Discussion Paper No. 12-070

Market Power, Efficiencies, and Entry

Evidence from an Airline Merger

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Non-technical summary

The U.S. airline industry has recently experienced a substantial consolidation trend. Three larger and several smaller mergers within the last ten years raise the immediate question after the welfare consequences of these consolidations. Did these mergers cause significant price increases for the final consumers? Or were countervailing factors such as merger efficiencies and entry by competitors strong enough to leave/restore prices at/to pre-merger levels? 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. Such knowledge is likely to have positive effects on the quality of future actions by the antitrust authority.

Against this background, we empirically investigate the competitive effects of the merger between Delta Air Lines and Northwest Airlines (2009) in the domestic U.S. airline industry. Applying fixed effects regression models we find that – holding other price determinants constant – the merger led to short term real price increases of about 11 percent on overlapping routes and about 10 percent on routes which experienced a merger-induced switch of the operating carrier. Over a longer period, however, our descriptive analysis reveals that consumers on affected routes are left with an increase of only about 3 percent in real prices. Additional econometric analyses allow the conclusion that both merger efficiencies and post-merger entry by competitors initiated this downward trend in real prices. Our results suggest that competition in the U.S. airline industry is sufficiently strong to mitigate the market power effects of even larger consolidations.

Das Wichtigste in Kürze

Die jüngere Geschichte der US-amerikanischen Luftverkehrsindustrie ist durch einen substanziellen Konsolidierungstrend geprägt. Drei große sowie einige kleinere Fusionen, die in den vergangen zehn Jahren zu beobachten waren, legen dabei die Frage nach den Wohlfahrtseffekten solcher Konsolidierungen nahe. Haben diese Fusionen zu signifikanten Preisanstiegen für die Endkonsumenten geführt oder waren gegenläufige Effekte wie die Realisierung von Effizienzvorteilen oder die Reaktion von Wettbewerbern stark genug um die Preise auf dem Niveau, das vor der Fusion zu beobachten war, zu halten oder zumindest wieder auf dieses Niveau zurück zu bringen? Antworten auf diese Frage sind von großer Bedeutung, nicht nur als Teil einer ex-post Evaluation einer bestimmten Fusionsentscheidung, sondern insbesondere auch im Rahmen einer generellen Erweiterung des Verständnisses über die Funktionsfähigkeit des Wettbewerbs in der US-amerikanischen Luftverkehrsindustrie. Solch zusätzliches Wissen kann positive Effekte auf die Qualität zukünftiger Entscheidungen der Wettbewerbsbehörde haben.

Vor diesem Hintergrund untersuchen wir die wettbewerblichen Effekte der horizontalen Fusion zwischen Delta Air Lines und Northwest Airlines (2009) im inländischen US-amerikanischen Luftverkehrsmarkt. Unter Anwendung verschiedener Paneldatenmodelle mit fixen Effekten stellen wir fest, dass die Fusion in der kurzen Frist auf Streckenmärkten, die zuvor von beiden Fluggesellschaften bedient wurden, zu einem Preisanstieg von rund 11 Prozent und auf Märkten mit einem fusionsbedingten Wechsel der Fluggesellschaft zu einem Preisanstieg von rund 10 Prozent geführt hat. In der mittleren und langen Frist zeigt sich allerdings, dass sowohl durch die Fusion entstandene Effizienzgewinne als auch Markteintrittsreaktionen von Wettbewerbern zu einer substanziellen Reduktion der kurzfristigen Preiserhöhungen geführt haben, sodass sich die Konsumenten im Mittel über sechs Quartale nach der Fusion real nur noch rund 3 Prozent höheren Preisen ausgesetzt sehen. Unsere Ergebnisse legen die Schlussfolgerung nahe, dass der Wettbewerb in der US-amerikanischen Luftverkehrsindustrie hinreichend funktionsfähig ist um auch die Marktmachteffekte größerer Konsolidierungen entscheidend abzuschwächen.

MARKET POWER, EFFICIENCIES, AND ENTRY

EVIDENCE FROM AN AIRLINE MERGER

Kai Hüschelrath[♣] and Kathrin Müller[*]

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Abstract
We investigate the competitive effects of the merger between Delta Air Lines and Northwest Airlines (2009) in the domestic U.S. airline industry. Applying fixed effects regression models we find that the transaction led to short term price increases of about 11 percent on overlapping routes and about 10 percent on routes which experienced a merger-induced switch of the operating carrier. Over a longer period, however, our analysis reveals that both merger efficiencies and post-merger entry by competitors initiated a downward trend in prices leaving consumers with a small net price increase of about 3 percent on the affected routes.

Keywords Airline industry, merger, market power, efficiencies, entry-inducing effects

JEL Class L40, L93

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1 INTRODUCTION

The study of the competitive effects of horizontal mergers has captivated generations of researchers. A substantial part of this extraordinary appeal might originate from the general dichotomy such mergers are exposed to: increases in market power – which often go hand in hand with welfare-reducing price increases – and countervailing welfare-improving factors such as the realization of efficiencies or the inducement of market entry by competitors. From an antitrust policy perspective, the key challenge of horizontal merger investigations consequently lies in an appropriate assessment and weighting of these potential pro- and anti-competitive effects to arrive at a robust conclusion whether the proposed transaction should be blocked, approved, or approved subject to the fulfillment of specific remedies (which aim at healing identified competition concerns).

The U.S. airline industry in general and the Delta Air Lines – Northwest Airlines merger in particular provide an ideal environment for an empirical ex-post investigation of the competitive effects of industry consolidation. The U.S. airline industry recently experienced severe profitability problems initiated by a mixture of exogenous cost shocks (e.g., taxes and fuel), exogenous demand shocks (e.g., the 9/11 attacks or the recent economic crisis) and the continuing expansion of low-cost carriers (see Borenstein, 2011). In such an environment, firms are often tempted to consider a merger as instrument to ease these pressures through both reductions in competition (generating revenue increases) and the realization of efficiencies (generating cost decreases).

The Delta-Northwest merger – announced and approved in 2008 and completed in December 2009 with the combination of ground operations and reservations systems – provides a particularly interesting research object not only because the two carriers competed directly on a significant number of airport-pairs but especially because the expectations on the competitive effects of the merger diverged substantially. Although the majority of commentators – including the U.S. Department of Justice as responsible antitrust authority – argued that merger efficiencies and post-merger entry by competitors will foreclose significant price increases and/or service decreases post-merger (see, e.g., U.S. Department of Justice, 2008), other interest groups believed that the underlying efficiency estimates were overstated and competition by other network carriers and/or low-cost carriers is insufficient to act as an effective competitive constraint (see, e.g., American Antitrust Institute, 2008).

Against this background, we empirically investigate the competitive effects of the merger between Delta and Northwest in the domestic U.S. airline industry. Applying fixed effects regression models we find that – holding other price determinants constant – the merger led to short term real price increases of about 11 percent on overlapping routes and about 10 percent on routes which experienced a merger-induced switch of the operating carrier. Over a longer period, however, our analysis reveals that consumers on affected routes are left with an increase of only about 3 percent in real prices. Additional econometric analyses allow the conclusion that both merger efficiencies and post-merger entry by competitors initiated this downward trend in real prices. Our results suggest that competition in the U.S. airline industry is sufficiently strong to mitigate the market power effects of even larger consolidations.

The paper is structured as follows. The following second section characterizes the key steps in a competitive effects assessment of horizontal mergers by differentiating between merger-induced market power increases, merger efficiencies and entry-inducing effects. The subsequent third section provides an overview of the Delta Air Lines – Northwest Airlines merger. In particular, we describe the merger transaction as such and outline its key antitrust implications brought forward by various commentators. The fourth section presents our empirical analysis. While Section 4.1 describes the construction of the dataset, Section 4.2 specifies our empirical approach and Section 4.3 provides the descriptive analysis. Subsequently, Section 4.4 concentrates on the presentation and interpretation of our main empirical results. The fifth section concludes the paper with a summary of the key results.

2 THE COMPETITIVE EFFECTS OF HORIZONTAL MERGERS

In this section, we provide an overview of existing research on the competitive effects of horizontal mergers. We differentiate between a review of the theoretical literature – subdivided into market power, efficiencies and entry – and a complementary review of existing empirical evidence.

2.1 THEORETICAL FRAMEWORK

2.1.1 MARKET POWER

Market power typically is defined as the ability of a firm or group of firms within a market to profitably charge prices above the competitive level for a sustained period of time. A horizontal merger inevitably leads to the loss of a direct competitor in a (relevant) market and is therefore – according to unilateral effects theory – suspicious of extending the market

power of the merging parties leading to further decreases in output and increases in price to the detriment of consumers.[1]

The key determinants of the size of the price increase post-merger are identified by oligopoly theory. For example, for the case of a simple Cournot model with homogeneous products, it is straightforward to show that the percentage price increase post-merger is a function of market concentration – expressed either by market shares or (changes in) the (post-merger) Herfindahl-Hirschman Index – and market demand elasticity (see, e.g., Werden and Froeb 2008). In case of differentiated products, Bertrand models often provide a better fit to the nature of competitive interaction. As shown by Shapiro (2004) for the case of a simple differentiated Bertrand model, the percentage price increase triggered by the merger depends on the pre-merger price-cost margin – a measure of the degree of market power pre-merger – and the diversion ratio – a measure of how close two products are in the product space and therefore how intense competition is between these two products.

From a welfare perspective, mergers in simple Cournot contexts typically lead to reductions in both consumer welfare and total welfare. Total welfare is reduced by the so-called deadweight loss induced by the prices above the competitive level. Adding the corresponding increase in producer surplus determines the entire loss in consumer welfare due to the merger. The absolute size of the merger-induced welfare losses is a function of market demand elasticity, market revenue and the size of the price increase post-merger.

Although the relevance of basic unilateral effects theory for the analysis of competitive effects in antitrust policy is undisputed, it is obvious that its analytical focus is rather static. However, competition by its very nature is dynamic and enriching the static market power perspective with dynamic components opens various possibilities for welfare-improving horizontal mergers. In a detailed review of the literature, Whinston (2007), for example, recognizes dynamic extensions such as repeated interaction (reflected in the so-called coordinated effects theory), durable goods, endogenous mergers, multimarket contact and several long-run competition variables, such as capacity investment, R&D and new product development. In the following two sub-sections, we discuss the implications of two further channels of countervailing procompetitive effects of horizontal mergers: efficiencies and entry.

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[1] Although the non-merging firms in the industry typically respond to such a move with an increase in output, Farrell and Shapiro (1990) show that the former effect is typically stronger than the latter leading to an increase in price and a corresponding reduction in consumer surplus.

2.1.2 EFFICIENCIES

Although increases in market power might be a key – rather unofficial – motivation for mergers, firms often justify their merger intentions with the realization of substantial merger efficiencies. Generally, such efficiencies might occur in the form of both variable cost reductions (e.g., economies of (traffic) density or scale) and fixed cost reductions (e.g., savings in R&D expenditures).[2] The realization of efficiencies differs with respect to the time window in which they are scheduled to materialize. For example, while a re-allocation of production can be accomplished fairly quickly, efficiencies in R&D might only materialize in the medium or long term.

Under a total welfare standard, every merger that leads to a price increase post-merger would, ceteris paribus, reduce total welfare by the size of the deadweight loss. However, as soon as the realization of merger-specific efficiencies allows the merged entity to reduce costs, the consequential increase in producer surplus has to be traded off against the deadweight loss (see Williamson (1968) for a seminal paper). If the efficiencies are large enough, total welfare increases post-merger.

Partly based on criticism of the various assumptions underlying this basic welfare trade-off model, scholars have investigated the 'market power-efficiency trade-off' of horizontal mergers in oligopoly models.[3] In a simple Cournot model, it is straightforward to show that if the marginal costs of the merging firms are reduced by a 'sufficient amount', the merged entity has an incentive to increase output post-merger, leading to lower prices and increases in total as well as consumer welfare. As shown by Froeb and Werden (1998), the sufficient percentage cost reduction to prevent price increases post-merger depends on the merging firms' market shares and market demand elasticity.[4]

As part of antitrust assessments, the major problem with merger efficiencies is to check their plausibility, their likelihood of realization and their likely effects on post-merger

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[2] Several taxonomies of merger efficiencies have been developed. While Kolaski and Dick (2002) differentiate between allocative efficiencies, productive efficiencies, dynamic efficiencies, and transactional efficiencies, a taxonomy by Röller et al. (2001) is based on the concept of the production function (rationalization, economies of scale, technological progress, purchasing economies and slack).

[3] Farrell and Shapiro (1990) find in a Cournot context that in the absence of synergies, horizontal mergers necessarily lead to an increase in price even if the reallocation of production from less efficient to more efficient production facilities within the merged entity is taken into account. Furthermore, even if merger-specific synergies exist, their model shows that the post-merger firm's marginal cost must fall substantially in order to lead to price decreases post-merger.

[4] In case of a differentiated Bertrand model, Froeb and Werden (1998) show that the sufficient percentage cost reduction to prevent price increases post-merger depends on the pre-merger price-cost margin and the diversion ratio.

competition. From a microeconomic perspective, it is straightforward to identify substantial informational advantages on the side of the merging firms about the existence and size of merger efficiencies. Amir et al. (2009) manage to show in a Cournot context that firms have an incentive to 'overestimate' the efficiencies achieved by the merger with respect to both the antitrust authority (in order to get the merger through) and rivals (in order to influence their beliefs on the competitiveness of the new merged entity). They therefore conclude that antitrust authorities should be reluctant to accept cost-reducing arguments, as there is a high probability that the estimated efficiencies are smaller or even non-existent, leading to higher prices in the post-merger world. The results of empirical studies – presented in Section 2.2 below – (indirectly) support this argument in the sense that – holding other determinants of prices, such as the competitive environment, constant - most mergers are found to lead to significant price increases.

2.1.3 ENTRY

Post-merger entry is another important market power mitigating factor. Even if market concentration is relatively high, incumbents may be unable to exercise market power as long as potential entrants could (and would) easily and quickly start producing substitutes.

Werden and Froeb (1998) investigate the role of entry-inducing effects in antitrust policy. Based on mergers in simple Cournot and Bertrand industries, they find that firms only have an incentive to merge if (a) they expect significant efficiencies generated from the merger, or (b) they are aware of substantial entry barriers which allow them to charge supracompetitive prices post-merger. They conclude that antitrust authorities should be rather skeptical with respect to the power of entry to prevent (or reverse) anticompetitive effects of horizontal mergers. Cabral (2003) investigates the entry-inducing effects of mergers in a differentiated Bertrand model and, on the one hand, finds that the possibility of entry subsequent to the merger improves consumer welfare. On the other hand, he shows for the case of a merger to monopoly that post-merger consumer welfare may decrease with a larger size of merger efficiencies; basically because they decrease the probability of entry post-merger and the beneficial effect from the cost-saving passed on to consumers is too weak to overcompensate this detrimental effect on consumer welfare.[5] Last but not least, Spector (2003) investigates the relationship between merger efficiencies and entry in a Cournot context. Interestingly, he

[5] Generalizing Cabral's approach, Erkal and Piccinin (2010) show in a model with endogenous entry and differentiated products that, first, consumer welfare is increasing in the level of efficiencies. Second, they find that more post-merger entry is not necessarily desirable for consumers as more entry implies that the realized merger efficiencies were not large enough.

finds that any profitable Cournot merger that fails to generate synergies inevitably decreases consumer welfare irrespective of entry conditions. He therefore concludes that such mergers should be blocked without even considering the role of post-merger entry.

As part of antitrust assessments, the major problem with entry is to evaluate its likelihood, timeliness and sufficiency. The *likelihood of entry* is determined by the profitability and possibility of entry. The profitability of entry can be operationalized by estimating the expected net present value of the post-entry profits as well as the sunk costs of entry. If the discounted profits are larger than the sunk costs of entry, then entry would be profitable; otherwise it would not be. The possibility of entry is determined by (structural and/or strategic) barriers to entry existing in the market. The *timeliness of entry* criterion examines whether entry is rapid enough to deter or reverse the exercise of market power. Typically, entry is considered timely if it could occur within two years from initial planning to significant market impact. Finally, the *sufficiency of entry* criterion demands that entry must be of sufficient scope and magnitude to restrict the exercise of market power (see, e.g., U.S. Department of Justice and U.S. Federal Trade Commission, 2010).

2.2 EMPIRICAL EVIDENCE

From an empirical perspective, a large literature on particularly the price effects of horizontal mergers is available. Following Pautler (2003: 145ff.), these studies can be subdivided into multi-industry studies, industry studies and case studies of specific mergers in specific industries. Concentrating on the latter type of studies, Kaplan (2000), Kaplow and Shapiro (2007) and Whinston (2007) provide selective overviews of such case studies for a diverse set of industries including banking, hospitals, microfilms, telecommunications, computers, railroads, cement and tires. The results of the different studies are mixed. Mergers often lead to significant price increases and reductions in service quality, although there is also some evidence showing decreasing prices post-merger. A recent survey by Weinberg (2008) basically confirms these results. He reviews 14 case studies from various industries and finds significant price increases in 11 of these case studies. The spectrum of the post-merger price change reaches from -17 percent in case of a banking merger to +23 percent in case of a microfilm merger.

For the U.S. airline industry, existing empirical research almost exclusively refers to mergers in the 1980s. On the one hand, this period was characterized by a 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) – leading to the approval of basically all merger proposals independent of their potential for anticompetitive effects.

Two U.S. airline mergers – both completed in 1986 – experienced a particularly detailed ex-post investigation of their competitive 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 6 percent and service decreases of about 24 percent for the NW-RC merger. Yield increases (2 percent) and service decreases (16 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 10 percent in total (with about 7 percent price increases if other airlines remain as route competitors and about 23 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 percent on monopoly routes which were operated by TW or NZ before the merger.[6] 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 in studies by 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

[6] 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.

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 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 rumours 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.

3 THE DELTA AIR LINES – NORTHWEST AIRLINES MERGER

3.1 THE MERGER TRANSACTION AT A GLANCE

Following constant rumors of a possible merger between Delta Air Lines (DL) and Northwest Airlines (NW) – at least since the beginning of 2008 – both companies announced its intent to merge on April 15, 2008.[7] At that time, *Delta Air Lines* – founded in 1928 as Delta Air Service – was the fourth largest domestic U.S. carrier with a market share of 12.4 percent[8] (in terms of revenue passenger miles). It operated large hubs at Atlanta, Salt Lake City,

[7] Delta Air Lines, Northwest Airlines Combining To Create America's Premier Global Airline, Delta Air Lines News Release, April 14, 2008, available at http://news.delta.com/index.php?s=43&item=135

[8] Please note that the calculation of the market shares is based on revenue passenger miles of domestic services only. If international markets are included, shares may vary significantly.

Cincinnati and New York (JFK). Including regional services (provided by affiliated regional carriers[9]), Delta was active in 820 airport-pairs (206 airport-pairs excluding regional carriers).

Northwest Airlines – founded in 1926 as Northwest Airways – was the seventh largest domestic U.S. airline with a market share of about 7.6 percent and hub operations in Detroit, Minneapolis and Memphis. At the time of the merger announcement, the carrier was active in 201 airport-pairs (196 airport-pairs excluding regional carriers). The proposed transaction would create the largest domestic U.S. carrier with a market share of about 20 percent.[10] In international markets, both carriers already cooperated intensively as members of the SkyTeam alliance.

As announced by both carriers, the merger proposal was motivated by the expected realization of substantial efficiencies. According to Delta's chief executive officer, Richard Anderson, customers and communities will benefit substantially from an expanded global route system and a more competitive and financially secure airline. "The transaction is expected to generate more than $1 billion in annual revenue and cost synergies from more effective aircraft utilization, a more comprehensive and diversified route system and cost synergies from reduced overhead and improved operational efficiency." Although no hub closures were announced as a consequence of the merger, Atlanta was chosen as the headquarters of the new airline named 'Delta'.

Following antitrust approval from the European Union on August 6, 2008[11], the merger won approval of both Delta and Northwest's shareholders on September 26, 2008.[12] The final step to the clearance of the deal – approval by the Department of Justice's Antitrust Division – was reached on October 29, 2008[13] (see the following section for details).

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[9] The group of network carriers is supported by a larger group of regional airlines. Most of those smaller airlines operate in small feeder traffic markets and often assist one particular network carrier in the operation of its hub-and-spoke network. Although most of these regional carriers are legally independent, their economic existence is often tied to a large network carrier. For example, in most instances, regional carriers do not issue their own tickets but refer to the network carrier for all flight bookings.

[10] The largest domestic U.S. carrier at the time of the announcement of the merger was American Airlines with a market share of 16.7 percent followed by Southwest Airlines with a market share of 16.3 percent. In the meantime, the merger between United Airlines and Continental Airlines – approved by the DOJ in August 2010 – created an even larger entity with about 21.9 percent domestic market share (all reported values are based on 2008 revenue passenger miles).

[11] Case No COMP/M.5181 - Delta Air Lines/ Northwest Airlines, August 6, 2008, available at http://ec.europa.eu/competition/mergers/cases/decisions/m5181_20080806_20310_en.pdf

[12] Shareholders Approve Merger of Delta and Northwest, New York Times, September 25, 2008, available at http://www.nytimes.com/2008/09/26/business/26air.html.

[13] Statement of the Department of Justice's Antitrust Division on its Decision to Close its Investigation of the Merger of Delta Air Lines Inc. and Northwest Airlines Corporation, October 29, 2008, available at http://www.justice.gov/opa/pr/2008/October/08-at-963.html

Firm integration activities were started quickly after receiving approval from the DOJ. For example, on March 30, 2009, Richard Anderson stated that "[i]n just five months, Delta has made significant strides to bring together the best of both airlines for the benefit of our customers, employees and the communities we serve." Integration activities not only include hidden operations such as synchronizing flight schedules, aligning route maps, or integrating technologies and workgroups but also aspects visible for the customers such as employee uniforms, airport signage, and onboard products and services.[14] Despite these substantial integration activities, the merger transaction was closed not before December 31, 2009 when the operating certificates were merged, i.e. Northwest Airlines ceased to exist as a carrier, and ground operations and reservation systems were combined.[15]

3.2 ANTITRUST ISSUES

As any merger of significant size, the DL-NW merger was subject to antitrust approval by the responsible antitrust authority; for airline merger cases the Department of Justice's (DOJ) Antitrust Division. After a detailed six month investigation of the merger proposal, on October 29, 2008, the DOJ announced the closure of its investigation of the merger, basically because it believed that the merger is unlikely to substantially lessen competition but likely to produce substantial efficiencies: "The two airlines currently compete with a number of other legacy and low cost airlines in the provision of scheduled air passenger service on the vast majority of nonstop and connecting routes where they compete with each other. In addition, the merger likely will result in efficiencies such as cost savings in airport operations, information technology, supply chain economics, and fleet optimization that will benefit consumers. Consumers are also likely to benefit from improved service made possible by combining under single ownership the complementary aspects of the airlines' networks." (U.S. Department of Justice (2008), p. 1).

Although the detailed analysis of the DL-NW merger was not published, several prior investigations[16] and publications specified the DOJ's general approach to airline mergers. As

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[14] Delta-Northwest Merger Becomes Visible to Customers with Introduction of Combined Domestic Products, Delta Air Lines News Release, March 30, 2009, available at http://news.delta.com/index.php?s=43&item=430

[15] Our assumption of December 31, 2009 as the closing date of the merger transaction coincides, e.g., with a list of U.S. airline mergers and acquisitions provided by Airlines for America (http://www.airlines.org/Pages/U.S.-Airline-Mergers-and-Acquisitions.aspx).

[16] For example, in 2001, United Airlines and US Air abandoned 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.

outlined in McDonald (2005), a merger review typically starts with the identification of city-pairs in which the merging carriers both operate (so-called overlapping city-pairs), followed by the calculation of market shares for the merging carriers and possible competitors. Any city-pair for which the merger leads to a significant increase in concentration will be investigated further by considering possible entry reactions by competitors. The likelihood of entry depends on factors such as pre-merger presence at the respective airports or the degree of infrastructure bottlenecks.

As the merger review concentrates particularly on the overlapping parts of the merging parties networks, it can be said that the higher the degree of complementarity of the two networks, the lower is the probability that the DOJ will challenge the merger proposal. Given the fact that the DL-NW merger did not involve a common hub or the operation of different hubs in the same metropolitan area[17], the degree of complementarity – together with the substantial efficiencies and entry-inducing effects expected by the transaction – was found large enough by the DOJ to approve the transaction without imposing any remedies.

The investigation and final decision of the DOJ was accompanied by comments on the various potential pro- or anticompetitive effects of the proposed merger. While some commentators, e.g., expect increases in fares and decreases in service quality (especially for smaller communities) post-merger, others argue that the merger will not harm domestic competition significantly but will lead to substantial benefits for the consumers in international markets. The most detailed (published) study on the proposed transaction was issued in July 2008 by the American Antitrust Institute (2008). The authors follow a basic cost benefit approach and conclude that the proposed transaction is likely to harm competition and consumers and should therefore be blocked. The conclusion is drawn from the results of three major analytical steps: First, adverse competitive effects in both city-pair and connecting markets will result from the proposed merger. Second, the efficiencies (especially economies of density and scale) claimed by the merging parties are unlikely to materialize post-merger in the dimension announced by the merging parties. Third, entry by competitors – be them other network carriers and/or low-cost carriers – cannot be counted on to discipline post-merger price increases, e.g., due to substantial entry barriers at hub airports or the focus of low cost carriers on entry into dense markets only (see American Antitrust Institute (2008), p. 3).

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[17] For example, the decision of the DOJ to block the proposed merger between United Airlines and US Air in 2001 was partly driven by United's large hub at Washington Dulles airport and US Air's large presence at the two remaining large airports in the D.C. area (Reagan National and Baltimore/Washington).

In the following section, we will investigate these three essential steps in greater detail and provide answers to the questions, first, whether the merger caused a significant increase in price, second, whether merger efficiencies led to price reductions for the consumers and, third, whether entry-inducing effects were strong enough to at least overcompensate price increases triggered by the merger-induced increase in market power.

4 EMPIRICAL ANALYSIS

4.1 CONSTRUCTION OF THE DATASET

The dataset we use to assess the competitive effects of the DL-NW merger was constructed by collecting and merging data from several sources. We use airline traffic data for the years from 1995 to 2011 from the U.S. DOT T-100 Domestic Segment database. This data contains monthly domestic non-stop segment data reported by U.S. 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 operated by Delta and/or Northwest. 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 detail, the construction of the dataset can be subdivided into the following three subsequent steps.

In the first step, we identify all route exits of the merging parties which have been taken place between the 3rd quarter of 1995 and the 1st quarter of 2010. The quarter of exit is defined as the quarter following the quarter of the last occurrence of an airline-route observation in the dataset. Merger-related exits are assumed to have taken place in the quarter after the merger was closed, i.e., the merger of the operation certificates and the airlines' combination of ground operations and reservations systems. As mentioned above, the Delta-Northwest deal was closed on December 31, 2009 and we therefore interpret all exits in the first quarter of 2010 as merger-related exits.

In the second step, we keep all non-stop routes which were subject to at least one exit (operational exit or merger exit) and which are still served by another carrier after the exit of

the merging carriers.[18] For each exit, we keep the eight quarters before and the eight quarters after the exit event to assess the effects of an exit using a 'before-and-after' approach. In the regressions, we use only those routes for which we have more than six observations before and after exit.

In the third step, we construct quarterly route level and airport level data from the T-100 and DB1B databases.[19] 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 (i.e., since DB1B is a 10 percent ticket sample, 100 DB1B passengers). We add demographic information on the labor force, average income, and the number of establishments of the respective Metropolitan Statistical Areas from the U.S. Bureau of Labor Statistics. Applying this procedure, we arrive at a quarterly panel dataset of 330 non-stop routes allowing a detailed econometric investigation of the effects of merger-related and operational exits by Delta and Northwest.

4.2 EMPIRICAL APPROACH

Our empirical approach can be subdivided into four consecutive steps. In the first step, we use fixed effects regression models to estimate the short run effects of merger-related and operational exit events on average market yield. In the second step, we extend the observation window after exit and rerun the respective regressions for the medium and long term in order to investigate possible changes; first and foremost due to the realization of merger efficiencies. The third step introduces an interaction term allowing the effects of exit to differ on routes which became a monopoly post-exit. Finally, in the fourth step, we refrain from holding the number of carriers constant after an exit event and examine the entry-inducing effects of exits.

Discussing the technicalities of the four steps of our empirical approach in greater detail, our variables of interest are the exit variables which are captured by three dummy variables. We distinguish between two types of merger-related exits. In the first case, only the exiting carrier (Northwest) was active on the respective non-stop route and the resulting entity (the new 'Delta') inherited this route. We call this a 'route switching' merger exit. Although such switches of the operating carrier apparently do not lead to a change in the number of carriers,

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[18] If no non-stop service is provided after exit, route level effects cannot be observed.

[19] At this step, operations of regional carriers are merged with the operations of their respective network carrier. If a regional carrier operates flights for more than one network carrier, the network carrier is assigned on a route-by-route basis according to the hub airport involved. This procedure was cross-checked with information on the ticketing carrier on the respective routes provided by the DB1B database.

they might still be subject to merger-related changes such as, e.g., changes in pricing and other strategic variables, improvements in network connectivity or increases in multimarket contact.

If, however, both of the merging parties have provided non-stop service on a particular airport-pair before the merger, we call this an 'overlapping route' merger exit. This type differs from a merger exit with route switching since the number of competing carriers is reduced by one carrier. Operational exits are all other route exits which are not directly related to the merger exit. This category includes, e.g., network restructuring exits or exits due to unprofitability. Exits which were either observed in times of financial distress or took place before the merger was closed are also classified as operational exits.

Turning to our estimation approach, we first estimate log-linear fixed effects regression models which can be denoted by

$$\begin{aligned}\ln(y_{it}) = \beta_0 + \beta_{opEx} \cdot opEx_{it} + \beta_{mExSw} \cdot mExSw_{it} + \beta_{mExOv} \cdot mExOv_{it} \\ + \beta_X \cdot X_{it} + \beta_{year} \cdot year_t + \sum_{j=2}^{4} \beta_{qj} \cdot quarter_{jt} + \nu_i + \varepsilon_{it},\end{aligned} \tag{1}$$

where y_{it} is the non-stop yield (i.e., fare per passenger mile). The variable *opEx* captures operational exits, *mExSw* captures switching merger exits and *mExOv* captures merger exits on overlapping routes. Applying a 'before-and-after' approach, the different exit dummies are zero before the exit event and become one in the quarter after exit and the subsequent quarter(s) depending on whether short-, medium-, or long term effects shall be assessed. To capture the short-term effects of entry we compare non-stop fares eight quarters before exit with the first two quarters after exit. Thus, the exit variable is one for two quarters. Two quarters after exit the observation periods ends. Respectively, we capture medium-term effects by following prices four quarters after exit and long-term effects by following prices six and eight quarters in case of merger-related and operational exits respectively.[20] The introduction of such a 'dynamic' perspective allows us to investigate whether the observed short-term effects are permanent or rather disappear due to the realization and the pass-on of merger efficiencies. Thus, the coefficient estimates of the different exit variables report the average percentage change in prices after a certain type of exit. We further include a set of route-, airport- or MSA-specific control variables (*X*) as well as a yearly trend (*year*) and seasonal dummies (*quarter*).

[20] Data limitations – the last available quarter is the second quarter of 2011 – do not allow us to investigate the long-term effects for the desired eight quarters after exit.

As control variables, we include the number of carriers without the exiting carrier or merging parties (*# airlines w/o exit*) and the number of low-cost carriers, also without the exiting carrier or merging carriers (*# LCCs w/o exit*). These variables account for the effect of market structure over time. We further control for the average size of planes the carriers use to serve the route (*avg. plane size*) since costs should decline with an increasing capacity of the aircraft. When estimating the price effects of exit, we also include the average one-stop yield (*ln(one-stop yield)*) to account for possible price competition from connecting flights.[21] We also control for the influence of airport size as measured by the mean of the two endpoint airports' passenger share (*airport size (mean)*). Furthermore, three demographic variables on the MSA level enter the analyses which aim to capture demand effects. The labor force (*ln(labor 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 and regional economic prosperity shall be captured by the average weekly wage in the respective MSAs (*ln(avg. weekly wage) (mean)*).

As it is reasonable to assume that the size of the competitive effects under investigation depends on the post-exit market structure, in the third step, we introduce an interaction term which allows isolating the effects of exits on routes which resulted in a monopoly post-exit. The fixed effects regression model becomes

$$\begin{aligned}\ln(y_{it}) = {} & \beta_0 + \beta_{opEx} \cdot opEx_{it} + \beta_{mExSw} \cdot mExSw_{it} + \beta_{mExOv} \cdot mExOv_{it} \\ & + \beta_{opExM} \cdot opEx_{it} \times mono_i + \beta_{mExSwM} \cdot mExSw_{it} \times mono_i + \beta_{mExOvM} \cdot mExOv_{it} \times mono_i \\ & + \beta_X \cdot X_{it} + \beta_{year} \cdot year_t + \sum_{j=2}^{4} \beta_{qj} \cdot quarter_{jt} + \nu_i + \varepsilon_{it}.\end{aligned} \tag{2}$$

In this model approach, the coefficients of the exit dummies alone denote the average percentage change in prices if there are at least two competitors left directly after the exit event. If the market structure turns from a duopoly to a monopoly after exit[22], the effects of exit can be calculated as the sum of the respective coefficients (e.g. $\beta_{mExOv} + \beta_{mExOvM}$).

For an assessment of possible entry-inducing effects of firm exit, in the fourth step, we estimate a similar model as specified in equation (1) above. The dependent variable becomes

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[21] The one-stop yield is missing if either the route is not served via connecting flights or if there are not enough observations in DB1B data to be able to calculate a reliable mean (see Section 4.1). In order to avoid losing a substantial amount of observations for regression analysis, an arbitrary value is assigned to these observations and an additional dummy variable is included which marks these observations (*missing one-stop yield*). This method is called dummy variable adjustment or missing indicator method and is frequently used in econometric analysis (Allison, 2001).

[22] The route might also stay a monopoly in case of switching route exits.

the change in the number of carriers other than the exiting one or the merging parties (Δ # airlines w/o exit). Accordingly, we refrain from holding the number of other carriers constant but include the lagged value of this variable since the previous competitive environment should largely determine entry activity of other carriers after exit events.

4.3 DESCRIPTIVE ANALYSIS

Given the construction of our dataset and our desire to particularly study the effects of merger-related exits (i.e., two specific sub-samples), we refrain from discussing the detailed descriptive statistics for the entire dataset or the sub-samples (see Table 4 to Table 7 in the Appendix). Instead, we present an overview table which shows the characteristics of the key variables for the entire dataset and the three sub-samples. In order to ease interpretation, Table 1 does not only report the average values in the quarter before and after exit but also provides the average values for the entire observation periods before exit (7-8 quarters) and after exit (6-8 quarters).

Table 1: Summary statistics (overview table)

Variable	Quarter before/of mean	s.d.	Quarter after exit Mean	s.d.	Period before exit Mean	s.d.	Period after exit mean	s.d.
Non-stop yield								
entire sample	22.343	(16.946)	23.291	(17.446)	23.336	(17.563)	23.444	(17.387)
op. exit	*22.408*	*(16.835)*	*22.768*	*(16.665)*	*23.228*	*(16.851)*	*23.125*	*(16.890)*
merger-ex. (sw.)	*12.966*	*(7.995)*	*13.984*	*(9.317)*	*13.540*	*(9.310)*	*13.904*	*(8.614)*
merger-ex. (ov.)	*31.156*	*(19.007)*	*34.222*	*(20.437)*	*33.194*	*(20.610)*	*34.218*	*(20.076)*
Δ # airlines w/o								
entire sample	0.006	(0.292)	0.197	(0.512)	0.004	(0.270)	0.032	(0.321)
op. exit	*0.009*	*(0.320)*	*0.310*	*(0.563)*	*0.010*	*(0.268)*	*0.039*	*(0.339)*
merger-ex. (sw.)	*0.036*	*(0.267)*	*-0.036*	*(0.380)*	*-0.009*	*(0.360)*	*0.018*	*(0.327)*
merger-ex. (ov.)	*-0.034*	*(0.184)*	*0.000*	*(0.187)*	*-0.004*	*(0.147)*	*0.009*	*(0.193)*

Notes: Prices in 1995 $ cents.
Sources: U.S. DOT, T-100 Domestic Segment Data, Airline Origin and Destination and U.S. Bureau of Labor Statistics, authors' calculations.

The *entire dataset* consists of 330 route exits, with 216 exits (about 65 percent) belonging to the operational exits category, 58 merger exits (about 18 percent) on overlapping routes and 56 merger exits (about 17 percent) on switching routes. Directly after exit we observe for the entire sample that about 53 percent of the routes are monopolies (with about 51 percent for operational exits, 54 percent for merger exits on switching routes and 59 percent for merger exits on overlapping routes).

Our first dependent variable is the *non-stop yield* which is measured in real 1995 U.S. cents per passenger mile. As shown in Table 1, in the quarter before/of exit, a passenger paid 22.34 cents per mile compared to 23.29 cents in the quarter after exit, i.e., an increase of 4.3

percent. Interestingly, comparing the respective values for the sub-samples reveals a substantial heterogeneity. While the operational exits lead to a rather moderate increase from 22.41 cents to 22.77 cents (about 1.6 percent), merger-related exits show substantially higher fare increases from 12.97 cents to 13.98 cents for switching routes (about 7.8 percent) and from 31.16 cents to 34.22 cents for overlapping routes (about 9.8 percent). Interestingly, when comparing the entire observation periods before and after the respective exit events, we find only a very moderate price increase of 0.5 percent for the entire sample, a slight yield decrease for the sub-sample of operational exists and moderate price increases for the merger-related exits (2.7 percent for switching routes and 3.1 percent for overlapping routes). Although our econometric approach below will investigate these relationships in greater detail, our descriptive analysis suggests that the merger led to price increases in the short term which were at least partly reversed in subsequent quarters. Having in mind our discussion in Section 2 above, both realized merger efficiencies and increased competition through entry by competitors might be important drivers of this development.

Our second dependent variable is the *change in the number of other carriers* on the respective routes with which we aim to assess the entry-inducing effect of exit. For the entire dataset, we find that this number increases from 0.006 in the quarter before/of exit to 0.197 in the quarter after exit. Again, an analysis of the sub-samples leads to diverging results. While the entry-inducing effect of operational exists is found to be much stronger than the average in the short run, the results for the two merger-related exists show no effect in case of overlapping routes and even a slight decrease for the switching routes. However, extending the observation window to the entire period before and after exit triggers substantial changes in the results. The average entry-inducing effect as measured by the change in the number of other carriers is still found to be the strongest for operational exits (0.032). However, merger-related exits on switching routes now also show increased entry activity (0.018 average change in the number of carriers) as compared to the period before (-0.009 average change in the number of carriers). The same conclusion is true for the overlapping routes, although the effect is half the size found for the switching routes. Given these findings, we can come to the preliminary conclusion that the merger apparently had an entry-dissuading effect in the short run, however, triggered entry by competitors in the longer run. Furthermore, descriptive data analysis suggests that entry seems to be more attractive on switching routes than on overlapping routes. Our econometric approach in the following section will investigate these relationships in greater detail.

4.4 Econometric Results and Interpretation

Based on the description of our dataset and the empirical approach above, this section presents our empirical results and interpretation. We subdivide our discussion into the reporting of the key empirical results for the two types of merger-related exits. Results of the regressions with route fixed effects on non-stop yield can be retrieved from Table 2. The table is split into three panels. The first panel shows the short-term regressions, the second panel shows the medium-term regressions, and the third panel shows the long-term regressions. Within each panel, the first column does not include the post-exit monopoly interaction term while the second column does. The effects for operational exits are included for the purpose of comparison.

Table 2: Fixed effects regressions for the effect of exits on non-stop yield

	ln(non-stop yield) - short term				ln(non-stop yield) - medium term				ln(non-stop yield) - long term			
Variable	**coef.**	**(s.e.)**	**coef.**	**(s.e.)**	**coef.**	**(s.e.)**	**coef.**	**(s.e.)**	**coef.**	**(s.e.)**	**coef.**	**(s.e.)**
operational exit	0.050***	(0.009)	0.049***	(0.012)	0.059***	(0.009)	0.060***	(0.012)	0.054***	(0.008)	0.058***	(0.012)
merger exit (switching)	0.100***	(0.014)	0.119***	(0.017)	0.095***	(0.013)	0.105***	(0.018)	0.082***	(0.013)	0.093***	(0.017)
merger exit (overlap)	0.111***	(0.016)	0.098***	(0.029)	0.097***	(0.015)	0.088***	(0.027)	0.079***	(0.016)	0.080***	(0.028)
op. exit # monopoly			0.001	(0.015)			-0.002	(0.014)			-0.008	(0.015)
m. ex. (sw.) # monopoly			-0.034	(0.022)			-0.020	(0.022)			-0.020	(0.021)
m. ex. (ov.) # monopoly			0.023	(0.032)			0.016	(0.029)			-0.001	(0.031)
# airlines w/o exit	-0.012	(0.012)	-0.012	(0.012)	-0.018*	(0.010)	-0.018*	(0.010)	-0.038***	(0.010)	-0.038***	(0.009)
# LCCs w/o exit	-0.114***	(0.029)	-0.113***	(0.029)	-0.113***	(0.027)	-0.113***	(0.026)	-0.097***	(0.024)	-0.097***	(0.024)
avg. plane size	-0.001***	(0.000)	-0.001***	(0.000)	-0.001***	(0.000)	-0.001***	(0.000)	-0.001***	(0.000)	-0.001***	(0.000)
ln(one-stop yield)	0.380***	(0.049)	0.380***	(0.049)	0.402***	(0.045)	0.402***	(0.045)	0.385***	(0.052)	0.385***	(0.052)
missing one-stop yield	2.628***	(0.361)	2.627***	(0.361)	2.780***	(0.332)	2.780***	(0.332)	2.644***	(0.357)	2.643***	(0.357)
airport size (mean)	-0.010	(0.034)	-0.011	(0.034)	-0.014	(0.034)	-0.015	(0.034)	-0.018	(0.034)	-0.019	(0.034)
ln(# establ.) (mean)	0.890***	(0.190)	0.898***	(0.192)	0.798***	(0.175)	0.803***	(0.177)	0.651***	(0.163)	0.643***	(0.163)
ln(avg. weekly wage)	0.413***	(0.090)	0.416***	(0.089)	0.379***	(0.084)	0.379***	(0.084)	0.486***	(0.083)	0.491***	(0.083)
ln(labor force) (mean)	-0.346	(0.401)	-0.341	(0.399)	-0.368	(0.387)	-0.364	(0.386)	-0.538	(0.396)	-0.536	(0.394)
Year	-0.062***	(0.006)	-0.062***	(0.006)	-0.057***	(0.006)	-0.057***	(0.006)	-0.043***	(0.005)	-0.043***	(0.005)
Quarter 2	-0.020***	(0.005)	-0.020***	(0.005)	-0.018***	(0.005)	-0.018***	(0.005)	-0.007	(0.005)	-0.007	(0.005)
Quarter 3	-0.039***	(0.008)	-0.039***	(0.008)	-0.040***	(0.007)	-0.040***	(0.007)	-0.034***	(0.006)	-0.034***	(0.006)
Quarter 4	-0.090***	(0.009)	-0.090***	(0.009)	-0.088***	(0.008)	-0.088***	(0.008)	-0.089***	(0.008)	-0.090***	(0.008)
Constant	119.006***	(11.954)	119.102***	(11.947)	110.410***	(10.708)	110.468***	(10.681)	84.516***	(8.602)	84.800***	(8.580)
R^2 (within/between/overall)	0.386/0.134/0.138		0.387/0.128/0.133		0.378/0.233/0.237		0.379/0.227/0.231		0.350/0.623/0.607		0.351/0.633/0.616	
Observations	3,297		3,297		3,957		3,957		5,027		5,027	
Routes	330		330		330		330		330		330	

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

As shown in Table 2, in the short run, exit through merger has significant effects on both route types. For the switching routes, average yield increases by 10.0 percent in the short run compared to 11.1 percent for the overlapping routes. Interestingly, these yield increases are about double the size of the price reactions to operational route exits. In the medium and long run, however, our analysis reveals that these price increases are reduced. In the long run, switching routes show a yield increase of still 9.3 percent compared to 8.0 percent for overlapping routes. As we not only control for the number of firms (to exclude the effect of entry by competitors) but also for the other key drivers of price changes in our regressions, the yield reductions in the medium and long run must be associated to the realization of merger efficiencies which are found to be – at least partly – passed on to the final customers in the form of price reductions. However, our results also reveal that these efficiencies are not large enough to overcompensate the significant yield increases which have been observed immediately after the completion of the merger. Interestingly, as revealed by the estimations including the interaction term, the effects do not differ in direction or significance between monopoly routes and oligopoly routes post-exit.

Table 3: Fixed effects regressions for the effects of exits on entry

	Δ # airlines w/o exiting/merger – short term		**Δ # airlines w/o exiting/merger – medium term**		**Δ # airlines w/o exiting/merger - long term**	
Variable	coef.	(s.e.)	coef.	(s.e.)	coef.	(s.e.)
operational exit	0.250***	(0.031)	0.206***	(0.027)	0.193***	(0.025)
merger exit (switching)	-0.018	(0.028)	0.033	(0.026)	0.058**	(0.024)
merger exit (overlap)	0.000	(0.026)	0.036*	(0.021)	0.057***	(0.018)
# airlines w/o exit (lag)	-0.432***	(0.031)	-0.361***	(0.026)	-0.304***	(0.024)
# LCCs w/o exit (lag)	-0.173***	(0.063)	-0.163***	(0.053)	-0.163***	(0.050)
Avg. plane size	-0.002**	(0.001)	-0.002***	(0.001)	-0.002***	(0.001)
airport size (mean)	0.288***	(0.100)	0.344***	(0.090)	0.302***	(0.076)
ln(# establ.) (mean)	0.797*	(0.415)	0.634*	(0.369)	0.324	(0.290)
ln(avg. weekly wage) (mean)	-0.100	(0.229)	-0.139	(0.208)	-0.299*	(0.179)
ln(labor force)	-1.882**	(0.840)	-1.398*	(0.801)	-1.057	(0.663)
Year	-0.004	(0.012)	-0.018	(0.012)	-0.023**	(0.009)
Quarter 2	0.011	(0.018)	0.005	(0.016)	-0.002	(0.014)
Quarter 3	-0.041**	(0.020)	-0.044***	(0.017)	-0.043***	(0.015)
Quarter 4	-0.015	(0.018)	-0.008	(0.018)	0.000	(0.016)
Constant	27.078	(23.196)	49.318**	(22.435)	58.740***	(17.259)
R^2 (within/between/overall)	0.272/0.000/0.012		0.229/0.001/0.016		0.207/0.000/0.012	
Observations	3,289		3,949		5,019	
Routes	330		330		330	

*Notes: Significance levels *** p<0.01, ** p<0.05, * p<0.1, cluster-robust standard errors in parentheses.*
Sources: U.S. DOT, T-100 Domestic Segment Data and U.S. Bureau of Labor Statistics, authors' calculations.

As shown in Table 3, the change in the number of carriers does not react after merger-related exits in the short- and medium-term, but increases by 0.058 carriers (switching routes) and 0.057 carriers (overlapping routes) over the long term period. Again, the results for the operational exits differ substantially. Exits of this type lead to an immediate increase in the number of carriers (0.250 carriers) and turn out to be persistent over the long term period (0.193 carriers). Interestingly, as shown as part of our descriptive analysis above, entry following operational exits is strong enough to even cause a slight decrease in the average yield in the long run. For the merger-related exits, however, we find that the entry-inducing effects – together with (the passed-on fraction of) merger efficiencies – in the long run are not strong enough to completely restore prices to the pre-merger level. Again referring to the descriptive evidence discussed above, average prices over this period are in total 2.7 percent higher for switching routes and 3.1 percent higher for overlapping routes.

Based on our empirical results, several policy-relevant conclusions can be drawn. First, referring to our estimations of the price effects of the merger, we find higher price increases for overlapping routes than for switching routes suggesting that the market position in the former route type is stronger making larger price increases possible. Second, the substantially larger reductions of the short-term price increase in the long run on overlapping routes (-3.2 percentage points) compared to switching routes (-1.8 percentage points) suggest that merger efficiencies are realized to a larger degree on the overlapping parts of the network. This finding can be explained by the realization of economies of traffic density[23] on these routes and is in line with the theoretical results of Brueckner and Proost (2011) who investigate the welfare consequences of carve-outs for airline alliances under antitrust immunity.

Third, although admittedly a rough estimate, our results support the conclusion that – for the actual merger case at hand – entry-inducing effects are more important than merger efficiencies in the sense that they lead to a larger reduction of the post-merger price increase. In the short run, we find price increases of 10.0 percent for switching routes and 11.1 percent for overlapping routes. While merger efficiencies lead to the rather modest reductions of -3.2 percentage points for overlapping routes and -1.8 percentage points for switching routes, the remaining 8.0-3.2=4.8 percentage points for overlapping routes and the 7.3-1.8=5.5 percentage points for switching routes can be attributed to the entry-inducing effects of the

[23] Economies of traffic density imply that the cost per passenger falls with an increasing traffic volume on a particular route as a result of both the use of larger – typically more efficient - airplanes and the spreading of fixed endpoint costs over a higher number of passengers.

merger. In percentage terms, the 7.3 percentage points overall price decrease on switching routes in the long run was driven to 24.7 percent by merger efficiencies and to the remaining 75.3 percent by entry-inducing effects. The results for the group of overlapping routes show diverging results: the overall price decrease of 8.0 percentage points was driven to 40.0 percent by merger efficiencies leaving the remaining 60.0 percent for the entry-inducing effects. Ceteris paribus, this finding not only suggests that ease of entry assessments should receive a more detailed attention during the merger control procedure than the assessment of merger efficiencies but also allow the conclusion that overlapping routes and switching routes possibly demand separate treatments as part of an antitrust investigation of airline mergers.

5 SUMMARY AND CONCLUSION

The U.S. airline industry has recently experienced a substantial consolidation trend. In the last ten years three larger and several smaller mergers raise the immediate question after the welfare consequences of these consolidations. Did these mergers cause significant price increases for the final consumers? Or were countervailing factors such as merger efficiencies and entry responses by competitors strong enough to leave/restore prices at/to pre-merger levels? 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. Such knowledge is likely to have positive spillover effects on the quality of future actions by the antitrust authority.

Against this background, we empirically investigate the competitive effects of the merger between Delta and Northwest (2009) in the domestic U.S. airline industry. Applying fixed effects regression models we find – holding other price determinants constant – that the merger led to short term real price increases of about 11 percent on overlapping routes and about 10 percent on routes which experienced a merger-induced switch of the operating carrier. Over a longer period, however, our analysis reveals that consumers on affected routes are left with an increase of only about 3 percent in real prices. Additional econometric analyses allow the conclusion that both merger efficiencies and post-merger entry by competitors initiated this downward trend in real prices. Our results suggest that competition in the U.S. airline industry is sufficiently strong to mitigate the market power effects of even larger consolidations.

Although our key results are robust, it is important to point to several caveats of our analysis. First, although the merging parties combined ground operations and reservations systems in the beginning of 2010 and therefore closed the merger transaction, the complex process of integration of two large companies might not have already been finalized entirely six quarters after the merger. Admittedly, this conjecture raises hopes that consumers are about to enjoy further merger-related benefits; however, it also cannot be ruled out that the countervailing force of price increases due to increased market power gains momentum (again). The recently observed successive mega merger between United Airlines and Continental Airlines (2010) at least suggests that a substantial number of airport-pairs might not only face further increases in concentration but will also experience – following the theory of multimarket contact – reduced incentives of the remaining carriers to compete fiercely.

Second, it is important to note that the announcement and the official completion of the Delta – Northwest merger falls into a period of financial and economic distress with a (possibly large) general impact on average prices in domestic U.S. airline markets. Although we control for this effect by including a yearly time trend and seasonal dummies, alternative estimation approaches might yield different results.

Third, integration processes of earlier airline mergers especially showed that network integration led to substantial changes in the number and density of operated routes, i.e., (larger) airline mergers were usually followed by waves of multiple exit and entry events (partly induced by the dismantling of entire hubs). As our analysis is based on a simple addition of the route networks of both carriers at the time of the merger, it is therefore unable to fully take the effects of such restructuring activities into account. Again, it remains to be investigated whether the net welfare impact of post-merger network restructuring is positive or negative.

Last but not least, assessments of the impact of the merger on various non-price dimensions of market competition are a fruitful area of future research. Such studies could, e.g., focus on the impact of the merger on various measures of service quality such as on-time performance or customer complaints, but could also investigate changes in the connectivity of both large metropolitan areas and smaller rural areas due to the merger.

Although the paper investigates the competitive effects of one particular merger in one particular industry, our results generally suggest that both assessments of (the plausibility of) potential merger efficiencies and entry-inducing effects are important cornerstones in a

coherent antitrust policy towards horizontal mergers. While an antitrust authority only has limited options to influence the realization of efficiencies by the merged entity after the approval decision is made, it has significant ongoing possibilities to promote the power of entry-inducing effects: namely by keeping markets open and competition alive through the elaborate use of the well-equipped toolbox of antitrust policy.

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APPENDIX

Table 4: Summary statistics (entire dataset)

Variable	Quarter before/of exit mean	s.d.	Quarter after exit Mean	s.d.	Period before exit mean	s.d.	Period after exit Mean	s.d.
ln(non-stop yield)	2.879	(0.653)	2.925	(0.646)	2.919	(0.662)	2.928	(0.654)
non-stop yield	22.343	(16.946)	23.291	(17.446)	23.336	(17.563)	23.444	(17.387)
Δ # airlines w/o exit	0.006	(0.292)	0.197	(0.512)	0.004	(0.270)	0.032	(0.321)
operational exit	-	-	0.655	(0.476)	-	-	0.714	(0.452)
merger exit (switching)	-	-	0.170	(0.376)	-	-	0.141	(0.348)
merger exit (overlap)	-	-	0.176	(0.381)	-	-	0.146	(0.353)
post-exit monopoly	0.527	(0.500)	0.527	(0.500)	0.527	(0.499)	0.524	(0.500)
# airlines w/o exit	1.058	(0.836)	1.255	(0.904)	1.054	(0.863)	1.349	(0.892)
# LCCs w/o exit	0.309	(0.524)	0.300	(0.533)	0.309	(0.537)	0.333	(0.551)
avg. plane size	114.679	(40.229)	111.340	(43.490)	119.709	(39.543)	111.653	(44.711)
ln(one-stop yield)	2.727	(1.107)	2.798	(1.026)	2.824	(0.961)	2.820	(1.031)
missing one-stop yield	0.024	(0.154)	0.018	(0.134)	0.014	(0.119)	0.018	(0.133)
airport size	1.708	(0.745)	1.716	(0.741)	1.732	(0.740)	1.718	(0.759)
ln(# establ.)	11.398	(0.731)	11.394	(0.732)	11.391	(0.729)	11.404	(0.745)
ln(avg. weekly wage)	6.742	(0.179)	6.732	(0.161)	6.708	(0.171)	6.744	(0.162)
ln(labor force)	14.337	(0.671)	14.338	(0.670)	14.332	(0.671)	14.342	(0.683)
Year	2006	(3.742)	2006	(3.966)	2005	(3.859)	2007	(3.845)
Quarter 2	0.176	(0.381)	0.106	(0.308)	0.250	(0.433)	0.276	(0.447)
Quarter 3	0.221	(0.416)	0.176	(0.381)	0.250	(0.433)	0.220	(0.414)
Quarter 4	0.497	(0.501)	0.221	(0.416)	0.250	(0.433)	0.228	(0.420)
Observations	330		330		2,637		2,390	

Notes: Prices in 1995 $ cents.
Sources: U.S. DOT, T-100 Domestic Segment Data, Airline Origin and Destination and U.S. Bureau of Labor Statistics, authors' calculations.

Table 5: Summary statistics - operational exits

	quarter before/of exit		quarter after exit		period before exit		period after exit	
	Mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.
ln(non-stop yield)	2.888	(0.645)	2.917	(0.623)	2.930	(0.639)	2.923	(0.642)
non-stop yield	22.408	(16.835)	22.768	(16.665)	23.228	(16.851)	23.125	(16.890)
Δ # airlines w/o exit	0.009	(0.320)	0.310	(0.563)	0.010	(0.268)	0.039	(0.339)
post-exit monopoly	0.509	(0.501)	0.509	(0.501)	0.510	(0.500)	0.509	(0.500)
# airlines w/o exit	1.296	(0.731)	1.606	(0.714)	1.278	(0.787)	1.638	(0.726)
# LCCs w/o exit	0.324	(0.525)	0.319	(0.532)	0.317	(0.528)	0.347	(0.545)
avg. plane size	110.397	(40.298)	106.895	(44.134)	116.171	(40.103)	107.471	(45.050)
ln(one-stop yield)	2.780	(1.102)	2.797	(1.104)	2.874	(0.964)	2.835	(1.046)
missing one-stop yield	0.023	(0.151)	0.023	(0.151)	0.014	(0.120)	0.019	(0.136)
airport size	1.718	(0.823)	1.715	(0.817)	1.729	(0.817)	1.722	(0.820)
ln(# establ.)	11.379	(0.795)	11.383	(0.797)	11.367	(0.794)	11.397	(0.798)
ln(avg. weekly wage)	6.659	(0.157)	6.683	(0.162)	6.645	(0.167)	6.701	(0.160)
ln(labor force)	14.324	(0.741)	14.327	(0.740)	14.315	(0.740)	14.336	(0.740)
Year	2004	(3.645)	2004	(3.625)	2003	(3.658)	2005	(3.635)
Quarter 2	0.269	(0.444)	0.162	(0.369)	0.250	(0.433)	0.253	(0.435)
Quarter 3	0.338	(0.474)	0.269	(0.444)	0.250	(0.433)	0.241	(0.428)
Quarter 4	0.231	(0.423)	0.338	(0.474)	0.249	(0.433)	0.253	(0.435)
Observations	216		216		1,725		1,706	

Notes: Prices in 1995 $ cents.

Sources: U.S. DOT, T-100 Domestic Segment Data, Airline Origin and Destination and U.S. Bureau of Labor Statistics, authors' calculations.

Table 6: Summary statistics - merger exits (switching routes)

	quarter before/of exit		quarter after exit		period before exit		period after exit	
	Mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.
ln(non-stop yield)	2.444	(0.449)	2.506	(0.474)	2.463	(0.488)	2.506	(0.466)
non-stop yield	12.966	(7.995)	13.984	(9.317)	13.540	(9.310)	13.904	(8.614)
Δ # airlines w/o exit	0.036	(0.267)	-0.036	(0.380)	-0.009	(0.360)	0.018	(0.327)
post-exit monopoly	0.536	(0.503)	0.536	(0.503)	0.536	(0.499)	0.536	(0.499)
# airlines w/o exit	0.679	(0.876)	0.643	(0.883)	0.719	(0.868)	0.711	(0.916)
# LCCs w/o exit	0.411	(0.596)	0.375	(0.620)	0.453	(0.657)	0.423	(0.656)
avg. plane size	149.086	(30.923)	148.085	(32.453)	149.785	(32.486)	149.600	(34.446)
ln(one-stop yield)	2.388	(0.437)	2.425	(0.458)	2.398	(0.440)	2.450	(0.443)
missing one-stop yield	0.000	(0.000)	0.000	(0.000)	0.000	(0.000)	0.000	(0.000)
airport size	1.761	(0.521)	1.807	(0.532)	1.802	(0.522)	1.789	(0.538)
ln(# establ.)	11.538	(0.598)	11.515	(0.595)	11.539	(0.587)	11.526	(0.596)
ln(avg. weekly wage)	6.908	(0.087)	6.829	(0.108)	6.834	(0.100)	6.858	(0.106)
ln(labor force)	14.408	(0.506)	14.405	(0.505)	14.409	(0.502)	14.405	(0.501)
Year	2009	(0.000)	2010	(0.000)	2009	(0.501)	2010	(0.472)
Quarter 2	0.000	(0.000)	0.000	(0.000)	0.250	(0.433)	0.333	(0.472)
Quarter 3	0.000	(0.000)	0.000	(0.000)	0.250	(0.433)	0.167	(0.373)
Quarter 4	1.000	(0.000)	0.000	(0.000)	0.250	(0.433)	0.167	(0.373)
Observations	56		56		448		336	

Notes: Prices in 1995 $ cents.

Sources: U.S. DOT, T-100 Domestic Segment Data, Airline Origin and Destination and U.S. Bureau of Labor Statistics, authors' calculations.

Table 7: Summary statistics - merger exits (overlapping routes)

	quarter before/of exit		quarter after exit		period before exit		period after exit	
	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.
ln(non-stop yield)	3.263	(0.601)	3.361	(0.599)	3.315	(0.620)	3.364	(0.591)
non-stop yield	31.156	(19.007)	34.222	(20.437)	33.194	(20.610)	34.218	(20.076)
Δ # airlines w/o exit	-0.034	(0.184)	0.000	(0.187)	-0.004	(0.147)	0.009	(0.193)
post-exit monopoly	0.586	(0.497)	0.586	(0.497)	0.586	(0.493)	0.586	(0.493)
# airlines w/o exit	0.534	(0.799)	0.534	(0.821)	0.545	(0.806)	0.552	(0.800)
# LCCs w/o exit	0.155	(0.410)	0.155	(0.410)	0.144	(0.370)	0.175	(0.424)
avg. plane size	97.407	(27.517)	92.414	(28.074)	103.825	(26.838)	95.515	(30.064)
ln(one-stop yield)	2.858	(1.473)	3.163	(1.002)	3.054	(1.171)	3.105	(1.238)
missing one-stop yield	0.052	(0.223)	0.017	(0.131)	0.028	(0.165)	0.032	(0.175)
airport size	1.618	(0.611)	1.632	(0.602)	1.675	(0.602)	1.629	(0.605)
ln(# establ.)	11.333	(0.575)	11.318	(0.580)	11.338	(0.567)	11.322	(0.578)
ln(avg. weekly wage)	6.893	(0.091)	6.820	(0.110)	6.821	(0.103)	6.845	(0.105)
ln(labor force)	14.319	(0.525)	14.314	(0.527)	14.321	(0.520)	14.314	(0.523)
Year	2009	(0.000)	2010	(0.000)	2009	(0.501)	2010	(0.472)
Quarter 2	0.000	(0.000)	0.000	(0.000)	0.250	(0.433)	0.333	(0.472)
Quarter 3	0.000	(0.000)	0.000	(0.000)	0.250	(0.433)	0.167	(0.373)
Quarter 4	1.000	(0.000)	0.000	(0.000)	0.250	(0.433)	0.167	(0.373)
Observations	58		58		464		348	

Notes: Prices in 1995 $ cents.

Sources: U.S. DOT, T-100 Domestic Segment Data, Airline Origin and Destination and U.S. Bureau of Labor Statistics, authors' calculations