Discussion Paper No. 13-028

Airline Networks, Mergers, and Consumer Welfare

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Non-technical summary

We study the consumer welfare effects of mergers in airline networks. Based on the development of a general classification of affected routes, we apply a difference-in-differences approach to exemplarily investigate the price effects of the America West Airlines (HP) - US Airways (US) merger completed in 2005. In contrast to the existing literature, we do not restrict our analysis to (hub-to-hub or hub-to-spoke) non-stop routes but also consider the price effects of losing competition by low-quality substitutes in the form of one-stop connections.

Our estimations on the route-carrier level show that, across all route types, two years after its completion, the merger led to 6.4 percent higher prices than observed on the comparator routes over the same time frame. However, introducing our classification of routes revealed substantial variation in the merger-induced price effects. While average prices on routes with non-stop overlap were on average 9.4 percent higher than on comparator routes, routes on which the merger eliminated one-stop competition by US showed prices increase of 11.1 percent suggesting that this 'imperfect substitute' constrained HP significantly in its price-setting behavior. Interestingly, we do not find robust evidence for the opposite direction, i.e., the loss of HP one-stop competition is found to leave post-merger prices unaffected on the respective non-stop routes. For the 'no overlap' route category, results also diverge. While we find a substantial and highly significant price decrease of on average 8.3 percent on US routes, the corresponding value for the HP routes shows no significant change in average prices. Last but not least, our analysis revealed that – for most route types – average prices of the merging parties and their competitors do not differ significantly from each other; this is found to be true for both price increases and price decreases post-merger.

Das Wichtigste in Kürze

Wir analysieren die Konsumentenwohlfahrtseffekte von horizontalen Fusionen in Luftverkehrsnetzen. Basierend auf der Entwicklung einer Klassifikation von potentiell betroffenen Streckenmärkten untersuchen wir mit Hilfe eines Differenz-von-Differenzen-Ansatzes die Preiseffekte der im Jahre 2005 abgeschlossenen Fusion von America West Airlines (HP) und US Airways (US). In Abgrenzung zur existierenden Literatur beschränken wir unsere Analyse nicht nur auf die (hub-zu-hub oder hub-zu-spoke) Direktflug-Streckenmärkte, sondern untersuchen auch mögliche Preiseffekte durch den Verlust von Wettbewerbern auf qualitativ minderwertigen Umsteigeverbindungen.

Unsere Schätzungen auf der Strecke-Fluggesellschaft-Ebene zeigen – für alle Streckentypen – dass zwei Jahre nach dem Abschluss der Fusion 6,4 Prozent höhere Durchschnittspreise als auf den Vergleichsrouten über den gleichen Zeitraum zu beobachten waren. Die Einführung einer Routenklassifikation offenbart hingegen eine substantielle Variation in den fusionsinduzierten Preiseffekten. Während die Durchschnittspreise auf Direktflug-Streckenmärkten um 9,4 Prozent höher waren als auf den Vergleichsrouten, zeigen Routen auf denen die Fusion zu einer Eliminierung von Umsteigewettbewerb durch US geführt hat Preiserhöhungen von 11,1 Prozent; dieses Ergebnis suggeriert, dass HP signifikant in seiner Preissetzung durch das qualitativ minderwertige Produkt ‚US Umsteigeverbindung' restringiert wurde. Interessanterweise finden wir keine robusten Belege für die umgekehrte Richtung, das heißt, der Verlust von HP Umsteigeverbindungen lässt die Durchschnittspreise nach der Fusion auf den entsprechenden Direktflugverbindungen unverändert. Für die Streckenmärkte ohne Überlappungen ergeben sich auch unterschiedliche Ergebnisse. Während wir einen substantiellen und hoch signifikanten Preisrückgang von durchschnittlich 8,3 Prozent für US Streckenmärkte finden, zeigt der korrespondierende Koeffizient für HP Routen keine signifikante Änderung der Durchschnittspreise. Nicht zuletzt liefert unsere Analyse auch Belege dafür, dass sich – für die meisten Routentypen – die Durchschnittspreise zwischen den Fusionsparteien und deren Wettbewerbern auf den jeweiligen Routen nicht signifikant voneinander unterscheiden; dies gilt sowohl für Preisansteige als auch für Preisreduktionen nach der Fusion.

AIRLINE NETWORKS, MERGERS, AND CONSUMER WELFARE

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Abstract
We study the consumer welfare effects of mergers in airline networks. Based on the development of a general classification of affected routes, we apply a difference-in-differences approach to exemplarily investigate the price effects of the America West Airlines - US Airways merger completed in 2005. We find that although average prices increased substantially on routes in which both airlines competed either on a non-stop or one-stop basis prior to the merger, substantial average price reductions observed for routes without any pre-merger overlap suggest that the merger led to a net increase in consumer welfare.

Keywords Airline industry, merger, market power, consumer welfare, price effects

JEL Class L40, L93

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1 INTRODUCTION

Hub-and-spoke networks have developed in many transport modes as an efficient way to organize traffic flows. Examples include liner shipping, highway transport or rail traffic. In the U.S. airline industry, such network structures were largely introduced after the liberalization of the industry in 1978. Although most airlines recognized the key cost- and demand-related advantages of hub-and-spoke networks already in the regulatory era, strict route entry and exit regulation by the Civil Aeronautics Board foreclosed larger network restructuring activities before the liberalization of the industry.

The dominance of hub-and-spoke networks in organizing airline traffic immediately suggests that any serious attempt to understand the structure, conduct and performance of the liberalized industry must be based on a profound knowledge of the economic characteristics of such networks. Interestingly, despite a large amount of especially theoretical research that tries to disentangle these various economic effects from the perspective of a monopoly airline, research on the rivalry between different networks is as limited as contributions which explicitly focus on the consumer welfare implications of a reduction in network rivalry through merger.

Early experiences with merger activity in the deregulated U.S. airline industry suggest that the degree of non-stop route overlap matters substantially when it comes to a forecast of the likely consumer welfare effects of mergers in hub-and-spoke airline networks. The larger the degree of overlap between the networks of the two merging carriers, the larger is the potentially anticompetitive effect of the transaction. This ‘enforcement principle’ still guides the decisions of antitrust authorities on both sides of the Atlantic.

Partly as a consequence of the focus on the degree of non-stop route overlap in antitrust investigations, recently approved merger proposals were exclusively characterized by largely complementary networks. However, although an analysis of the non-stop route overlap

certainly is a compulsory step in a full-fledged antitrust assessment, the pro- or anticompetitive impact of mergers can be wider and may include possible effects on routes with either one-stop competition or no overlap pre-merger.

Against this background, we study the consumer welfare effects of mergers in largely complementary airline networks. Based on the development of a general classification of affected routes, we apply a difference-in-differences approach to exemplarily investigate the price effects of the America West Airlines (HP) - US Airways (US) merger completed in 2005. In contrast to the existing literature, we do not restrict our analysis to (hub-to-hub or hub-to-spoke) non-stop routes but also consider the price effects of losing competition by low-quality substitutes in the form of one-stop connections. We find that non-stop overlap *and* one-stop overlap routes experience substantial price increases post-merger due to the merger-induced elimination of an effective competitive constraint. For the large group of routes with no overlap pre-merger, we find either no price effect (HP routes) or a substantial price reduction (US routes). Although our results do suggest that the merger led to a net increase in consumer welfare, they also allow the identification of additional channels of consumer-welfare-reducing price increases – namely routes which lose one-stop competition due to the merger. Our study therefore also provides guidance for antitrust authorities in the assessment of airline mergers in largely complementary networks.

The paper is structured as follows. The subsequent second section provides an overview of the key contributions from both theory and empirics with respect to the consumer welfare effects of mergers in airline networks. Subsequently, section three focuses on the development of a classification of routes possibly affected by a merger of two airlines with a largely complementary network. We will differentiate between routes with non-stop overlap, routes with one-stop overlap and routes with no overlap. In the fourth section, we apply the route classification to a real airline merger. Specifically, we concentrate on the merger between America West Airlines and US Airways completed in 2005 and study the price

effects of the merger by applying a difference-in-differences approach. Section five concludes the paper with a review of its main insights and a discussion of possible avenues for future research.

2 THE CONSUMER WELFARE EFFECTS OF AIRLINE MERGERS

Any study focusing on the consumer welfare effects of mergers can build on a significant amount of existing research. In this section, we provide an overview of the key contributions from both theory (Section 2.1) and empirics (Section 2.2). As several general surveys on the consumer welfare effects of mergers are available[1], we restrict our review of the existing literature to particularly mergers in airline networks.

2.1 THEORY

A hub-and-spoke network is defined as a route system in which many 'spoke' locations are connected to one or a small number of 'hubs' which serve the function of bundling incoming and outgoing transactions. Such bundling is typically not only associated with improvements in productive efficiency through economies of traffic density (and scope) but also reaches a better spatial coverage of the respective service (see generally, e.g., Brueckner et al. (1992), Brueckner and Spiller (1994) or Caves et al. (1984)). Although hub-and-spoke networks by construction lead to substantial concentration and therefore potential bottleneck and market power concerns at the respective hub locations, they are considered as an efficient way to organize traffic flows.

[1] From a theoretical perspective, Werden and Froeb (2008) as well as Kaplow and Shapiro (2007) and Whinston (2007) provide surveys. Following Pautler (2003), existing empirical research can be subdivided further into multi-industry studies, industry studies and case studies of specific mergers in specific industries. Concentrating on the later type of studies, Kaplan (2000) and Weinberg (2008) provide selective overviews of such case studies for a diverse set of industries including banking, hospitals, microfilms, telecommunications, computers, railroads, cement and tires.

The general characteristics of airline hub-and-spoke (HS) networks have been studied quite extensively from a theoretical perspective. Guided by the well-known cost- and demand-related characteristics of such networks, the majority of papers assume an airline network of a monopoly airline and investigate, e.g., under which conditions a monopolist airline has incentives to switch from a point-to-point network to a HS network, how such an airline would allocate costs and set prices across routes, or whether a monopolist airline has possibilities to strategically impede competition by excessively increasing its hub presence (see, e.g., Bittlingmayer (1990), Brueckner and Zhang (2001), or Hendricks et al. (1995)).

The welfare effects of competition and mergers in airline HS networks are only investigated by a small number of papers (see especially Brueckner and Spiller (1991), Oum et al. (1995) and Aguirregabiria and Ho (2010)). In their seminal paper, Brueckner and Spiller (1991) differentiate between competition in three different HS route structures – interhub competition, direct competition and leg competition[2] – and investigate the implications for competition and mergers on traffic and fares. The authors find that competition is not necessarily beneficial in HS networks as soon as both the effects on hub-to-hub and hub-to-spoke routes are taken into account (see also Bittlingmayer (1990)). As an increase in competition is likely to reduce traffic for the incumbent airline(s) on that route, cost complementarities and economies of traffic density are reduced possibly causing increases in marginal costs (and therefore prices) on complementary – seemingly unaffected – routes of the network. Whether the benefits of additional competition overtop these cost increases depends on the (demand and cost) characteristics of the respective routes/network. As a consequence, mergers in HS networks cannot be considered as generally consumer welfare

[2] *Interhub competition* refers to a route network in which cities A and B cannot be reached by a non-stop flight but only by one-stop connections via hub 1 or hub 2. *Direct competition* refers to a route network in which cities A and B can be reached either by a non-stop flight or an one-stop connection via hub 1. *Leg competition* refers to direct competition on a spoke route, e.g., the non-stop route from city A to hub 1.

reducing as the costs of a reduction in competition might be overtopped by additional efficiencies created by the larger network operated by the merged entity.

Although any investigation of the consumer welfare effects of a merger has to consider market price as a key variable, it is equally undisputed that additional service-related variables might also influence consumer welfare. For example, Bailey and Liu (1995) study the effects of airline consolidation on price *and* service (measured by scope of operations or network density). They assume that consumers prefer larger airline networks as they basically allow them to reach a higher number of destinations with a higher level of convenience in a shorter amount of time. In a two-stage model with open entry, they show that the service-enhancing effects of further consolidation may indeed outweigh the price-increasing effects of a reduction in the number of effective competitors. In another contribution, Richard (2003) concentrates on flight frequency as a service-related driver of consumer welfare. Based on a model of firms' decisions which endogenizes flight frequency, the results of various simulation exercises suggest that although a merger typically causes decreases in passenger volume and consumer surplus, some markets show net welfare gains as soon as merger-induced changes in flight frequency are included into the welfare assessment.

2.2 Empirical Evidence

Existing empirical research on particularly the price effects of U.S. airline mergers largely refers to the late 1980s. Two U.S. airline mergers – both completed in 1986 – experienced a particularly detailed ex-post investigation of their consumer welfare effects: Northwest Airlines – Republic Airlines (NW-RC) and Trans World Airlines – Ozark Airlines (TW-OZ). Both mergers involved a shared major hub airport and therefore led to substantial increases in market power post-merger. In a first influential paper, Werden et al. (1991) investigate the price and output effects of the two mergers *at their respective hub airports* and find yield increases of about 5.6 percent and service decreases of about 23.7 percent for the NW-RC

merger. Yield increases (1.5 percent) and service decreases (16.2 percent) were somewhat smaller for the TW-OZ merger. Borenstein (1990) analyzes the effects of the same two mergers at their hub airports and finds evidence for price increases for the NW-RC merger of about 9.5 percent in total (with about 6.7 percent price increases if other airlines remain as route competitors and about 22.5 percent if the merger led to a monopoly route). For the TW-OZ merger, however, his analysis resulted in largely insignificant results with the exception of a significant price *de*crease of about 12.3 percent on monopoly routes which were operated by TW or NZ before the merger.[3] Interestingly, Borenstein's analysis therefore showed that the mergers had an impact "not just on routes that both airlines had served prior to the merger, but also on routes where only one of the two merger partners competed with another airline or operated without active competition" (Borenstein (1990), p. 404). He explains this finding by the possibilities to reduce the threat of potential competition due to increased airport dominance.

Borenstein's key result of merger effects on routes in which only one of the merging carriers was active pre-merger is confirmed by studies of Kwoka and Shumilkina (2010) and Kim and Singal (1993). While Kwoka and Shumilkina (2010) also analyze a single merger (USAir and Piedmont in 1987) and find that prices rise by 5 to 6 percent on routes which were only served by one of the merging carriers and the other was a potential entrant, Kim and Singal (1993) analyze the effects of fourteen U.S. airline mergers between 1985 and 1988 and find that relative fares on the merging firms' routes rose by about 9.4 percent. Significant price increases were particularly found on routes in which the merging parties did not compete (directly) prior to the merger. They explain this observation by an increase in multi-market contact triggered by the merger. Furthermore, the authors identified a substantial

[3] It is important to note here that the observed price *de*crease is rather unexpected and might be explained by a general period of low demand at TWA's St. Louis hub. For the NW-RC merger, Borenstein (1990) finds significant price increases of about 6 percent for NW or RC routes in which (a) competitor(s) remain after the merger and price increases of about 12 percent for NW or RC routes which became a monopoly post-merger.

difference in the behavior of 'mergers including a failing firm' and 'mergers without a failing firm'. Fares of failing airlines were found to be much lower on average before the merger, providing an explanation for the substantially larger price increases after the merger compared to cases of mergers between 'healthy' firms.

Partly due to the substantial reduction in merger activity in the 1990s and 2000s, existing research on the competitive effects of more recent U.S. airline mergers is very limited. From an ex-post perspective, Bilotkach (2011) investigates the America West – US Airways merger with a particular focus on its implications for multimarket contact (MMC). He finds that the merger changed the way that the airlines take into account the extent of MMC when making strategic choices as to frequency of service. From an ex-ante perspective, constant rumors of possible mega-mergers led to several policy studies on the possible effects of such mergers (see, e.g., U.S. General Accounting Office, 2001, U.S. Government Accountability Office, 2010). However, academic contributions are restricted to a research paper by Benkard et al. (2010) in which the authors simulate the dynamic effects of three proposed horizontal U.S. airline mergers. Using data for 2003-2008, they find that a merger between two major hub carriers leads to increased entry by both other hub carriers and low cost carriers thereby offsetting some of the initial concentrating effects of the merger.[4]

Given this review of the existing literature, we contribute to the empirical literature on the consumer welfare effects of mergers in airline networks. In particular, we develop a classification of routes affected by an airline merger which does not only take the non-stop overlap markets into account but extents the perspective to one-stop competition, i.e., we

[4] Complementary to the few theoretical studies focusing on service-related effects of airline mergers, several papers provide empirical evidence for the relevance of such factors. For example, Mazzeo (2003) investigates the relationship between high market concentration and airline service. However, his analysis concentrates on on-time performance only and finds that flight delays are more common and longer on routes operated by a single airline and on routes through airports where the carrier has a large market share. Most recently, Israel et al. (2011) study the consumer welfare effects of a greater connectivity and more convenient schedules in an empirical framework and conclude that a full assessment of the welfare effects of mergers demands an inclusion of quality effects, i.e., quality-adjusted post-merger fares have to be compared to the pre-merger fares.

investigate possible price effects of the merger on routes in which one of the merging carriers competed against the other through a stop-over connection. Although antitrust authorities have identified the potential significance of such competition by low-quality products in past decisions, it has not yet been included into a general investigatory framework which can be applied as part of an econometric analysis.

3 Mergers in Airline Networks – A Classification of Affected Routes

Although the preceding section revealed significant existing research on the question after the price effects of mergers in airline networks, the large majority of these papers refer to U.S. airline mergers completed in the 1980s. On the one hand, this period was characterized by substantial industry consolidation leading to a large number of mergers as possible study objects. On the other hand, the Department of Justice followed a laissez-faire approach to antitrust policy at that time – strongly influenced by the theory of contestable markets by Baumol et al. (1982) – and leading to the approval of basically all merger proposals independent of their potential for anticompetitive effects. This general policy led to the approval of airline mergers which had a substantial non-stop route overlap due to sharing of a common hub.

More recently, however, antitrust authorities tend to take account of the anticompetitive potential of airline mergers with a significant degree of non-stop route overlap. For example, the European Commission (EC) recently prohibited two mergers which both involved shared hubs: Dublin in case of the Ryanair-Aer Lingus merger proposal (Case No COMP/M.4439, decided in 2007) and Athens in case of the Olympic Air-Aegean Airlines merger proposal (Case No COMP/M.5830, decided in 2011). In both cases, the EC concluded that (route) competition would be harmed substantially by the mergers and therefore prohibited the transactions.

In the United States, several merger proposals were abandoned after the DOJ signaled competition concerns. For example, in 2001, United Airlines and US Air ended their merger plans after the DOJ announced its intent to block the transaction (see, e.g., U.S. General Accounting Office, 2001 for an analysis of the expected competitive effects of the proposed merger). Three years earlier, in 1998, a proposal of Northwest Airlines' to acquire Continental Airlines received similar signals from the DOJ and was subsequently abandoned.

Due to the tougher enforcement of antitrust rules in recent years, approved airline mergers are characterized by largely complementary networks. Although the empirical results of earlier studies remain relevant, the new merger characteristic raises the demand for a route classification that explicitly takes the complementarities of the merging network into account. Figure 1 below shows a simple route network with two airlines which allows the derivation of a new classification of routes possibly affected by an airline merger with largely complementary networks.

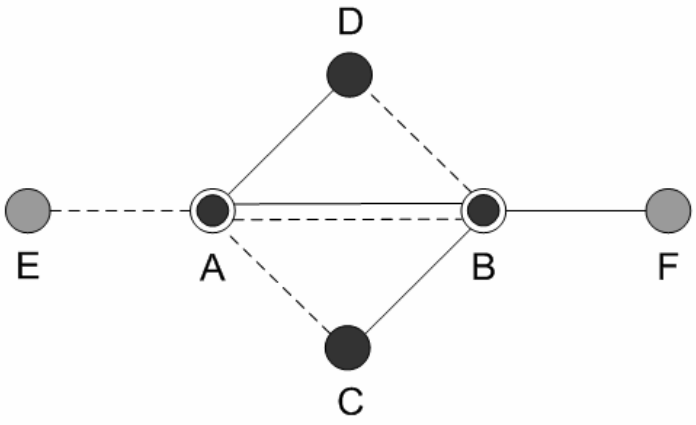

Figure 1: A simple route network with two airlines

Source: own figure

We assume that two airlines provide services in the above network. Airline 1 operates hub A while airline 2 operates hub B (black dots with white circle). Airline 1 offers direct flights to cities B, C and E (dashed lines), while airline 2 provides direct services to cities A, C and F (solid lines). As a consequence, both airlines are present at the respective airports in cities A,

B, C and D (black dots), while airline 1/2 has an exclusive position at airport E/F (grey dots). Based on this simple airline network, we define the following types of routes possibly affected by the merger:

Routes with non-stop overlap

This route type is characterized by direct competition of both merging airlines in a particular non-stop airport-pair. In this route category, a merger by definition leads to an increase in market concentration and is susceptible of increasing market power of the merging airlines. As a consequence, this route type typically is the major focus of antitrust investigations. In the simple airline network defined in Figure 1 above, airlines 1 and 2 only compete directly on the AB airport-pair.

Routes with one-stop overlap

This route type is characterized by the presence of indirect competition of one of the merging airlines in a particular airport-pair: while one carrier offers a direct connection, the other carrier operates a one-stop connection between origin and destination airports. Although one-stop connections must be considered as a lower-quality product compared to a direct flight (e.g., due to longer travel times and the need to change airplanes en-route), such imperfect substitutes can still act as effective competitive constraint particularly in medium and long-haul markets. A merger reduces or even eliminates this low-quality competition through one-stop connections and might consequently harm consumers through higher prices post-merger. In the simple airline network above, airline 1 faces one-stop competition on routes AC and BD, as consumers can also travel with airline 2 from A to C via B and from B to D via A. Vice versa, airline 2 might be constrained in its price-setting behavior on routes BC and AD due to one-stop connections by airline 1 (B to C via A and A to D via B).

Routes with no overlap

This route type is characterized by the absence of non-stop or one-stop overlaps, i.e., no direct or indirect competition exists between the merging airlines. In the simple airline network above, this is the case for route AE for airline 1 and route BF for airline 2. Although at first glance, it appears that these routes are unaffected by the merger, a closer look reveals that the merger-induced change in the operator might contain several possibilities for price reactions. First, referring to the theory of HS networks sketched above, a merger might have a significant impact of the overall number of passengers travelling on the respective routes. Ceteris paribus, an increase in the number of passengers is associated with decreases in marginal costs due to cost complementarities and economies of traffic density (and vice versa) and would consequently suggest a downward trend in price. Second, a change in ownership might cause changes in pricing and other strategic variables possibly triggering significant price changes post-merger. Third, the merger might have an impact on the quality of the merged product. For example, the merger of two complementary networks creates additional travel possibilities for the customers of both airlines thereby increasing quality (and possibly justifying price increases). Fourth, the merger increases multimarket contact among the remaining airlines in the industry and might therefore ease the realization of (tacitly) collusive outcomes. Last but not least, potential competition might be eliminated by the merger possibly allowing the remaining carriers to increase price.

Based on this classification of routes possibly affected by the merger, an empirical implementation has to differentiate between five different route types: non-stop overlaps between airline 1 and airline 2, one-stop competition by airline 1 (airline 2) on a particular non-stop route from airline 2 (airline 1) and routes with no overlap operated by airline 1 and airline 2. Although the remainder of this paper will concentrate on an application of the derived classification to a particular merger, i.e., will conduct an ex-post merger review, the proposed classification can be of great use in ex-ante assessment of proposed mergers as well.

In addition to a qualitative assessment of the significance of the different route types and potential competition problems, simulation exercises can provide additional insights on the likely effects of the merger of two airline networks.

In the following section, we will present an empirical implementation of our proposed route classification. Specifically, we will investigate the price effects of the merger between America West Airlines (HP) and US Airways (US) completed in 2005. Although the last decade has seen a couple of mergers between U.S. airlines, several arguments suggest focusing on the HP-US transaction. First, the merger took place at a time without severe external or internal shocks such as terrorist attacks, economic recession or other larger airline mergers. Second, the networks of both carriers were truly complementary showing only four non-stop route overlaps at the time of the merger. Third, the hubs of both airlines were located quite distant from each other with Phoenix and Las Vegas in case of America West Airlines and Charlotte, Philadelphia, and Pittsburgh in case of US Airways. This characteristic, ceteris paribus, makes one-stop connections a closer substitute to non-stop connections than in cases of closely located hubs.[5] Last but not least, the merging airlines had quite distinctive business strategies with US Airways being a classical full-service, high-cost carrier which already operated in the regulatory era of the industry, and America West being founded after the liberalization of the industry with a substantially lower cost base. In this respect, it is important to note that the merged company decided to use the brand 'US Airways' although US Airways basically was the (almost bankrupt) junior partner in the transaction.

[5] Although it might not be acceptable for most passengers to travel from New York via Boston to Philadelphia, it might be considered as a close substitute to go from New York to Phoenix on either a direct flight or a connecting flight via, e.g., Salt Lake City or Denver.

4 EMPIRICAL ANALYSIS

Given the development of an analytical framework for an assessment of mergers in airline networks in the preceding section, this section applies the framework to the merger between America West and US Airways ('HP-US merger') completed in 2005 (3rd quarter). The section is structured as follows. Section 4.1 describes the construction of the dataset, while Section 4.2 specifies our empirical approach and presents our results. Section 4.3 finally provides an interpretation of our empirical results.

4.1 CONSTRUCTION OF THE DATASET

Our dataset was constructed by collecting and merging data from several sources. We use airline traffic data for the years from 2003 (4th quarter) to 2007 (3rd quarter) from the U.S. DOT T-100 Domestic Segment database. This data contains monthly domestic non-stop segment data reported by U.S. air carriers when both origin and destination airports are located within the boundaries of the United States and its territories. We use T-100's information on origin, destination, non-stop distance, available capacity, number of departures, and number of passengers to construct a quarterly panel data-set of non-directional non-stop route airport-pair markets. We drop airline-route observations with less than 12 quarterly departures and airline-route observations which were only served one quarter between 1995 and 2011. In addition, we use fare data from the U.S. DOT DB1B Market Origin and Destination Survey to enrich the constructed panel dataset with quarterly route-level fare data. In calculating average non-stop fares, zero fares and abnormally high fares were excluded from the dataset. We only use average fares which are based on at least ten observations and thousand quarterly passengers. We add demographic information on the population and the number of establishments of the respective Metropolitan Statistical Areas from the U.S. Bureau of Labor Statistics.

4.2 EMPIRICAL APPROACH AND RESULTS

The implementation of our empirical approach can be subdivided into two major analytical steps. In the first step, we apply the analytical framework derived in Section 3 above to the route level, i.e., we study the average price effects of the merger between America West and US Airways for the five different route categories by applying a difference-in-differences approach. The second step narrows the perspective down and complements the simple analysis of average prices per route with a more detailed analysis of the average price changes of both the merging parties and the remaining rivals on the respective routes. In both steps, we investigate the average price effects on the respective route types two years before and two years after the completion of the merger. We use the exit of the HP routes in the T-100 data set as the quarter in which the merger was completed (4th quarter of 2005).[6]

Before we commence with the analysis of the price effects of the merger, Table 1 characterizes the different route types included in our estimations.

Table 1: Characteristics of routes included in the estimations

	# of routes	# of direct competitors	distance	quarterly passengers
comparator routes	1,364	1.4	798.8	72,864
direct comp.	4	2.1	1993.8	131,633
US route (no HP comp.)	147	1.6	636.6	103,668
US route (HP one-stop comp.)	7	1.7	2231.3	97,951
HP route (no US comp.)	57	2.4	897.4	232,978
HP route (US one-stop comp.)	24	2.1	2013.5	111,513

Sources: U.S. DOT, T-100 Domestic Segment Data, Airline Origin and Destination Survey (DB1B), authors' calculations.

As shown in Table 1, the HP-US merger in sum affected 239 airport-pairs. Referring to our route classification, we have only 4 airport-pairs in the 'non-stop overlap' category, compared

[6] This approach is in accordance with other sources such as 'Airlines for America'. See http://www.airlines.org/Pages/U.S.-Airline-Mergers-and-Acquisitions.aspx, last accessed on 3 February 2013).

to 7+24=31 in the ‘one-stop overlap’ category and 147+57=204 routes showing ‘no overlap’. As further revealed by Table 1, HP routes have a higher number of direct competitors in the respective airport pairs suggesting – ceteris paribus – more intensive competition. Additionally, data on the average distances show that – due to the locations of the hubs of the merging parties – non-stop and one-stop competition largely take place in long distance markets, while the no overlap routes are (on average) substantially shorter and basically aim at distributing traffic from the respective hubs to airports in the Western parts of the U.S. in case of America West and in the Eastern parts of the U.S. in case of US Airways. Last but not least, the figures for the average number of passengers per quarter reveal that America West routes are denser for both routes with one-stop competition and routes with no competition (between the merging parties).

4.2.1 ANALYSIS ON ROUTE LEVEL

In a first step, we apply a difference-in differences approach to route level data, i.e., we observe one average price per quarter for every affected route and the comparator routes two years before and two years after the merger. Regression results are shown in Table 2 below while the summary statistics are reported in Table 4 in the Appendix.

Table 2: Fixed-effects regressions of merger's price effects (route level)

	ln(avg. yield)	
Variable	coeff.	(s.e.)
post merger	0.099***	(0.006)
post # direct comp.	0.105***	(0.027)
post # US route (no HP comp.)	-0.115***	(0.016)
post # US route (HP one-stop comp.)	0.063*	(0.033)
post # HP route (no US comp.)	0.028**	(0.014)
post # HP route (US one-stop comp.)	0.071***	(0.016)
# airlines w/o merger parties	-0.024***	(0.009)
# LCCs	-0.173***	(0.021)
ln(avg. plane size)	-0.043**	(0.021)
airport size (max)	0.042**	(0.018)
HHI of airport with larger size	0.039	(0.077)
airport size (max) # HHI of larger airport	-0.128***	(0.023)
airport size (min)	0.044*	(0.026)
HHI of airport with smaller size	0.032	(0.056)
airport size (min) # HHI of smaller airport	-0.109***	(0.042)
ln(population) (mean)	0.212	(0.165)
ln(# establ.) (mean)	0.485***	(0.116)
Year 2004	-0.098***	(0.005)
Year 2005	-0.153***	(0.008)
Year 2006	-0.183***	(0.012)
Year 2007	-0.237***	(0.015)
2nd Quarter	-0.016***	(0.002)
3rd Quarter	-0.050***	(0.003)
4th Quarter	-0.095***	(0.004)
Constant	-5.177**	(2.230)
Observations	25,648	
Routes	1,603	
R^2 (within/between/overall)	0.111 0.058	0.052

*Notes: Significance levels *** p<0.01, ** p<0.05, * p<0.1, cluster-robust standard errors in parentheses. Hausman test prefers the fixed-effects over the random-effects model.*
Sources: U.S. DOT, T-100 Domestic Segment Data, Airline Origin and Destination Survey (DB1B), U.S. Census and U.S. Bureau of Labor Statistics, authors' calculations.

As shown in Table 2, across all route types, two years after its completion, the merger led to 9.9 percent higher prices than observed on the comparator routes over the same time frame. This is a surprising first result given the largely complementary route network of both carriers. Turning from this general analysis across all affected routes to the application of our route classification reveals that the merger led to significant price increases in four out of five

route types. Two years after the completion of the merger, prices on routes with non-stop overlap were on average 10.5 percent higher than on comparator routes. On routes in which the merger eliminated one-stop competition by US or HP, prices increase by 6.3 percent or 7.1 percent respectively, supporting the expected significant but reduced competitive pressure created by these imperfect substitutes. For the group of routes with no non-stop or one-stop overlap, results diverge substantially. While we find a substantial and highly significant decrease in price of on average 11.5 percent on US routes, the corresponding value for the HP routes shows a moderate increase of 2.8 percent.

The control variables largely show the expected behavior. The number of competitors *(# airlines w/o merger parties*) as well as the number of low cost carriers in a particular route (*# LCCs*) have negative effects on average market price. However, the effect of the presence of a low cost carrier is by far larger than the presence of other carriers. This finding is supported by prior studies on the effects of entry (see Brueckner et al. (2011) and Hüschelrath and Müller (2011)). Furthermore, average prices decrease with an increase in plane size (*ln(avg. plane size)*) due to the well-known cost advantages of operating larger airplanes. Turning from route-related to airport-related control variables, we also control for the influence of airport size as measured by the mean of the two endpoint airports' passenger share (*airport size (max)*). As revealed by Table 2, average prices increase slightly with the overall size of the airport. Interestingly, if not airport size but airport concentration (measured by the Herfindahl-Hirschman Index (HHI)) is used as control variable, the results reported in Table 2 show that average prices are reduced with a larger concentration at the larger and the smaller airport used for the operation of a certain route connection. Furthermore, two demographic variables on the MSA level enter the analyses which aim to capture demand effects. The population (*ln(population force) (mean)*) shall capture potential total demand. The number of establishments (*ln(# establ.) (mean)*) is included to capture the demand of less price-sensitive

business people. As revealed by Table 2, only the number of establishments is found to have a positive and large effect on average yield.

4.2.2 ANALYSIS ON ROUTE-CARRIER LEVEL

In a second step, we apply the same difference-in-differences approach to the route-carrier level, i.e., we observe separate average prices per quarter for the merging parties and their competitors for all affected routes and the comparator routes two years before and two years after the merger. Regression results are shown in Table 3 below while the summary statistics are reported in Table 5 in the Appendix.

Table 3: Fixed-effects regressions of merger's price effects (route-carrier level)

	ln(yield)		ln(yield)	
Variable	coeff.	(s.e.)	coeff.	(s.e.)
post merger	0.064***	(0.004)	0.064***	(0.004)
post # direct comp.	0.094***	(0.022)	0.086***	(0.018)
post # US route (no HP comp.)	-0.083***	(0.011)	-0.092***	(0.015)
post # US route (HP one-stop comp.)	0.019	(0.024)	0.001	(0.035)
post # HP route (no US comp.)	0.020	(0.013)	0.212**	(0.088)
post # HP route (US one-stop comp.)	0.111***	(0.023)	0.338***	(0.070)
post # direct comp. # rival			0.013	(0.036)
post # US route (no HP comp.) # rival			0.018	(0.021)
post # US route (HP one-stop comp.) # rival			0.030	(0.046)
post # HP route (no US comp.) # rival			-0.204**	(0.089)
post # HP route (US one-stop comp.) # rival			-0.264***	(0.073)
# airlines w/o merger parties	-0.027***	(0.005)	-0.028***	(0.005)
# LCCs	-0.089***	(0.011)	-0.090***	(0.011)
ln(avg. plane size)	-0.027*	(0.014)	-0.027**	(0.014)
airport size (max)	0.047***	(0.010)	0.048***	(0.010)
HHI of airport with larger size	0.079	(0.051)	0.079	(0.051)
airport size (max) # HHI of larger airport	-0.143***	(0.016)	-0.145***	(0.016)
airport size (min)	0.107***	(0.015)	0.106***	(0.015)
HHI of airport with smaller size	0.130***	(0.044)	0.130***	(0.044)
airport size (min) # HHI of smaller airport	-0.160***	(0.028)	-0.162***	(0.028)
ln(population) (mean)	0.140	(0.109)	0.159	(0.109)
ln(# establ.) (mean)	0.296***	(0.071)	0.306***	(0.070)
Year 2004	-0.076***	(0.003)	-0.077***	(0.003)
Year 2005	-0.110***	(0.006)	-0.111***	(0.006)
Year 2006	-0.116***	(0.009)	-0.117***	(0.009)
Year 2007	-0.158***	(0.011)	-0.161***	(0.011)
2nd Quarter	-0.006***	(0.001)	-0.006***	(0.001)
3rd Quarter	-0.041***	(0.002)	-0.041***	(0.002)
4th Quarter	-0.073***	(0.003)	-0.074***	(0.003)
Constant	-2.385	(1.625)	-2.788*	(1.623)
Observations	41,445		41,445	
Route-Carrier	3,868		3,868	
Routes	1,603		1,603	
R^2 (within/between/overall)	0.105 0.085	0.069	0.108 0.085	0.069

*Notes: Significance levels *** p<0.01, ** p<0.05, * p<0.1, cluster-robust standard errors in parentheses. Hausman test prefers the fixed-effects over the random-effects model.*
Sources: U.S. DOT, T-100 Domestic Segment Data, Airline Origin and Destination Survey (DB1B), U.S. Census and U.S. Bureau of Labor Statistics, authors' calculations.

As shown in Table 3, across all route types, two years after its completion, the merger led to 6.4 percent higher prices than observed on the comparator routes over the same time frame. Compared to the result on the route level – 9.9 percent – the price increase is found to be

substantially lower for the route-carrier level. Turning from this average value across all affected routes to the application of our route classification reveals that the merger is still found to have caused significant price changes in three out of five route types. Two years after the completion of the merger, average prices of the merging parties on routes with non-stop overlap were on average 9.4 percent higher than on comparator routes. Interestingly, competitors on the respective routes raised average prices in the same dimension as the merging parties in the two years after the merger.

On routes in which the merger eliminated one-stop competition, prices of the merged entity increased by on average 11.1 percent (compared to 7.1 percent on route level) on HP routes which faced one-stop competition by US pre-merger. Ceteris paribus, this finding suggests that US one-stop connections were constraining HP in its price-setting behavior significantly. After the merger, this competitive constraint was eliminated and prices increased accordingly. However, for US routes with HP one-stop connections, results are mixed. While we find a weakly significant price increase of 6.3 percent on the route-level, the route-carrier level shows no significant price change post-merger. Although this finding might have to do with the relatively small number of routes in this category, competitors' reactions to the merger apparently also played a role. While in the other four route categories, rival prices do not differ significantly from the prices set by the merging parties, the category at hand shows significantly lower price increases for the rivals (7.4 percent) compared to the merging parties (11.1 percent).

Last but not least, the no overlap route category again shows a large and highly significant price *de*crease on US routes for both merged parties (-8.3 percent) and rivals (-7.4 percent), while the respective values for the HP routes are small and only significant for the average prices of the rivals (+0.8 percent). The control variables exclusively show the same direction as identified for the route level analysis although the sizes of the coefficients party diverge.

4.3 INTERPRETATION OF ESTIMATION RESULTS

Recapitulating the key results of the last two subsections, our estimations on the route level and the route-carrier level do suggest that especially passengers traveling on routes which were only operated by US Airways pre-merger (and did not face HP one-stop competition) profited substantially from the merger while passengers in all other route categories were either not affected or paid higher prices. However, does this finding support the conclusion that the merger was anticompetitive? Although it is above the scope of this paper to provide a sophisticated econometrics-based answer to this question, our estimation results together with several route characteristics reported in Table 1 above do allow some back-of-the-envelope calculation suggesting that consumers in sum profited substantially from the merger. The analysis which supports such a conclusion is shown in Table 4 below.

Table 4: Characteristics of affected routes and estimated price changes

	# of routes	Estimated price change (route level)	Estimated price change (route-carrier level)	Average number of passengers	Average number of passengers	Total passenger share
	#	*%*	*%*	*quarter*	*two years*	*%*
Direct comp.	4	10.5	9.4	131,633	4,212,256	2%
US route (no HP comp.)	147	-11.5	-8.3	103,668	121,913,568	47%
US route (HP one-stop comp.)	7	6.3	0.0	97,951	5,485,256	2%
HP route (no US comp.)	57	2.8	0.0	232,978	106,237,968	41%
HP route (US one-stop comp.)	24	7.1	11.1	111,513	21,410,496	8%

Source: own calculations based on results reported in Tables 1, 2, and 3

As shown in Table 4, although route-carrier level estimations suggest substantial price increases of 9.4 percent on routes with non-stop competition and 11.1 percent on HP routes which had US one-stop competition pre-merger, only about 10 percent of the overall number of passengers in the two year period following the merger travelled in these markets. For the majority of passengers, the merger either led to substantial price reductions of on average 8.3 percent (47 percent) or had no significant effect on average prices (43 percent). In absolute terms, while about 25.6 million passengers faced higher prices post-merger, about 111.7

million passengers experienced no change in average fares and about 121.9 million were able to enjoy significant fare reductions. Although admittedly a rough estimate, the derived figures suggest that – in sum – the merger between US Airways and America West Airlines led to substantial increases in consumer welfare.

Despite this presumably positive net effect of the HP-US merger on consumer welfare, it is important to note that this merger was highly complementary with only four non-stop overlaps and 31 one-stop overlaps. However, as soon as the degree of overlap becomes larger, our empirical results derived above would suggest that competition concerns might become more serious. For example, the merger between Delta Air Lines and Northwest Airlines (completed in 2009) showed 58 non-stop route overlaps; ceteris paribus, such a transaction would demand a much more detailed assessment whether the expected price increases on the overlapping parts of the network are still overcompensated by price reduction in markets without a non-stop or one-stop overlap.

On a more general level, the results reported in Table 4 suggest the importance of a disaggregated approach in an ex-post analysis of the consumer welfare effects of airline mergers. According to our estimation results for all affected routes reported in Table 2 (route level) and Table 3 (route-carrier level), the merger caused an average fare increase of 9.9 percent (route level) or 6.4 percent (route-carrier level), respectively. The implementation of our detailed route classification derived in Section 3 above, however, revealed that these results are largely driven by two relatively small groups of passengers who were actually harmed by the merger while the large majority of passengers remain either unaffected or profit substantially from the transaction.

5 SUMMARY AND CONCLUSION

The U.S. airline industry has recently experienced a substantial consolidation trend. In the last ten years, five large mergers[7] raise the immediate question after the welfare consequences of these consolidations. Under which circumstances are airline mergers likely to cause significant price increases for the final consumers and should therefore be remedied or even prohibited? Answers to these questions are crucial, not only as part of an ex-post evaluation exercise of a particular merger but especially due to the more general insights gained on the workability of competition in the U.S. airline industry and potential consequences for future merger reviews by antitrust authorities.

Against this background, we study the consumer welfare effects of mergers in airline networks. Based on the development of a general classification of affected routes, we apply a difference-in-differences approach to exemplarily investigate the price effects of the America West Airlines (HP) - US Airways (US) merger completed in 2005. In contrast to the existing literature, we do not restrict our analysis to (hub-to-hub or hub-to-spoke) non-stop routes but also consider the price effects of losing competition by low-quality substitutes in the form of one-stop connections.

Our estimations on the route-carrier level show that, across all route types, two years after its completion, the merger led to 6.4 percent higher prices than observed on the comparator routes over the same time frame. However, introducing our classification of routes revealed substantial variation in the merger-induced price effects. While average prices on routes with non-stop overlap were on average 9.4 percent higher than on comparator routes, routes on which the merger eliminated one-stop competition by US showed prices increase of 11.1

[7] The large mergers were American Airlines – Trans World Airlines (2001), America West – US Airways (2005), Delta Air Lines – Northwest Airlines (2009), United Airlines – Continental Airlines (2010) and Southwest Airlines and AirTran Airways (2011).

percent suggesting that this 'imperfect substitute' constrained HP significantly in its price-setting behavior. Interestingly, we do not find robust evidence for the opposite direction, i.e., the loss of HP one-stop competition is found to leave post-merger prices unaffected on the respective non-stop routes. For the 'no overlap' route category, results also diverge. While we find a substantial and highly significant price *de*crease of on average 8.3 percent on US routes, the corresponding value for the HP routes shows no significant change in average prices. Last but not least, our analysis revealed that – for most route types – average prices of the merging parties and their competitors do not differ significantly from each other; this is found to be true for both price increases and price decreases post-merger.

With respect to the overall consumer welfare effects of the merger, our estimation results on the surface suggest that the merger might have been anticompetitive as it led to substantial price increases in two route categories and to price decreases in only one category. However, taking the number of passengers traveling in the respective categories into account revealed that only about 10 percent of the overall number of passengers in the two year period following the merger travelled in markets which experienced a price increase post-merger. For the majority of passengers, however, the merger either led to substantial price reductions (47 percent) or had no significant effect on average prices (43 percent).

Although we propose a full-fledged framework to investigate the consumer welfare effects of mergers, it does contain several possibilities for extensions. First, as we restrict our empirical analysis of the merger to price effects, future studies might profit from the inclusion of other potential determinants of consumer welfare such as service quality. Second, our empirical analysis concentrates on airport-pairs. Although this (rather defensive) assumption is made by many airline-related papers, it would be interesting to investigate whether our

results hold for city-pair markets.[8] Third, our general classification of routes suggests an application to other airline mergers. Given the partly substantial differences with respect to both general size and network characteristics of mergers such as Delta Air Lines – Northwest Airlines (2009) or United Airlines – Continental Airlines (2010), important additional insights on the effects of competition and mergers in airline networks might be gained.

Although the paper studies the welfare effects of one particular merger in one particular industry, our analysis and results do provide several general conclusions. First, for a meaningful analysis of the price effects of mergers (both ex-ante and ex-post), it is crucial to find the correct level of disaggregation of the potentially affected markets. Otherwise, an economic analysis might draw wrong conclusions on the price effects of a particular transaction. Second, although losing direct competitors is found to cause substantial price increases, indirect 'low-quality' competitors might also constrain firms in their price-setting behavior and should therefore be considered as part of a merger investigation. Third, our estimations reveal that if the merging parties increase (decrease) prices post-merger, rivals typically also increase (decrease) prices by an equal amount thereby confirming the results of standard Cournot oligopoly models. Fourth, complementary to an estimation of the percentage price-increases post-merger, the number of affected consumers must be taken into account when it comes to estimations of the overall consumer welfare effects. Last but not least, when assessing mergers, the markets with the most severe competition concerns might diverge from the markets which contain the largest potentials for efficiency gains. This key finding suggests that – especially in network markets – merger assessments are complex exercises in which traditional tools of antitrust analysis might lead to flawed conclusions on the pro- or anti-competitiveness of a certain merger proposal.

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[8] As none of the five cities with hub presences of the merging parties – Phoenix, Las Vegas for America West and Charlotte, Philadelphia, and Pittsburgh for US Airways – has a larger (alternative) primary or secondary airport, the changes in results triggered from a switch to city-pair markets can be expected to be rather limited for the merger case at hand.

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APPENDIX

Table 5: Summary statistics - route level

	pre-merger period		post-merger period		overall	
	Mean	(s.d.)	Mean	(s.d.)	mean	(s.d.)
ln (yield)	2.996	(0.722)	3.014	(0.705)	3.005	(0.714)
Yield	26.376	(22.469)	26.505	(21.910)	26.441	(22.191)
Δ airlines w/o merger parties	0.000	(0.238)	0.003	(0.212)	0.002	(0.225)
comparison routes	0.851	(0.356)	0.851	(0.356)	0.851	(0.356)
post # direct comp.	0.002	(0.050)	0.002	(0.050)	0.002	(0.050)
post # US route (no HP comp.)	0.092	(0.289)	0.092	(0.289)	0.092	(0.289)
post # US route (HP one-stop comp.)	0.004	(0.066)	0.004	(0.066)	0.004	(0.066)
post # HP route (no US comp.)	0.036	(0.185)	0.036	(0.185)	0.036	(0.185)
post # HP route (US one-stop comp.)	0.015	(0.121)	0.015	(0.121)	0.015	(0.121)
# airlines w/o merger parties	1.289	(0.682)	1.292	(0.694)	1.291	(0.688)
# LCCs	0.300	(0.475)	0.339	(0.513)	0.319	(0.495)
ln(avg. plane size)	4.555	(0.529)	4.536	(0.523)	4.546	(0.526)
avg. plane size	107.594	(48.050)	105.484	(47.695)	106.539	(47.883)
airport size (max)	2.453	(1.403)	2.438	(1.354)	2.446	(1.379)
HHI of airport with larger size	0.428	(0.205)	0.441	(0.210)	0.434	(0.208)
airport size (min)	0.645	(0.664)	0.643	(0.672)	0.644	(0.668)
HHI of airport with smaller size	0.346	(0.206)	0.342	(0.203)	0.344	(0.205)
ln(population) (mean)	14.844	(0.802)	14.871	(0.796)	14.858	(0.799)
population (mean)	3,685,147	(2,861,681)	3,760,907	(2,869,394)	3,723,027	(2,865,735)
ln(# establ.) (mean)	11.254	(0.822)	11.302	(0.820)	11.278	(0.822)
# establ. (mean)	104,720	(87,773)	109,651	(91,541)	107,186	(89,709)
Year 2003	0.125	(0.331)	0.000	(0.000)	0.063	(0.242)
Year 2004	0.500	(0.500)	0.000	(0.000)	0.250	(0.433)
Year 2005	0.375	(0.484)	0.125	(0.331)	0.250	(0.433)
Year 2006	0.000	(0.000)	0.500	(0.500)	0.250	(0.433)
Year 2007	0.000	(0.000)	0.375	(0.484)	0.188	(0.390)
1st Quarter	0.250	(0.433)	0.250	(0.433)	0.250	(0.433)
2nd Quarter	0.250	(0.433)	0.250	(0.433)	0.250	(0.433)
3rd Quarter	0.250	(0.433)	0.250	(0.433)	0.250	(0.433)
4th Quarter	0.250	(0.433)	0.250	(0.433)	0.250	(0.433)
Observations	10,912		10,912		21,824	

Notes: Yield (market fare per passenger mile) measured in 1995 U.S. dollar cents; means calculated over all observations 8 quarters before, 8 quarter after the merger and over the whole 16 quarters.
Sources: U.S. DOT, T-100 Domestic Segment Data, Airline Origin and Destination Survey (DB1B), U.S. Census and U.S. Bureau of Labor Statistics, authors' calculations.

Table 6: Summary statistics – route-carrier level

	pre-merger period		post-merger period		overall	
	Mean	(s.d.)	mean	(s.d.)	mean	(s.d.)
ln (yield)	2.817	(0.707)	2.826	(0.671)	2.821	(0.689)
yield	22.100	(20.017)	21.744	(18.877)	21.923	(19.457)
comparison routes	0.772	(0.419)	0.777	(0.416)	0.775	(0.418)
post # direct comp.	0.006	(0.074)	0.005	(0.069)	0.005	(0.072)
post # US route (no HP comp.)	0.126	(0.331)	0.123	(0.329)	0.125	(0.330)
post # US route (HP one-stop comp.)	0.008	(0.090)	0.008	(0.090)	0.008	(0.090)
post # HP route (no US comp.)	0.059	(0.236)	0.058	(0.234)	0.059	(0.235)
post # HP route (US one-stop comp.)	0.029	(0.168)	0.028	(0.164)	0.029	(0.166)
rival fare	0.861	(0.346)	0.881	(0.324)	0.871	(0.335)
# airlines w/o merger parties	1.507	(0.868)	1.548	(0.906)	1.528	(0.888)
# LCCs	0.376	(0.519)	0.453	(0.579)	0.414	(0.551)
ln(avg. plane size)	4.692	(0.467)	4.673	(0.470)	4.683	(0.469)
avg. plane size	119.703	(45.394)	117.662	(45.428)	118.685	(45.422)
airport size (max)	2.652	(1.374)	2.623	(1.321)	2.638	(1.348)
HHI of airport with larger size	0.402	(0.201)	0.405	(0.205)	0.403	(0.203)
airport size (min)	0.914	(0.781)	0.902	(0.782)	0.908	(0.782)
HHI of airport with smaller size	0.326	(0.188)	0.323	(0.186)	0.325	(0.187)
ln(population) (mean)	14.997	(0.765)	15.013	(0.770)	15.005	(0.768)
population (mean)	4,196,859	(3,036,394)	4,270,718	(3,071,325)	4,233,709	(3,054,058)
ln(# establ.) (mean)	11.424	(0.796)	11.473	(0.802)	11.448	(0.799)
# establ. (mean)	121,557	(94,631)	128,136	(99,830)	124,840	(97,314)
Year 2003	0.127	(0.332)	0.000	(0.000)	0.063	(0.243)
Year 2004	0.498	(0.500)	0.000	(0.000)	0.248	(0.432)
Year 2005	0.376	(0.484)	0.128	(0.334)	0.251	(0.434)
Year 2006	0.000	(0.000)	0.505	(0.500)	0.254	(0.435)
Year 2007	0.000	(0.000)	0.367	(0.482)	0.184	(0.388)
1st Quarter	0.245	(0.430)	0.248	(0.432)	0.246	(0.431)
2nd Quarter	0.253	(0.435)	0.252	(0.434)	0.252	(0.434)
3rd Quarter	0.252	(0.434)	0.249	(0.433)	0.251	(0.433)
4th Quarter	0.250	(0.433)	0.251	(0.434)	0.251	(0.433)

Notes: Yield (market fare per passenger mile) measured in 1995 U.S. dollar cents; means calculated over all observations 8 quarters before, 8 quarter after the merger and over the whole 16 quarters.
Sources: U.S. DOT, T-100 Domestic Segment Data, Airline Origin and Destination Survey (DB1B), U.S. Census and U.S. Bureau of Labor Statistics, authors' calculations.