of the industry average. When pooling data for all mergers, we estimate that the overall effect of a merger on delays caused by the airlines was 0.33 minutes or 10 percent of the industry average. That is, we find that on average a merger worsens on-time performance though the analysis does suggest heterogeneous effects across mergers.[39]

[Table 4 about here]

In Column 2 of Table 4, we show estimates for equation (4), where we include a post-merger approval indicator as well as an indicator that takes the value 1 after the merging airlines have combined operations. Including both of these indicators in the regressions allows us to distinguish between strategic and organizational disruption effects. The table shows that after US Airways–America West, Delta–Northwest, and United–Continental combined their operations, the delays caused by the carriers increased by 0.56, 0.39, and 1.09 minutes, respectively (or, 17, 12, and 35 percent of the industry average). The difference with the US Airways–America West merger relative to the others is that the organizational disruption

[39] The coefficients are small because they are averages over all flights, many of which experienced no delays. When one scales the coefficients by the share of delayed flights, the magnitudes roughly increase by a factor of 10.

effect partially reversed efficiency gains that the merging airlines realized after their merger approval. When pooling data for all mergers, the estimated increase in delays caused by post-merger organizational disruption was 0.7 minutes or 22 percent of the industry average. These results suggest that the organizational disruption effect—and not strategic choices by the merged airlines—can explain the post-merger decrease in quality. The pooled results also suggest an increase in on-time performance immediately after the mergers were approved, though this effect is small relative to the organizational disruption effect and seems to be driven entirely by the US Airways–America West merger.

As discussed in the previous section, all of the specifications include flight-code fixed effects (i.e., carrier–origin–destination–day-of-week–hour-of-day combination fixed effects), which measure systematic on-time performance differences across flights. Controlling for flight-code fixed effects help us rule out that our results may be driven by a post-merger change in the composition of flights. That is, even if there is a change in the composition of flights, our estimates for post-merger effects would be zero unless the merging airlines change their on-time performance at the flight-code level. One may also worry that the mergers may have caused changes in market structure at the route level (i.e., entry or exit of other carriers) that may be affecting the interpretation of our results. Additionally, post-merger changes in aircraft utilization may be in part driving our results.

To address concerns raised by concurrent changes in both market structure and aircraft utilization, we replicate Panel D of Table 4 in Table 5 with additional controls for the number of airlines serving each route in a given month–year combination (Column 1) and the month–year utilization rate of the flight aircraft as well as aircraft model fixed effects (Column 2). Column 1 shows that controlling for the number of airlines serving a route does not change the coefficients on the post-merger indicators in any meaningful way, suggesting that changes in market structure that are concurrent to the mergers are not driving our results. The table also shows a negative coefficient on the number of airlines serving a route, which suggests that there are fewer avoidable delays in routes where there is more competition. Column 2 shows that controlling for aircraft utilization and aircraft model fixed effects does not affect our results either.

In Table 5 we explore differential merger effects by including specifications for whether a flight lands or departs from one of the carriers' hubs (Column 3) and by whether a flight lands and departs in one of the 20 highest traffic airports (Column 4). The results suggest that there are no differential strategic nor organizational disruption effects. The results do suggest greater organizational disruption effects in large airports. However, the bulk of the organizational disruption effect is uniform across airport size.

[Table 5 about here]

In summary, we find that mergers on average worsen quality and that the bulk of that effect is explained by post-merger organizational disruption. While the organizational disruption effect is temporal, it may last for more than two years after the merger approval and even result in permanent losses (e.g., United). We end the section by noting that there is anecdotal evidence suggesting that the merging airlines faced organizational challenges even before the date that serves as our measure of when the airlines combined operations. For instance, in June 2011, United experienced a computational problem that created widespread delays and flight cancellations, which, as shown in Figure 4, coincides with a seemingly permanent increase in average delays due to the carrier.[40] Similarly, Delta announced in August 2009 that it was going to cut management jobs and Northwest reported to the FAA a decrease in employees in September 2009, both of which coincide with an increase in average delays due to the carrier for these airlines.[41] While these anecdotes do not affect our overall measure of how these mergers impacted on-time performance, they bias our estimates for strategic and organizational disruption effects upwards and downwards, respectively. This further reinforces the importance of organizational disruption for understanding the impact of mergers on quality.

5.2 Do Firms Reinforce Each Other?

Are there post-merger organizational synergies? Does the new organization inherit the best (or worst) practices of each of the merging firms? We address these questions by using a similar approach to the previous subsection, but decomposing the merger effects by the identity of the airline that operated each flight before the merger. For instance, if prior to the merger Delta operated an Atlanta–Miami flight every Monday at 9AM and Northwest did not, we classify that flight as a "Delta" flight.[42] Distinguishing between airlines allows us to

[40]See http://www.nytimes.com/2011/06/18/us/18united.html?_r=0

[41]See http://www.cleveland.com/business/index.ssf/2009/08/delta_air_lines_will_cut_more.html and Figure B.2 in the Online Appendix.

[42]Since in these mergers there was limited route overlap between merging airlines, the classification of flights is mostly unambiguous.

measure the evolution of the relative performance of flights operated (or formerly operated) by each of the merging airlines, study whether the on-time performance of the merging airlines converged, and whether the merged firm improved relative to the pre-merger performance of the merging firms.

[Figure 5 about here]

Figure 5 shows estimates for equation (6), where we estimate the differential performance of the merging airlines with respect to the rest of the industry over time, but now distinguishing between which of the merging airlines operated the flight before the merger. The figure shows that airlines were heterogeneous before their respective mergers. For instance, America West and United were equally or more efficient (on average) than US Airways and Continental before their mergers, suggesting room for organizational efficiencies. In terms of whether these organizational synergies were realized, we find mixed evidence. On the one hand, United seems to have converged to the (relatively worse) on-time performance of Continental after consolidation, suggesting that United kept the worst of both organizations after its merger and a *best of both worlds* scenario is not a given. On the other hand, we also see that former US Airways and Northwest flights preserved their better on-time performance after their consolidation, suggesting limited synergies and the potential coexistence of two cultures within each of these two organizations.

Lastly, we examine the correlation of the time coefficients reported in Figure 5, before and after the merging airlines combined operations. The table suggests that after the combining of operations, the on-time performance of flights operated by each former airline became more synchronized, suggesting that they started experiencing similar performance shocks only after they consolidated operations. This evidence provides support for our identification strategy for measuring organizational disruption effects, as firm productivity only became highly correlated after organizational consolidation. Combined with Figure 5, the table also suggests that there are cultures within an organization that are better suited for handling the same performance shock (e.g., former Northwest flights versus former Delta flights).

[Table 6 about here]

5.3 Robustness

We consider a series of robustness checks. First, we use an alternative measure for the date of the combining of operations: the date when the merging airlines integrated their reservation systems. Integrating reservation systems is a key milestone in the process of combining operations. Table A.1 in the Online Appendix replicates Table 4 using this alternative measure, and shows that our coefficients do not qualitatively change in a significant way.

In a second set of robustness exercises, we repeat our analysis using alternative measures of on-time performance. Table 7 reports the results of our analysis when using the full set of on-time performance variables described in Section 3 as our dependent variables. Overall, we find the same patterns as in Table 4. When using the maximum carrier delay, we find no evidence of a strategic effect but do find an organizational disruption effect that lowers on-time performance by 16 percent of the industry average. When using travel time, we find a small positive strategic effect and an organizational disruption effect of almost 2 percent of the industry average. When using cancellations caused by the carrier, we find evidence in favor of efficiency gains immediately after the merger and then an increase in cancellations of 43 percent (of the industry average). Lastly, when using delays caused by late aircrafts, we find evidence of a small negative strategic effect and an organizational disruption effect of 21 percent of the industry average.

[Table 7 about here]

Finally, we repeat our analysis using measures of quality other than on-time performance: customer complaints and mishandled bags. Both of these measures are reported at the airline–month level. Table A.2 in the Online Appendix reports the results of this analysis. When pooling all mergers, we find that a merger on average increases customer complaints and mishandled bags by 90 and 27 percent of the industry average, respectively. These results are in line with the previous findings, which show that mergers reduce quality levels. Interestingly, we find that the organizational disruption effect is less important for these alternative measures of quality, though it still is found to have an effect.

6 Discussion

Mergers disrupt organizations and this can lead to large efficiency losses. We quantify the losses created by the consolidation of organizations by analyzing three recent mergers in the US airline industry. We exploit the timing of the milestones that carriers must complete to become a single entity to separate between organizational effects—e.g., integration of systems or employees contracts— and strategic effects—e.g., pricing strategies, network of flights. Our main findings are two-fold. First, the organizational consolidation is a disruptive process (as expected). However, this is not a fleeting effect with minor consequences on quality provision. In fact, we show this effect is lasting and significantly lowers performance. Second, the merged firm may not be able to preserve the pre-merger performance of the best performing firm.

Our results suggest that if integration plans are not well-thought-out, firms may have to unexpectedly spend a large amount of resources to deal with post-merger integration problems. Back of the envelope calculations show that the mergers we analyze generated losses of about $870 million dollars due to organizational inefficiencies, which is a conservative lower bound. Antitrust authorities should carefully assess how the post-merger organizational consolidation can affect the likelihood that efficiency gains are realized.

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Tables and Figures

Table 1: Dates for merger approval, jointly reporting and integration of reservation systems. The gap between these dates is what we exploit to separate the strategic and organizational effects.

Merger	Merger approval	Joint reporting	Integration of reserv. sys.
US Airways–America West	Sep 27, 2005	Jan 1, 2006*	Mar 4, 2007
Delta–Northwest	Oct 29, 2008	Jan 1, 2010	Feb 1, 2010
United–Continental	Oct 1, 2010	Jan 1, 2012	Mar 3, 2012

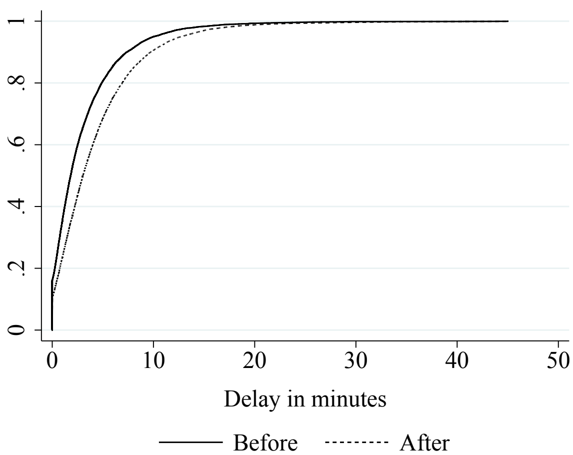
Note: US Airways and America West started to report combined on-time data in January 2006 and combined traffic and financial data in October 2007. We consider January 2006 as the relevant date since from then on all America West flights were branded as US Airways, along with most signage at airports and other printed material.

Table 2: Measures of quality, summary statistics.

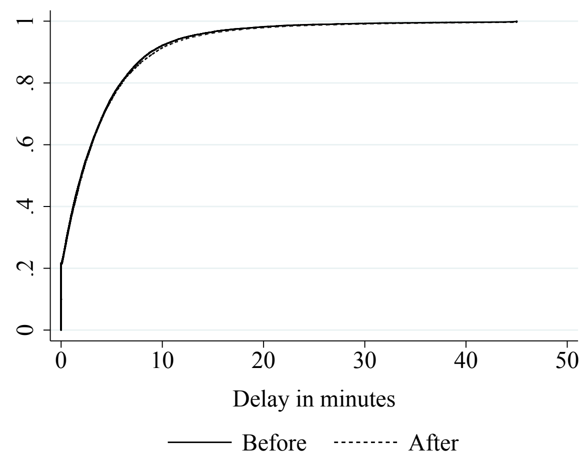
	Mean	St. Dev.	Min.	Max.
(Min.) Arrival delay due to the carrier (minutes)	3.219	19.085	0.00	2580.00
(Max.) Arrival delay due to the carrier (minutes)	4.556	19.120	0.00	2580.00
Travel time (minutes)	135.831	78.896	0.00	2916.00
Cancellations due to the carrier (1=canceled flight)	0.007	0.084	0.00	1.00
(Min.) Arrival delay due to late aircraft (minutes)	4.245	19.275	0.00	1391.00
Complaints (per 100,000 passengers)	0.982	0.845	0.00	13.52
Mishandled baggage (per 1,000 passengers)	5.424	3.262	0.11	28.16

Note: Authors' calculations based on BTS and Aviation Consumer Protection Division data, DOT.

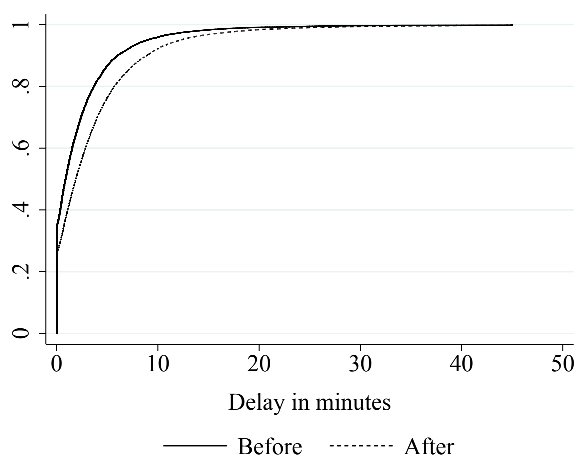
Figure 1: Distribution of delays before and after merger.



Panel A: US Airways & America West



Panel B: Delta & Northwest



Panel C: United & Continental

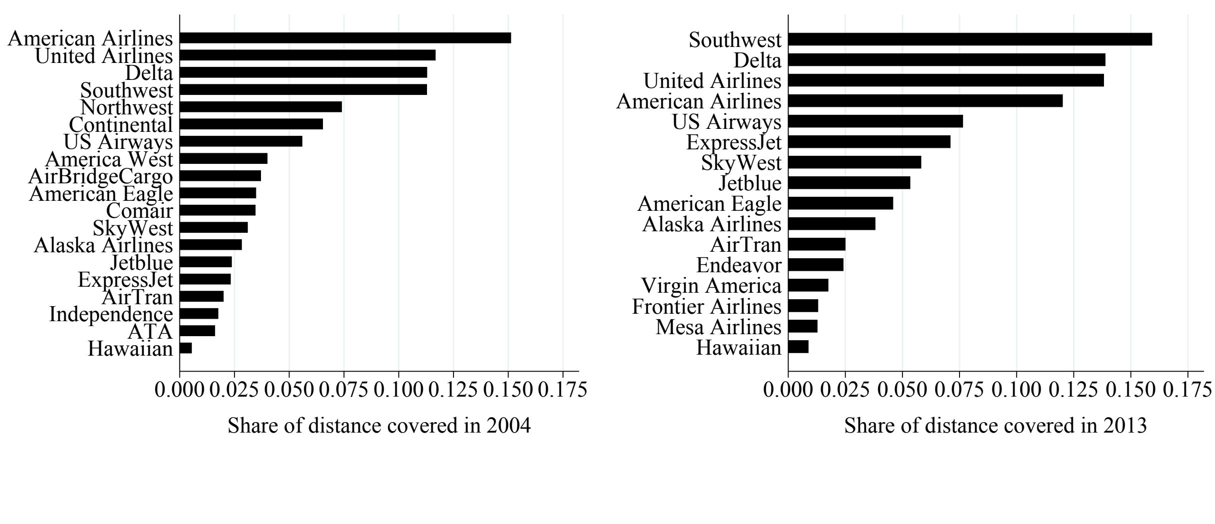
Note: The measure of delays is arrival delay due to the carrier (min.). The "before" curve plots the distribution of delays due to the carrier one year before the merger approval date. The "after" curve plots the distribution of delays due to the carrier in the second year after the merger approval date.

Table 3: Summary statistics before and after merger.

	All	US Airways & America West (1)	(2)	(3)	Delta & Northwest (1)	(2)	(3)	United Airlines & Continental (1)	(2)	(3)
% delayed flights	0.112	0.128	0.098	0.142	0.126	0.099	0.113	0.079	0.090	0.131
Avg delay	3.22	2.89	2.13	3.21	4.14	3.17	3.54	2.53	2.79	3.77
Avg delay of delayed	34.08	26.04	25.09	25.13	37.35	35.83	37.09	38.49	36.80	31.79
Avg monthly flights	554875	51964	47022	39975	71344	60233	60746	50910	46566	42793
Total routes	6168	604	520	544	942	807	846	589	582	605
Avg monthly routes	4093	511	478	416	776	629	611	499	499	481
Avg monthly flights from/to hubs	0.330	0.491	0.510	0.577	0.553	0.602	0.644	0.467	0.460	0.469
Routes always competed before	.	6	6	6	6	6	6	14	14	14
Routes competed at least once	.	8	8	8	16	16	16	18	18	18

Note: The measure of delays is arrival delay due to the carrier (min.). The first column reports figures for all the airlines during the full period (2004-2013). For each of the mergers, Column (1) reports figures for the period before merger approval, Column (2) for the period between merger approval and the combination of operations, and Column (3) for the period after they combine operations, as presented in Figure 3. We use the date when the merging airlines start to jointly report on-time performance data to FAA as our measure of the date of the combination of operations. The last two lines refer to routes operated by both merging airlines (i.e., both had at least one flight) in every month before the merger or at least in one month before the merger approval, respectively.

Figure 2: Airlines ranked by total distance covered, 2004 and 2013.



Notes:: Authors' calculations based on BTS data.

Table 4: Effect of mergers on quality provision: difference-in-differences analysis.

	(I)	(II)
Panel A: US Airways & America West		
After date of merger approval * UA	-0.405***	-0.889***
	(0.063)	(0.076)
After date of combined operations * UA		0.555***
		(0.077)
R^2	0.0524	0.0524
Observations	34,830,532	34,830,532
$\bar{Y}$	3.336	3.336
Panel B: Delta & Northwest		
After date of merger approval * DN	0.307***	0.094
	(0.081)	(0.079)
After date of combined operations * DN		0.392***
		(0.060)
R^2	0.0508	0.0508
Observations	32,406,051	32,406,051
$\bar{Y}$	3.323	3.323
Panel C: United Airlines & Continental		
After date of merger approval * UC	0.541***	-0.013
	(0.061)	(0.050)
After date of combined operations * UC		1.091***
		(0.073)
R^2	0.0457	0.0457
Observations	30,398,564	30,398,564
$\bar{Y}$	3.082	3.082
Panel D: All mergers		
After date of merger approval * merged	0.368***	0.254***
	(0.030)	(0.036)
After date of combined operations * merged		0.218***
		(0.032)
R^2	0.0424	0.0424
Observations	87091671	87091671
$\bar{Y}$	3.314	3.314

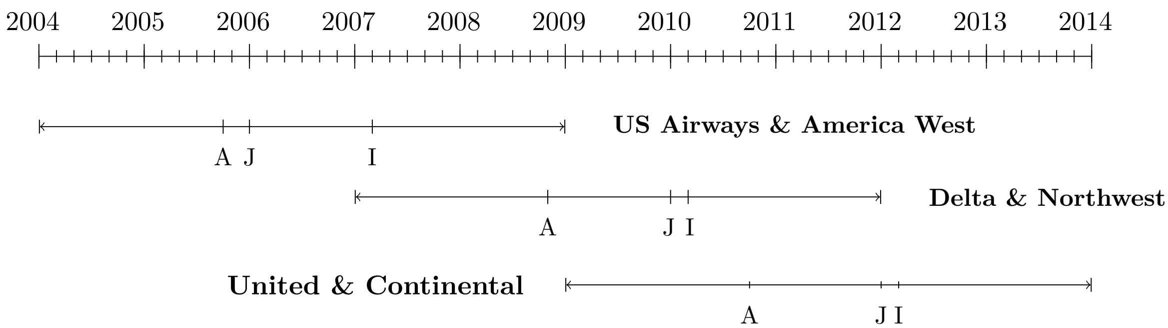
Note: Standard errors clustered at the route level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. A unit of observation is an individual flight. The dependent variable is carrier delay (min.), as defined in Section 3. All regressions include flight code and date–destination fixed effects, as defined in Section 4. The coefficients reported in column (I) are β_s^m from equation (3) and those in column (II) are β_s^m and β_c^m from equation (4) with $m = UA$, DN, UC, and $\{UA, DN, UC\}$ for Panels A, B, C, and D, respectively. See Section 4 for variable definitions.

Table 5: Number of competitors, aircraft utilization, and hub flights.

	(I)	(II)	(III)	(IV)
After approval * merged	-0.120***	-0.122***	-0.138***	-0.085*
	(0.038)	(0.039)	(0.053)	(0.044)
After comb. op. * merged	0.698***	0.710***	0.740***	0.612***
	(0.043)	(0.042)	(0.067)	(0.050)
Number of competitors	-0.103***			
	(0.016)			
Air time		-0.114***		
		(0.003)		
Aircraft's years of service		0.000		
		(0.000)		
After approval * merged * hub			-0.024	
			(0.082)	
After comb. op. * merged * hub			0.004	
			(0.092)	
After approval * merged * big airport				-0.111
				(0.080)
After comb. op. * merged * big airport				0.239***
				(0.083)
R^2	0.0432	0.0495	0.0432	0.0432
Observations	65,240,287	54,944,137	65,240,287	65,240,287
$\bar{Y}$	3.218	3.160	3.218	3.218

Note: Standard errors clustered at the route level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. A unit of observation is an individual flight. The dependent variable is carrier delay (min.), as defined in Section 3. All regressions include flight code and date–destination fixed effects, as defined in Section 4. Results in column (II) also incorporate aircraft model fixed effects. "Number of competitors" is the number of airlines that had at least one flight in a route–month. "Air time" is an aircraft's total air time in a given month (in thousands of minutes). "Hub" is an indicator for flights that depart from (arrive at) the main hub of the airline.

Figure 3: Regression ranges by merger.



Note: Range of dates for each merger in our analysis. A stands for the approval date of the merger, J for the date from which airlines began jointly reporting, and I for the date used as the beginning of the integration of operations.

Table 6: Correlation of time effects for merging airlines.

	UA	DN	UC
Before	0.003	-0.171	0.197
	(0.989)	(0.326)	(0.256)
After	0.816***	0.813***	0.914***
	(0.000)	(0.000)	(0.000)

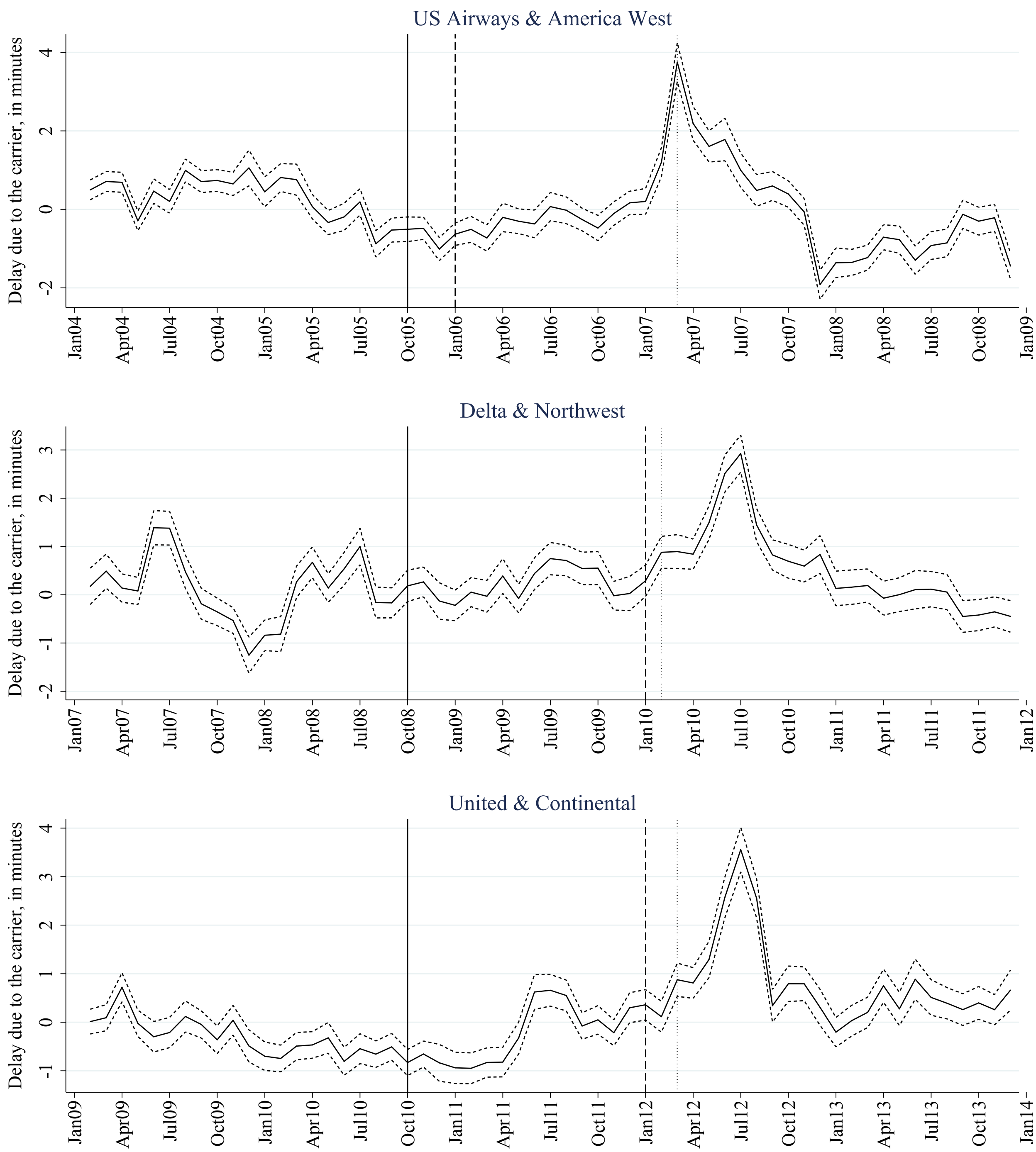
Note: Figures are the correlation coefficients between β_{my}^{m1} and β_{my}^{m2} from equation 6, for each merger (plotted in Figure 5). Correlations are reported before and after the combination of operations.

Table 7: Effect of mergers on other measures of on-time performance. All mergers.

	Carrier delay (max.)	Travel time	Carrier canceled	Late aircraft
After approval * merged	-0.149***	-0.127	-0.002***	-0.437***
	(0.043)	(0.160)	(0.000)	(0.059)
After comb. op. * merged	0.725***	2.901***	0.003***	0.880***
	(0.050)	(0.150)	(0.000)	(0.048)
R^2	0.0457	0.8299	0.0439	0.1098
Observations	65,240,288	65,240,287	66,548,957	65,240,287
$\bar{Y}$	4.556	135.851	0.007	4.245

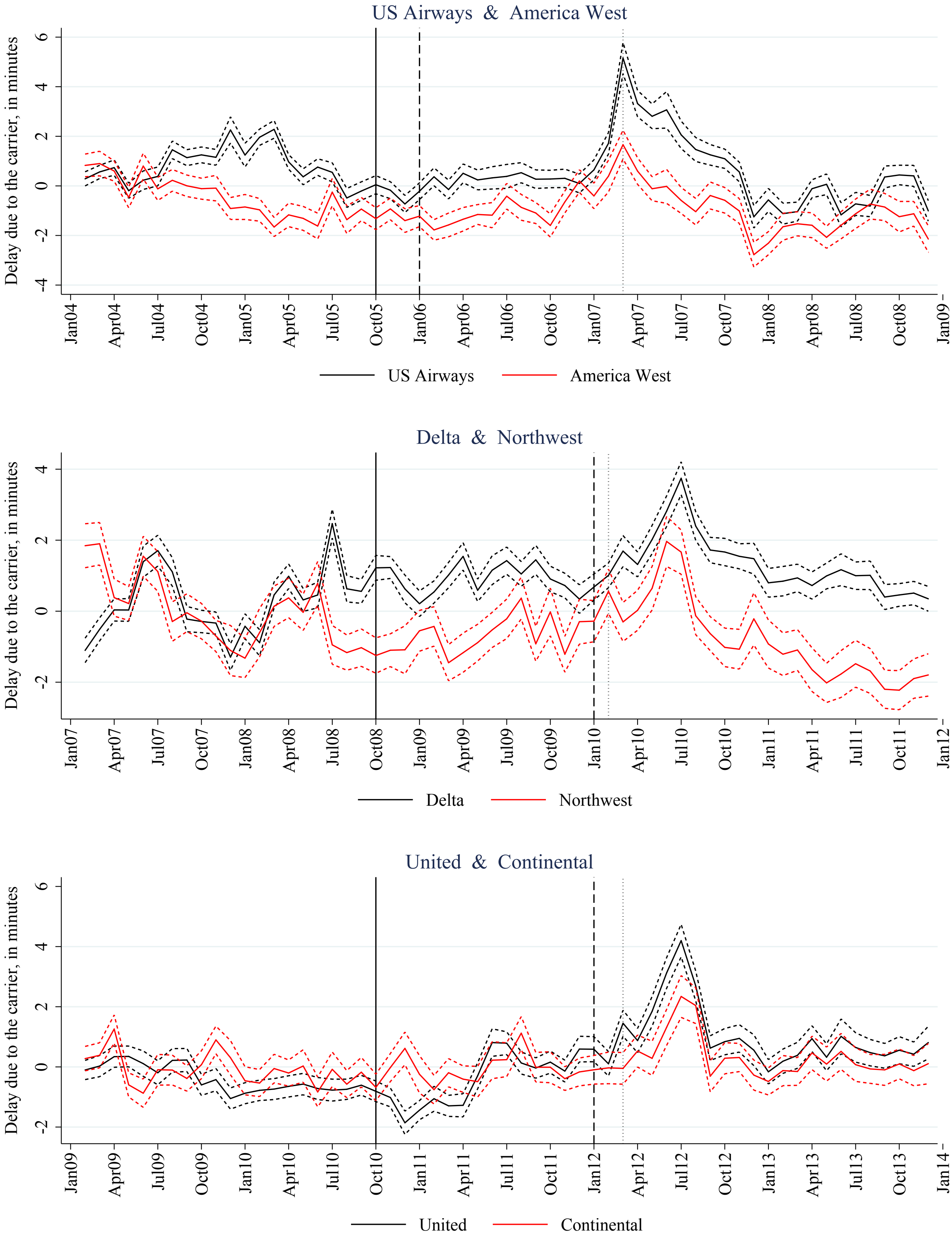
Note: Standard errors clustered at the route level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. A unit of observation is an individual flight. The dependent variables are indicated in column heads (see definitions in Section 3). All regressions include flight code and date–destination fixed effects, as defined in Section 4. The coefficients reported are β_s^m and β_c^m from equation (4) with $m = \{UA, DN, UC\}$. The regressions pool all mergers and include all the data. See Table A.3 for the individual merger results.

Figure 4: Monthly on-time performance and the effect of mergers.



Note: Solid lines represent coefficients β^m_{my} from equation 5. Dashed lines are 95% confidence intervals using standard errors clustered at the route level. A unit of observation is an individual flight. All regressions include flight code and date–destination fixed effects, as defined in Section 4. Solid bar: merger approval date, dashed bar: date of combination of operations (joint reporting), dotted bar: integration of reservation system, as reported in Table 1.

Figure 5: Monthly on-time performance and the effect of mergers by pre-merger carrier.



Note: Solid lines represent coefficients β^{m1}_{my} and β^{m2}_{my} from equation 6. Dashed lines are 95% confidence intervals using standard errors clustered at the route level. A unit of observation is an individual flight. All regressions include flight code and date–destination fixed effects, as defined in Section 4. Solid bar: merger approval date, dashed bar: the date of the combination of operations (joint reporting), dotted bar: integration of reservation system, as reported in Table 1.

Online Appendix: Not For Publication

Mergers and Organizational Disruption: Evidence from the US Airline Industry

Julia González, Jorge Lemus, and Guillermo Marshall

A Other Exercises

Table A.1: Results using the date of the integration of reservation systems as date of combined operations.

	(I)	(II)
Panel A: US Airways & America West		
After date of merger approval * UA	-0.405***	-0.575***
	(0.063)	(0.061)
After date of int. res. sys. * UA		0.354***
		(0.066)
R^2	0.0524	0.0524
Observations	34,830,532	34,830,532
$\bar{Y}$	3.336	3.336
Panel B: Delta & Northwest		
After date of merger approval * DN	0.307***	0.095
	(0.081)	(0.079)
After date of int. res. sys. * DN		0.408***
		(0.063)
R^2	0.0508	0.0508
Observations	32,406,051	32,406,051
$\bar{Y}$	3.323	3.323
Panel C: United Airlines & Continental		
After date of merger approval * UC	0.541***	0.039
	(0.061)	(0.050)
After date of int. res. sys. * UC		1.088***
		(0.074)
R^2	0.0457	0.0457
Observations	30,398,564	30,398,564
$\bar{Y}$	3.082	3.082
Panel D: All mergers		
After date of merger approval * merged	0.213***	-0.097***
	(0.035)	(0.035)
After date of int. res. sys. * merged		0.550***
		(0.039)
R^2	0.0432	0.0432
Observations	65,240,287	65,240,287
$\bar{Y}$	3.218	3.218

Note: Standard errors clustered at the route level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. A unit of observation is an individual flight. The dependent variable is carrier delay (min.) as defined in Section 3. All regressions include flight code and month–year fixed effects, as defined in Section 4. The coefficients reported in column (I) are β_s^m from equation (3) and those in column (II) are β_s^m and β_c^m from equation (4) with $m = UA$, DN, UC, and $\{UA, DN, UC\}$ for Panels A, B, C, and D, respectively. See Section 4 for variable definitions and regression ranges.

Table A.2: Other measures of quality as outcome variable.

	Complaints	Mishandled baggage
Panel A: US Airways & America West		
After merger approval · UA	-0.095	0.464
	(0.278)	(0.756)
After combining of operations · UA	0.716***	0.236
	(0.267)	(0.613)
R^2	0.4069	0.7972
Observations	1,032	1,032
$\bar{Y}$	0.957	6.674
Panel B: Delta & Northwest		
After merger approval · DN	0.310***	1.197***
	(0.116)	(0.355)
After combining of operations · DN	-0.142	-0.448
	(0.138)	(0.284)
R^2	0.6074	0.8403
Observations	1,056	1,056
$\bar{Y}$	1.037	5.015
Panel C: United Airlines & Continental		
After merger approval · UC	0.485***	0.251
	(0.092)	(0.168)
After combining of operations · UC	1.139***	0.857***
	(0.409)	(0.148)
R^2	0.5065	0.8013
Observations	984	984
$\bar{Y}$	1.068	3.628
Panel D: All mergers		
After merger approval · merged	0.468***	1.201***
	(0.069)	(0.169)
After combining of operations · merged	0.446**	0.217
	(0.173)	(0.179)
R^2	0.4306	0.7745
Observations	2,016	2,016
$\bar{Y}$	1.011	5.187

Note: Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. A unit of observation is an airline–month–year combination. The dependent variables are indicated in column heads. All regressions include airline and month–year fixed effects. The reported coefficients are β_s^m and β_c^m from equation (4) with $m = UA$, DN, UC, and $\{UA, DN, UC\}$ for Panels A, B, C, and D, respectively. See Section 4 for variable definitions and regression ranges.

Table A.3: Other measures of on-time performance as outcome variable by merger.

	Carrier delay (max.)	Travel time	Carrier canceled	Late aircraft
Panel A: US Airways & America West				
After approval * UA	-1.019***	-2.284***	-0.002***	-0.795***
	(0.082)	(0.232)	(0.001)	(0.095)
After comb. op. * UA	0.751***	2.133***	0.002**	0.475***
	(0.081)	(0.241)	(0.001)	(0.112)
R^2	0.0551	0.8319	0.0474	0.1266
Observations	34,830,532	34,830,532	35,582,521	34,830,532
$\bar{Y}$	4.774	135.157	0.008	4.346
Panel B: Delta & Northwest				
After approval * DN	-0.034	1.995***	-0.001	0.164
	(0.083)	(0.234)	(0.000)	(0.100)
After comb. op. * DN	0.283***	1.769***	0.002***	0.710***
	(0.064)	(0.178)	(0.000)	(0.072)
R^2	0.0534	0.8247	0.0503	0.1148
Observations	32,406,052	32,406,051	33,095,196	32,406,051
$\bar{Y}$	4.631	136.455	0.007	4.389
Panel C: United Airlines & Continental				
After approval * UC	0.063	-0.629***	-0.003***	-0.570***
	(0.055)	(0.176)	(0.000)	(0.070)
After comb. op. * UC	1.082***	4.574***	0.004***	1.119***
	(0.097)	(0.304)	(0.000)	(0.079)
R^2	0.0481	0.8316	0.0514	0.1080
Observations	30,398,565	30,398,564	30,955,284	30,398,564
$\bar{Y}$	4.305	136.647	0.006	4.129

Note: Standard errors clustered at the route level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. A unit of observation is an individual flight. The dependent variables are indicated in column heads (see definitions in Section 3). All regressions include flight code and date–destination fixed effects, as defined in Section 4. The coefficients reported are β_s^m and β_c^m from equation (4) with $m = UA$, DN, and UC for Panels A, B, and C, respectively. See Section 4 for variable definitions and regression ranges.

B Non-organizational Effects

Table B.1: Aircraft utilization

Panel A: US Airways & America West			
	Distance	Elapsed time	Air time
After merger approval · UA	-2.234***	-0.250**	-0.248***
	(0.742)	(0.108)	(0.094)
After combining of operations · UA	2.799**	0.342*	0.268
	(1.331)	(0.198)	(0.171)
R^2	0.2295	0.2060	0.2331
Observations	286,222	286,222	286,222
$\bar{Y}$	89.635	15.404	12.614
Panel B: Delta & Northwest			
After merger approval · DN	1.983***	0.454***	0.347***
	(0.725)	(0.100)	(0.089)
After combining of operations · DN	1.332*	0.161	0.080
	(0.702)	(0.101)	(0.087)
R^2	0.2248	0.2075	0.2336
Observations	278,368	278,368	278,368
$\bar{Y}$	87.449	14.957	12.262
Panel C: United Airlines & Continental			
After merger approval · UC	-4.109***	-0.605***	-0.497***
	(0.550)	(0.080)	(0.070)
After combining of operations · UC	4.115***	0.547***	0.447***
	(0.880)	(0.122)	(0.110)
R^2	0.2118	0.1903	0.2180
Observations	269,964	269,964	269,964
$\bar{Y}$	87.169	14.663	12.105

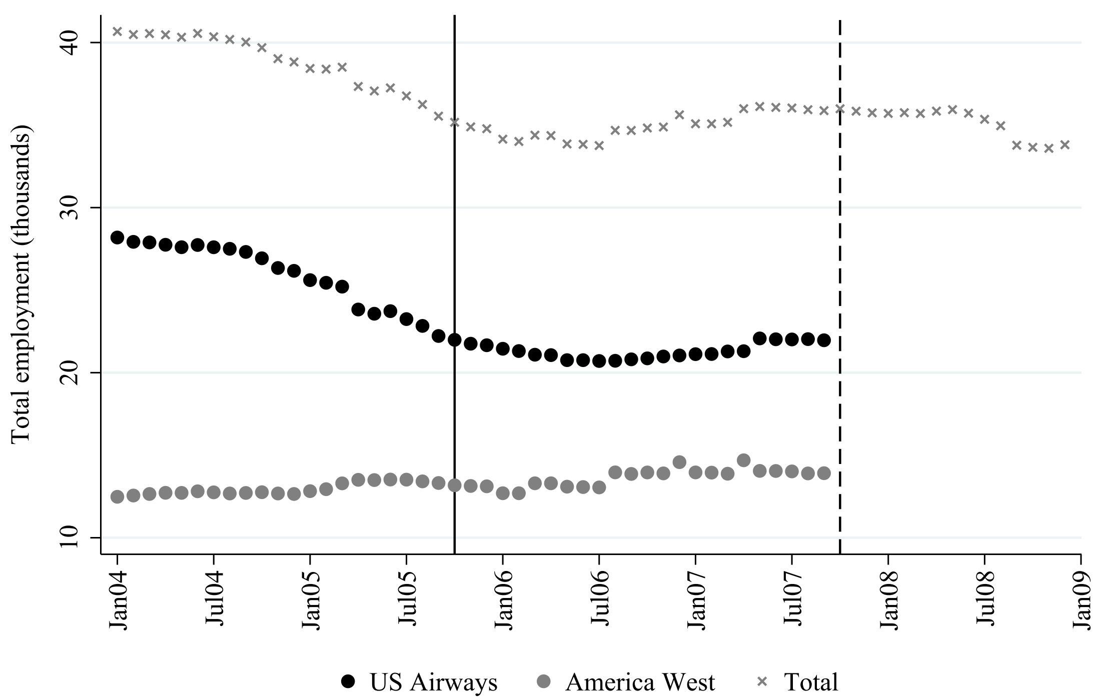
Notes: Standard errors clustered at the aircraft level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. A unit of observation is an aircraft–airline–month–year combination. The dependent variables are: monthly distance traveled (in thousands of miles), monthly actual elapsed time (i.e., from departure to arrival, in thousands if minutes), and monthly air time (i.e., from wheels off to wheels on, in thousands of minutes). All regressions include month–year and airline fixed effects. See Section 4 for variable definitions and regression ranges.

Table B.2: Number of aircraft

	UA	DN	UC
After merger approval · merged	-0.043	-0.042***	-0.027*
	(0.029)	(0.010)	(0.014)
After combining of operations · merged	-0.217***	-0.015*	-0.149***
	(0.026)	(0.009)	(0.015)
R^2	0.9798	0.9920	0.9776
Observations	1,027	1,010	960
$\bar{Y}$	5.188	5.266	5.293

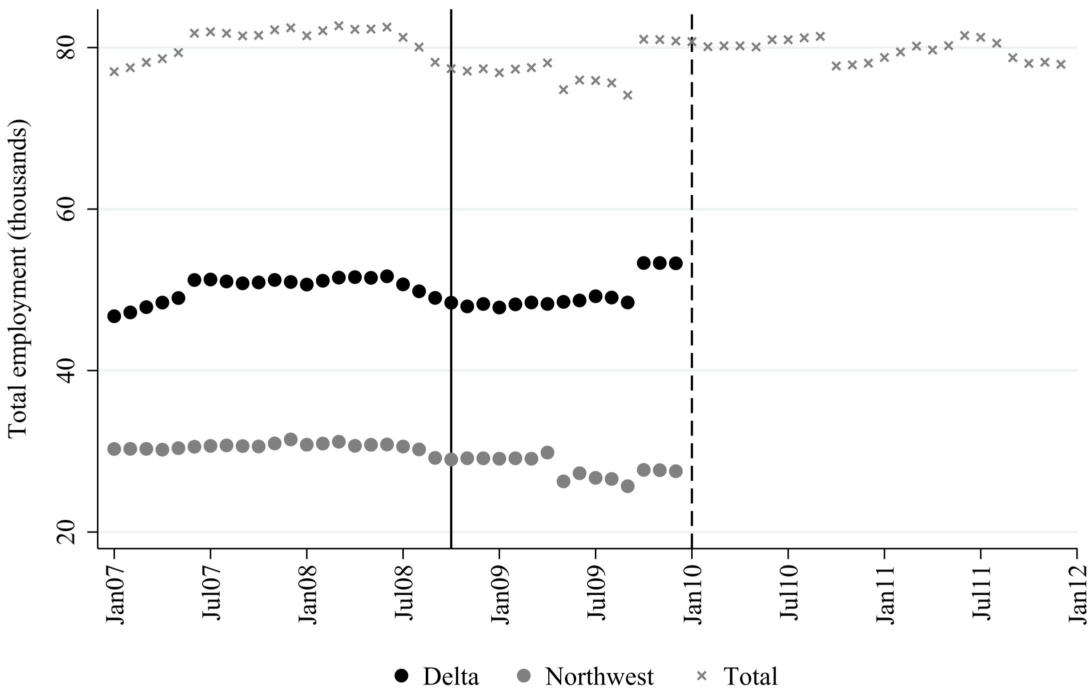
Note: Standard errors clustered at the aircraft level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. A unit of observation is an airline–month–year combination. The dependent variable is the monthly number of aircraft used for at least one flight. All regressions include month–year and airline fixed effects. See Section 4 for variable definitions and regression ranges.

Figure B.1: Employment, US Airways and America West.



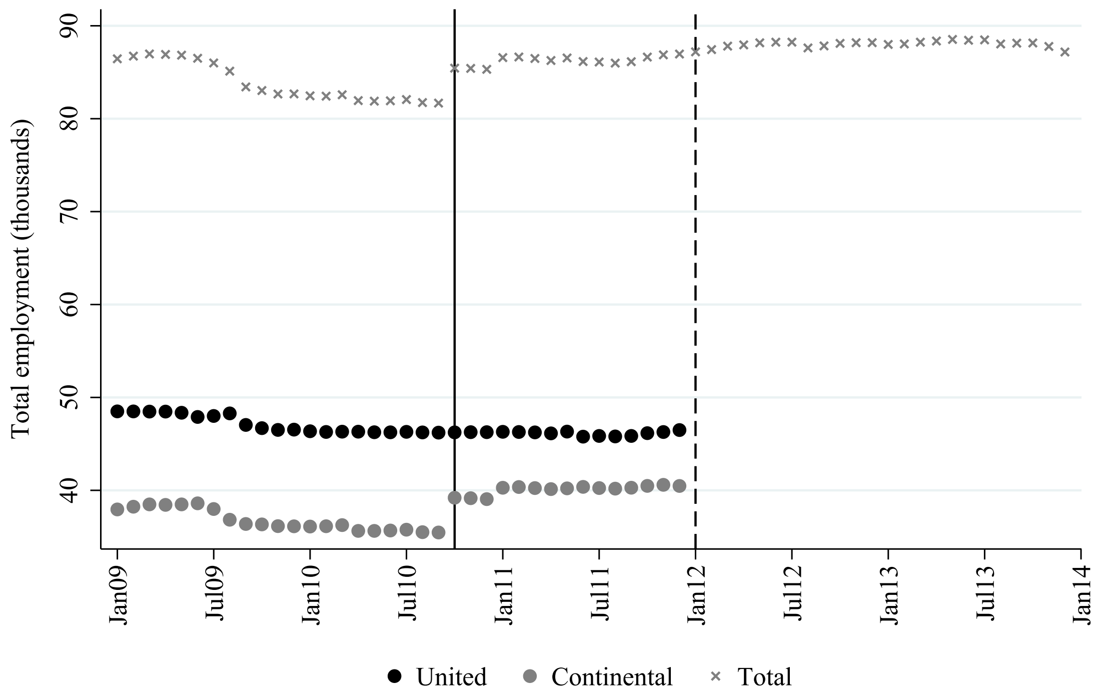
Notes: Authors' calculations based on BTS data. Solid line: merger approval; dashed line: joint report of information to the BTS, as reported in Table 1.

Figure B.2: Employment, Delta and Northwest.



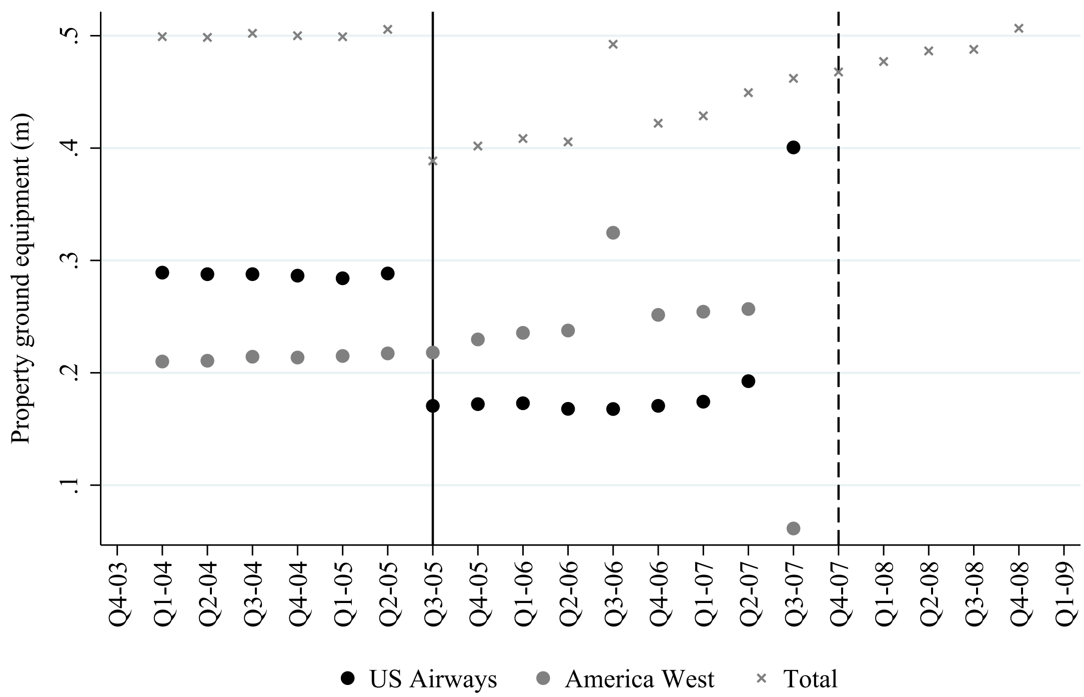
Notes: Authors' calculations based on BTS data. Solid line: merger approval; dashed line: joint report of information to the BTS, as reported in Table 1.

Figure B.3: Employment, United and Continental.



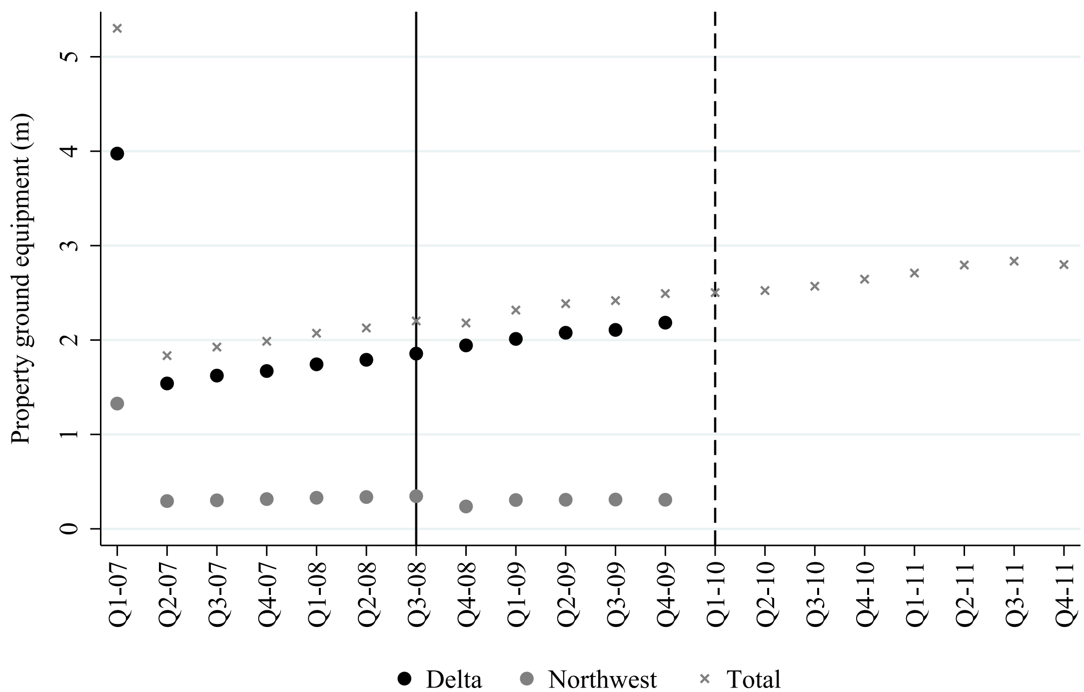
Notes: Authors' calculations based on BTS data. Solid line: merger approval; dashed line: joint report of information to the BTS, as reported in Table 1.

Figure B.4: Equipment, US Airways and America West.



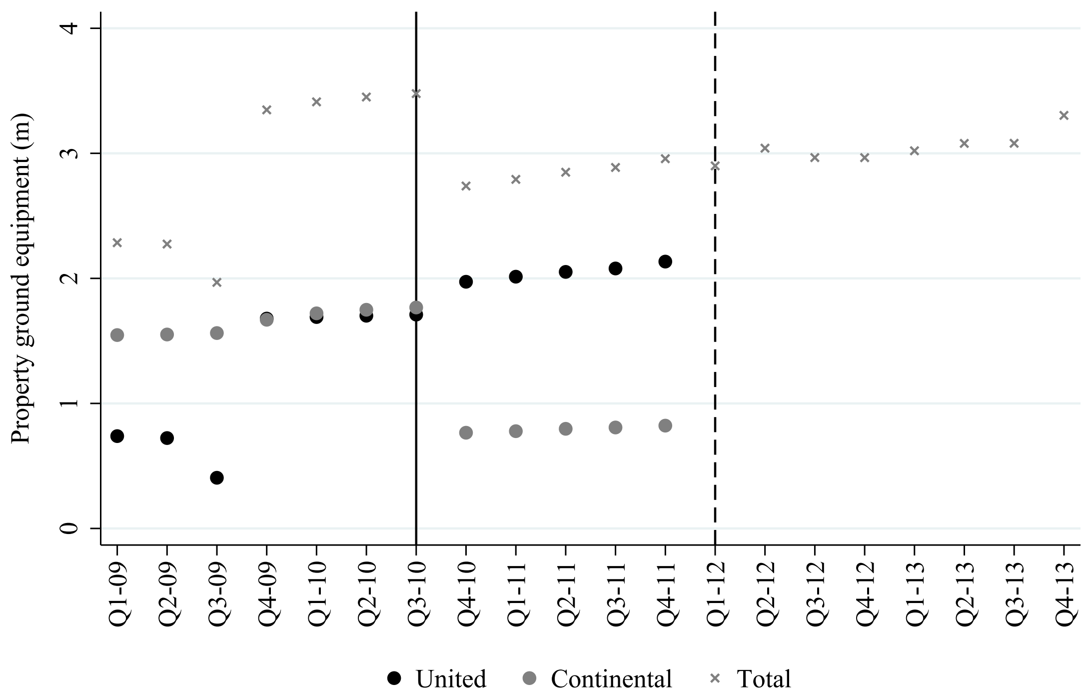
Notes: Authors' calculations based on BTS data. Solid line: merger approval; dashed line: joint report of information to the BTS, as reported in Table 1.

Figure B.5: Equipment, Delta and Northwest.



Notes: Authors' calculations based on BTS data. Solid line: merger approval; dashed line: joint report of information to the BTS, as reported in Table 1.

Figure B.6: Equipment, United and Continental.



Notes: Authors' calculations based on BTS data. Solid line: merger approval; dashed line: joint report of information to the BTS, as reported in Table 1.