Discussion Paper No. 12-037

The Competitive Effects of Firm Exit
Evidence from the U.S. Airline Industry

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Centre for European Economic Research

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Non-technical summary

In the last decade, the domestic U.S. airline industry has experienced a substantial consolidation trend. In addition to a number of high level mergers such as American Airlines – Trans World Airlines (2001), America West – US Airways (2005) and Delta Air Lines – Northwest Airlines (2009), several smaller carriers such as National Airlines (2002), Independence Air (2006) and ATA Airlines (2008) had to leave the industry.

Despite this high relevance of firm exits for the recent development of the domestic U.S. airline industry, empirical evidence on the effects of these consolidations is rare. Studies focusing on the market impact of liquidations do not exist to the best of our knowledge and the existing studies on the competitive effects of airline mergers almost exclusively stem from the 1980s and focus on the specific case of a largely overlapping route network of the merging parties (due to a shared hub). However, such a network structure is rather uncommon in recent mergers and therefore raises the demand for both a new conceptual framework for investigating firm exits in the airline industry and a corresponding new empirical analysis of the effects of such firm exits.

Against this background, we study the competitive effects of five liquidations and six mergers in the domestic U.S. airline industry between 1995 and 2010. Applying fixed effects regression models we find that route exits due to liquidation lead to substantially larger and permanent price increases (of about 12 percent) than merger-related exits. Within the merger category, our analysis reveals that prices on overlapping routes increase by about 6 percent in the short run, whereas a simple merger-induced switch of the operating carrier causes a significant price increase of about 3 percent. Accordingly, we observe large reductions in quantity for route exits caused by firm liquidations and moderate reductions in case of merger-related exits. Entry-inducing effects of firm exits are found particularly for liquidations and smaller mergers.

Das Wichtigste in Kürze

Im Laufe des vergangenen Jahrzehnts war in der US-amerikanischen Luftverkehrsindustrie ein substanzieller Konsolidierungstrend zu beobachten. Neben einigen größeren Fusionen wie beispielsweise American Airlines – Trans World Airlines (2001), America West – US Airways (2005) und Delta Air Lines – Northwest Airlines (2009) gingen einige kleinere Fluggesellschaften wie National Airlines (2002), Independence Air (2006) und ATA Airlines (2008) in Konkurs und verließen die Industrie.

Trotz dieser festgestellten hohen Relevanz von Firmenaustritten für die jüngeren Entwicklungen der US-amerikanischen Luftverkehrsindustrie sind empirische Untersuchungen zu den ökonomischen Effekten dieser Konsolidierungen sehr spärlich gesät. Während Studien mit einem Fokus auf konkursbedingte Firmenaustritte nach unserem Kenntnisstand gar nicht existieren, konzentrierten sich fast alle existierenden Studien zu den wettbewerblichen Effekten von Fusionen zwischen Fluggesellschaften auf Fälle aus den 1980er Jahren. Diese Fusionen waren allerdings gekennzeichnet von einem stark überlappenden Luftverkehrsnetz der fusionieren Parteien (bedingt durch einen gemeinsamen Hub-Flughafen); ein Merkmal, das aktuellere Fusionen nicht aufweisen. Es liegt daher nahe, nicht nur ein neues konzeptionelles Grundgerüst für eine Analyse der wettbewerblichen Effekte solcher Firmenaustritte zu entwickeln, sondern dieses in der Folge mit einer empirischen Analyse von konkurs- und fusionsbedingten Firmenaustritten zu kombinieren.

Vor diesem Hintergrund untersuchen wir die wettbewerblichen Effekte von fünf Konkursen und sechs Fusionen im US-amerikanischen Luftverkehr zwischen 1995 und 2010. Im Zuge der Anwendung verschiedener Paneldatenmodelle mit fixen Effekten stellen wir fest, dass konkursbedingte Marktaustritte zu substanziell höheren und permanenten Preisanstiegen (von durchschnittlich 12 Prozent) führen als fusionsbedingte Austritte. Innerhalb der Kategorie der fusionsbedingten Marktaustritte zeigt unsere empirische Analyse, dass auf überlappenden Streckenmärkten die Preise durchschnittlich um 6 Prozent in der kurzen Frist ansteigen, während für Routen, auf denen nur ein fusionsbedingter Wechsel der Fluggesellschaft stattfindet, Preisanstiege von durchschnittlich 3 Prozent zu beobachten sind. Im Einklang mit diesen Ergebnissen finden wir eine große Reduktion der angebotenen Kapazitäten im Falle von Konkursen und einen eher moderaten Rückgang im Falle von Fusionen. Verstärkter Markteintritt nach den entsprechenden Firmenaustritten kann insbesondere bei Konkursen und Fusionen von kleineren Fluggesellschaften festgestellt werden.

THE COMPETITIVE EFFECTS OF FIRM EXIT

EVIDENCE FROM THE U.S. AIRLINE INDUSTRY

Kai Hüschelrath[♣] and Kathrin Müller[*]

April 2012

Abstract
We study the competitive effects of five liquidations and six mergers in the domestic U.S. airline industry between 1995 and 2010. Applying fixed effects regression models we find that route exits due to liquidation lead to substantially larger price increases than merger-related exits. Within the merger category, our analysis reveals significant price increases on all affected routes immediately after the exit events. In the medium and long-run, however, realized merger efficiencies and entry-inducing effects are found to be strong enough to drive prices down to pre-exit levels.

Keywords Airline industry, exit, liquidation, merger, efficiencies, entry-inducing effects

JEL Class L40, L93

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1 INTRODUCTION

The benefits of competition and innovation are largely ensured by both market entry and market exit. Market entry plays a key role as an equilibrium force – which competes away excess profits to an equilibrium level – and as a disequilibrium force – which propels the industry from one equilibrium state to another due to the introduction and diffusion of innovations (see Geroski, 1991, 1995). Market exit is considered a key instrument to sanction unprofitable product and service ideas thereby renewing the industry population through a process of 'creative destruction' (Schumpeter, 1942). Only the close interaction of market entry of innovative and/or more efficient new firms and the corresponding decline and market exit of less innovative and/or less efficient incumbent firms through either merger or liquidation can guarantee dynamically efficient markets.

The U.S. airline industry has experienced many firm entries and exits since its deregulation in 1978. For example, following a transition period in the years after deregulation with a moderate number of in sum 13 firm entries and 6 firm exits, the substantial growth period from 1982 to 1984 witnessed the entry of 31 new interstate airlines – excluding regional carriers – compared to only 15 exits either through merger or liquidation. However, the subsequent shake-out period from 1985 to 1987 showed roughly inverted characteristics with only 16 additional entries compared to 38 exits (mostly through liquidation).[1]

Although the number of mergers and liquidations in the last two decades has been substantially lower than in the first shake-out phase of the liberalized U.S. airline industry, both types of firm exit continue to have a substantial impact on the industry. This is particularly true for large mergers such as American Airlines – Trans World Airlines (2001), America West – US Airways (2005) and Delta Air Lines – Northwest Airlines (2009) but also for larger liquidations such as National Airlines (2002), Independence Air (2006) and ATA Airlines (2008).

Despite this continuing relevance of firm exits in the U.S. airline industry, recent empirical evidence is rare. Empirical studies on the effects of liquidations do not exist to the best of our knowledge and the existing studies on the competitive effects of airline mergers almost exclusively stem from the 1980s and focus on the specific case of a largely overlapping route

[1] The data stems from Borenstein and Rose (2008). Interestingly, the authors report that out of the group of 44 (interstate) carriers that entered the U.S. airline industry between 1979 and 1984, only 7 operated in 1990 and only two remain in operation today (Southwest Airlines and America West (using the US Airways brand)).

network of the merging parties (due to a shared hub). However, such a network structure is rather uncommon in recent mergers and therefore raises the demand for both a new conceptual framework for investigating firm exits in the airline industry and a corresponding new empirical analysis of the effects of such exits.

Against this background, we study the competitive effects of five liquidations and six mergers in the domestic U.S. airline industry between 1995 and 2010. Applying fixed effects regression models we find that route exits due to liquidation lead to substantially larger and permanent price increases (of about 12 percent) than merger-related exits. Within the merger category, our analysis reveals that prices on overlapping routes increase by about 6 percent in the short run, whereas a simple merger-induced switch of the operating carrier causes a significant price increase of about 3 percent. Accordingly, we observe large reductions in quantity for route exits caused by firm liquidations and moderate reductions in case of merger-related exits. Entry-inducing effects of firm exits are found particularly for liquidations and smaller mergers. Our findings have important implications for unilateral effects analysis as part of horizontal merger assessments.

The paper is structured as follows. The following second section provides a conceptual framework for the analysis of the competitive effects of firm exit in the airline industry, followed by the discussion of descriptive evidence for the U.S. airline industry in the third section. The fourth section presents our empirical analysis and provides a discussion of the results and their policy implications. The fifth section concludes the paper with a summary of the key results.

2 THE COMPETITIVE EFFECTS OF FIRM EXIT IN THE AIRLINE INDUSTRY – A CONCEPTUAL FRAMEWORK

Market exit can be assessed on two different aggregation levels: exit of entire companies due to either liquidation or merger (so-called *firm exits*) and single market exit decisions of still operating companies for strategic reasons such as lack of profitability[2] or – in case of the airline industry - network reorganization (so-called *operational exits*). Firm exits differ from operational exits by the fact that the former typically cause multiple market exits at one particular point in time. Furthermore, while operational exists can typically be reversed if,

[2] Several reasons for an unprofitable route presence are conceivable: incumbent(s) reaction(s) to entry, wrongly estimated demand (O&D and/or connecting traffic), insufficient growth potential, increases in passenger facility or airport charges, macroeconomic demand shocks, input cost increases etc.

e.g., market conditions change, firm exits are ultimate thereby reducing (actual and potential) competition on a permanent basis.

The economic effects of the two distinctive forms of market exit can be analyzed from at least two perspectives: 'general economic effects' and 'competitive effects'. The former category investigates the consequences of market exit on general economic factors such as employment or (regional) economic growth. Any study of these general economic effects must look beyond the level of the respective firm and its product markets and has to include important knock-on effects of market exit on, e.g., the airport, other aviation-related service industries or spillovers to the general economic growth in the respective region. For example, if an airline decides to leave a certain hub airport, either due to liquidation (i.e., firm exit) or to network reorganization (i.e., operational exit), it is very likely that the respective airport and other aviation-related service industries will lose business. Furthermore, the entire region might face a reduction in attractiveness due to the lower quality of airline connections.

Complementary to an analysis of the effects of exit on the general economic level, an assessment of the *competitive effects* of exit is a compulsory part of an entire analysis of the economic consequences of exit. Generally, such an assessment investigates the effects of market exit on competition in these markets. Particularly interesting objects of investigation are the effects on average prices, demand, capacity and quality. For example, if before exit, two airlines were competing fiercely in a certain non-stop market and one of the competitors finally has to exit the market due to liquidation, it becomes likely that the remaining carrier will use this opportunity to increase price. However, in the medium and long run, market entry by other (more efficient) airlines might become attractive, i.e., firm exit might create so-called *entry-inducing effects* (see Werden and Froeb (1998) for a seminal paper[3]) suggesting that prices might increase immediately after exit but exhibit a downward trend in the medium and longer run. As a consequence, a study on the competitive effects of exit should not be constrained to an analysis of the short-term effects on price but has to extend its perspective to both a larger observation window and the inclusion and interpretation of further competition variables such as passengers and departures.

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[3] 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 profits 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.

In the remainder of this paper, we concentrate on the competitive effects of firm exit. The firm exit category is subdivided further into multiple market exits due to liquidation and multiple market exits due to merger. In our empirical investigation, we include 'operational exits' as third category in order to allow for a direct comparison between the effects of firm exits and single market exits. For a detailed discussion on the competitive effects of firm exit, we draw on a simple airline network with two separate airlines 1 and 2 operating hubs H_1 and H_2, respectively (see Figure 1).

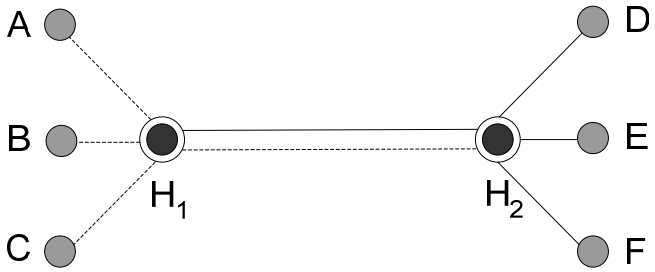

Figure 1: A simple network with two airlines
Source: own figure

The two hubs are connected by services of both carriers (route H_1H_2) while the respective spokes are only served by the respective hub airline, i.e., routes AH_1, BH_1 and CH_1 by airline 1 and H_2D, H_2E and H_2F by airline 2. In the following sub-sections, we discuss the competitive effects of a liquidation, i.e., airline 1 disappears from the market, and the competitive effects of a merger, i.e., airline 2 acquires airline 1 and continues operating the entire network.

2.1 FIRM EXIT THROUGH LIQUIDATION

The bankruptcy laws in many countries allow two different forms of bankruptcy: the attempt of reorganization (and a potential 'emergence' from bankruptcy) or a process of liquidation (which typically leads to the exit of the respective firm). As the focus in this paper is on the effects of firm exit, we concentrate on those bankruptcies which lead to the ultimate market exit (i.e., liquidation) of the respective firm.

When studying the competitive effects of liquidation exits on prices and quantity, basic oligopoly theory allows the derivation of several key relationships. In the short run, at least two separate arguments speak for significant price increases. First, the substantial reduction in capacity due to exit of one competitor is expected to cause substantial price increases and corresponding reductions in quantities. Second, pre-exit competition on the respective routes

might have been fierce (as at least one carrier was fighting for life) suggesting price increases 'up to the usual competitive level' post-exit.[4] Referring to the simple airline network defined above, the described competitive effects are expected on all routes operated by airline 1. If no other competitors are operating on the respective spoke routes AH_1, BH_1 and CH_1, (non-stop) services are terminated completely.

In the medium and long run, however, the anticipated effects on the key variables are less clear. On the one hand, existing carriers might find it profitable to expand capacity in the respective markets, thereby putting pressure on price. On the other hand, other airlines might have incentives to enter the respective routes (the hub-to-hub as well as the spoke routes) thereby increasing competition and triggering a downward trend in price. However, the respective possibilities of entry depend on both profit expectations on the one hand and the size of (structural and/or strategic) barriers to entry on the other hand leaving the direction and size of the medium- and long run effects of firm exit through liquidation unclear. For example, large scale entry into H_1 might not be too attractive given the fact that another airline just exited the respective airport. Furthermore, entry into H_2 might be difficult (technically and economically) as soon as airline 2 has a dominant position at this hub.

2.2 FIRM EXIT THROUGH MERGER

Mergers and acquisitions ('mergers' in the following) are another form of firm exit. In order to derive hypotheses on the effects of mergers on competition, we have to introduce a separation of possibly affected routes. So-called *overlapping routes* are characterized by the presence of both merging carriers before the merger, i.e., they are direct competitors in the respective non-stop markets (route H_1H_2 in Figure 1[5]). In contrast, we introduce a second category of routes for which possible merger effects cannot be ruled out: the so-called *switching routes*. Switching routes are operated by the junior merger partner ex-ante but are taken over by the lead merger partner as a consequence of the merger (routes AH_1, BH_1 and CH_1 in Figure 1 if airline 2 acquires airline 1).[6]

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[4] From this perspective, liquidation has the potential to realize 'liquidation efficiencies' in the sense that the market exit of one carrier allows the other carriers to earn a reasonable return on investment and to continue serving the respective market.

[5] Although Figure 1 only shows one overlapping route (H_1H_2), overlaps in real airline networks are not restricted to hub-to-hub operations but can also be observed in other constellations such as route CH_2 or route AD. Our empirical analysis below includes all different types of overlapping routes.

[6] In general, a key determinant of the possibilities to increase price post-merger are the network structures pre-merger. If the networks are largely complementary as assumed in the simple network structure in Figure 1, theory and empirical evidence suggest that anticompetitive effects are only likely on the (few) routes on which both merging parties are operating before the merger. However, if the degree of route overlap is

Focusing on *overlapping routes* first, in the short run, the capacity of the junior carrier is unlikely to be removed entirely from the market. However, mergers might lead to an increase in market power thereby incentivizing the merged entity to reduce quantity and increase price. Ceteris paribus, price increases immediately after the merger should be less pronounced than price increases after liquidation exits. In the medium and long run, the notional effects are again less clear. On the one hand, capacity expansions of existing competitors or entry by potential competitors might constrain the market power of the merged parties. On the other hand, barriers to entry such as hub dominance might reduce the threat of entry substantially thereby allowing the merged parties to permanently increase prices. Comparing liquidation-related exits and merger-related exits, it can be expected that capacity increases through entry are more likely after liquidations given the substantial loss of capacity due to the exit of one carrier. Merger-related exists, however, are more likely to put the merging parties in a stronger position on the respective overlapping routes suggesting a dissuading effect on the entry incentives of potential competitors.

Turning from overlapping routes to *switching routes*, an initial assessment of this route type might suggest that competitive effects are rather unlikely, especially because the number of competitors on these routes is unaffected by the merger. However, a closer look reveals that the merger-induced change in the operator might contain several possibilities for price reactions. First, a change in ownership might cause changes in pricing and other strategic variables possibly triggering significant price changes post-merger. Second, 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). Last but not least, the merger increases multimarket contact among the remaining airlines in the industry and might therefore ease the realization of (tacitly) collusive outcomes.

Although horizontal mergers unavoidably raise market concentration, a countervailing force to market power-induced price increases are possible *merger efficiencies* (see Williamson (1968) for a seminal paper). Such efficiencies might come in the form of both savings in marginal costs and fixed costs and are likely to be realized in the medium and long run. Merger efficiencies might create incentives to pass on a significant share down to the consumers through price reductions post-merger. Again, it is difficult ex-ante to derive clear

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substantial, e.g., due to hub operations of both airlines at the same airport, anticompetitive effects on a large number of non-stop connections are much more likely.

hypotheses in this respect. In general, efficiencies can partly become effective within the entire merged airline network (e.g., through a cheaper sourcing of input goods for the merged entity) and might partly be attributed to certain improvements of particular hub presences etc. In other words, efficiencies can play a role in both overlapping and switching routes. A key problem in an assessment of merger efficiencies is the unknown time-frame of their realization. While marginal cost savings might be realized relatively quickly after the merger, fixed costs savings might take substantially longer (and are therefore difficult to isolate empirically from other effects that might influence the price and cost levels of the respective airline).

3 FIRM EXIT IN THE U.S. AIRLINE INDUSTRY

Based on the general discussion of firm exit in the preceding section, this section investigates the issue specifically for the U.S. airline industry. Differentiating between firm exits and operational exits, Figure 2 shows the number of exits in non-stop domestic U.S. airline markets between the third quarter of 1995 and the first quarter of 2010.

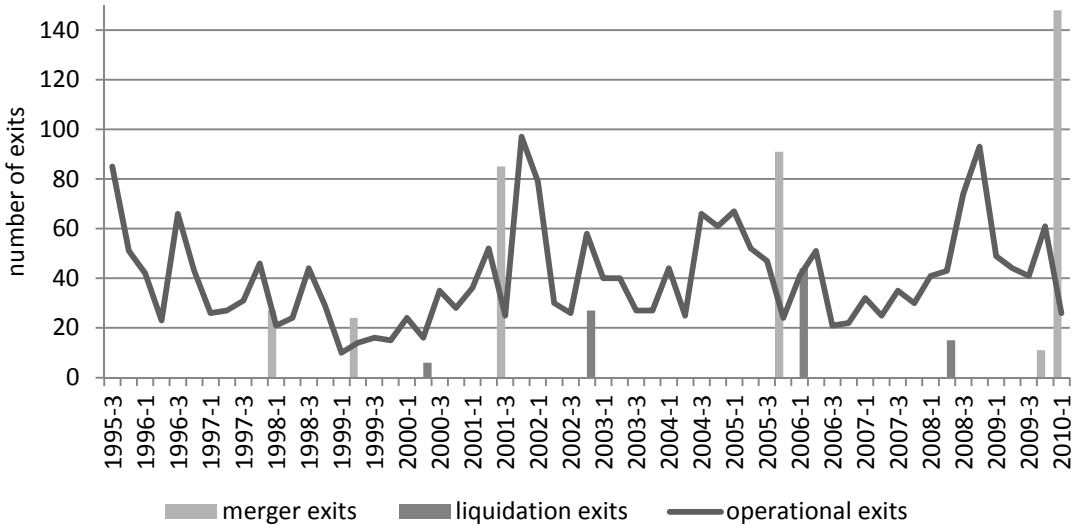

Figure 2: Exits from non-stop domestic U.S. airline markets (3rd quarter 1995 – 1st quarter 2010)[7]

Source: DOT T-100 Segment Data, authors' calculations.

The quarter of exit is defined as the first quarter after an airline provided the last non-stop service between two airports. In sum, the observation period shows that operational exits fluctuate substantially between the years with peaks after the 9/11 attacks and the beginning

[7] The graph shows the (aggregated) exit activities of the following 27 major U.S. carriers: AA, AS, B6, BF, CO, DH, DL, F9, FF, FL, G4, HA, HP, J7, N7, NJ, NK, NW, QQ, SY, TW, TZ, UA, US, VX, WN, YX (1).

of the economic crisis in 2008. The figure further reveals that six larger mergers and five[8] larger liquidations took place between 1999 and 2010. The by far largest number of route exits due to firm exit was triggered by the Delta Air Lines – Northwest Airlines merger which materialized in the first quarter of 2010. The by far largest liquidation case was Independence Air in the first quarter of 2006. In general, most liquidations and mergers create significant 'shocks' in the exit statistics in the respective quarters. The following sections will take a closer look at firm exits through liquidation and merger in the U.S. airline industry between 1995 and 2010.

3.1 FIRM EXIT THROUGH LIQUIDATION

In the United States, Chapter 7 of the Title 11 of the Bankruptcy Code governs the process of liquidation while Chapters 11 and 13 govern the process of reorganization of a debtor in bankruptcy. While Chapter 7 is the usual form of bankruptcy in the United States, most airline bankruptcies refer to Chapter 11. However, although most airlines successfully went through the process of reorganization and exited Chapter 11 at some point, several carriers eventually were liquidated. In fact, most liquidations of U.S. carriers were carried out under Chapter 11 and not under Chapter 7. For the period from 1995 to 2010, we identified five liquidations of larger U.S. airlines (see Table 1).

Table 1: Liquidations of larger U.S. airlines between 1995 and 2010

Airline	IATA Code	Year of firm entry	Quarter of firm exit	Number of domestic non-stop routes operated (quarter before/of firm exit)	Number of domestic passengers transported (quarter before/of firm exit)	Share of domestic passengers transported (quarter before/of firm exit)
ATA Airlines	TZ	1986	2008-2	15	372,412	2.35‰
Independence Air	DH	2004	2006-1	44	1,013,483	6.47‰
Vanguard Airlines	NJ	1994	2002-4	17	199,747	1.42‰
National Airlines	N7	1999	2002-4	10	612,514	4.35‰
Tower Air	FF	1983	2000-2	6	121,850	0.87‰

Sources: Airlines for America (http://www.airlines.org/Pages/U.S.-Airline-Bankruptcies-and-Service-Cessations.aspx), U.S. DOT, T-100 Domestic Segment Data, authors' calculations.

As shown in Table 1, all liquidation cases were relatively small, reflected in measures such as the number of non-stop routes operated in the quarter before exit or the share of passengers transported compared to the number of passengers in the entire domestic U.S airline industry. However, despite the small size of all liquidation cases compared to the entire national market, it would be superficial to automatically conclude the irrelevance of an economic analysis. As all exiting airlines had a particular geographic focus, the impact on this particular

[8] National Airlines and Vanguard Airlines were liquidated in the same quarter (2002-4).

set of routes in this particular region can be quite substantial and therefore justifies a detailed investigation.

Existing empirical research on the competitive effects of U.S. airline bankruptcies concentrates solely on cases in which the respective airlines were not liquidated but entered a temporary phase of reorganization. In a seminal paper, Borenstein and Rose (1995) investigate the effects of bankruptcy filings by seven U.S carriers on market conduct. They find that carriers lowered fares by 5 to 6 percent before entering bankruptcy, however, refrained from further fare cuts after entering bankruptcy protection. Furthermore, the study reveals that the fare reductions are only observable in the short term and are not followed by route-level competitors. Ciliberto and Schenone (2008) not only confirm this last result, but especially find that the observed changes in prices must be generated by a reduction in capacity by the bankrupt firms and not by other explanations such as cost reductions or changes in strategic behavior. In a sense, these results conflict with earlier findings by Busse (2002). She uses data on 14 major airlines between 1985 and 1992 and concludes that firms in worse financial condition are more likely to start price wars. Last but not least, Borenstein and Rose (2003) specifically investigate the impact of bankruptcy on airline service levels and find that bankruptcies reduce service levels (as measured in the 'number of nonstop flights' and the 'number of destinations served on a non-stop basis') at some airports. The estimated effect is found to be the greatest for midsize airports (i.e., airports between 100 and 400 flights per day).

Although the studies on the competitive effects of bankruptcy reorganization come to interesting and policy-relevant conclusions, economic theory suggests that the competitive effects of airline liquidations are different. As argued above, liquidation causes multiple route exits at one particular point in time which cannot be reversed thereby reducing (actual and potential) competition on a permanent basis. Given the absence of studies which empirically investigate the direction and size of the competitive effects of firm liquidations, we provide such an analysis in the fourth section below.

3.2 FIRM EXIT THROUGH MERGER

In the history of the U.S. airline industry, both types of firm exit, liquidations and mergers, have often been interpreted as closely interrelated in the sense that (especially large) bankrupt airlines were acquired by a competitor to basically avoid liquidation.

Table 2: Mergers and acquisitions of larger U.S. airlines between 1995 and 2010

Merging parties	Closed	Quarter of merger exits	Resulting carrier	Number of junior partner's domestic non-stop route exits due to merger	Junior partner's domestic passengers (quarter before/of merger)	Share of junior partner's domestic passengers (quarter before/of merger)
Delta Air Lines / Northwest Airlines	12/31/2009	2010-1	Delta Air Lines	148	7,220,155	4.770%
Frontier Airlines / Midwest Airlines	7/31/2009	2009-4	Frontier Airlines	11	529,666	0.321%
US Airways / America West Airlines	9/27/2005	2005-4	US Airways	91	6,859,074	4.059%
American Airlines / TWA	4/9/2001	2001-3	American Airlines	85	6,152,064	3.924%
American Airlines / Reno Air	2/1/1999	1999-2	American Airlines	24	1,247,481	0.928%
AirTran Airways / Valujet	11/17/1997	1998-1	AirTran Airways	27	718,592	0.535%

Sources: Airlines for America (http://www.airlines.org/Pages/U.S.-Airline-Mergers-and-Acquisitions.aspx), U.S. DOT, T-100 Domestic Segment Data, authors' calculations.

As shown in Table 2, the observation period has experienced six mergers between larger U.S. airlines, including (at least) three 'failing firms' (Trans World Airlines, US Airways, and Valujet). As reflected in the correspondingly high numbers of non-stop route exits due to the merger or the share of passengers in the quarter before the merger (relative to all domestic U.S. airline passengers), three mergers have been particularly large transactions – American Airlines – Trans World Airlines (2001), America West – US Airways (2005) and Delta Air Lines – Northwest Airlines (2010) – while the remaining three transactions were of significantly smaller size. However, as already argued for the liquidation cases above, it would be superficial to automatically ignore these smaller transactions, e.g., due to possibly substantial effects on the affected routes.

Existing empirical research on the competitive effects of U.S. airline mergers largely refers to the late 1980s.[9] On the one hand, this period was characterized by a substantial industry

[9] An incomplete list of empirical articles focusing on the competitive effects of U.S. airline mergers includes Beutel and McBride (1992), Borenstein (1990), Brueckner et al. (1992), Butler and Huston (1989), Jordan (1988), Kim and Singal (1993), Morrison (1996) and Werden et al. (1991). Furthermore, an event study

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.

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 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.[10] 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

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approach is followed in studies by Knapp (1990), McGuckin et al. (1992), Singal (1996) and Slovin et al. (1991).

[10] 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.

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 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.

The existence of both a significant number of liquidations and mergers in recent years demands a detailed econometric investigation of the competitive effects of these firm exits. The following section provides such an analysis for the route exits caused by five liquidations and six mergers which took place in the domestic U.S. airline industry between 1998 and 2010.

4 EMPIRICAL ANALYSIS

In this section, we present 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 statistics. Subsequently, Section 4.4 concentrates on the presentation

and interpretation of our main empirical results followed by the discussion of important policy implications in Section 4.5.

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 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. 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 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 27 largest U.S. carriers[11] 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. Liquidation exits are all exits of the respective carrier which occurred in the quarter of firm liquidation (see Table 1 above). Merger-related exits are assumed to have taken place in the quarter after the closure of the merger transaction (see Table 2 above).

In the second step, we keep all non-stop routes which were subject to at least one exit (operational exit, liquidation exit or merger exit) and which are still served by another carrier after the exit of the respective carrier.[12] If multiple exits on a certain non-stop route were observed over time, the route was duplicated. 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. We drop all routes for which we have less than seven observations before and seven observations after exit.

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[11] See footnote 7 above for a list of these 27 major U.S. carriers.

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

In the third step, we construct quarterly route level and airport level data from the T-100 and DB1B databases.[13] 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 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 1,258 non-stop routes allowing a detailed econometric investigation of the effects of firm exit.

4.2 EMPIRICAL APPROACH

Guided by our conceptual framework derived in Section 2 above, our empirical approach can be subdivided into five consecutive steps. In the first step, we use fixed effects regression models to estimate the short run effects of firm exit events on average market yield, departures and passengers.[14] In the second step, we extend the observation window after exit and rerun the respective regressions for medium- and long-term in order to investigate possible changes, e.g., 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. Subsequently, in the fourth step, we refrain from holding the number of carriers constant after an exit-event and examine the entry-inducing effects of firm exits. In the fifth and last step, we exclude the three large mergers (Delta Air Lines – Northwest Airlines, US Airways - America West Airlines and American Airlines – Trans World Airlines) from the analysis and rerun all regressions. This step allows us to investigate whether our results hold for the sub-sample of smaller mergers.

Discussing the technicalities of the five steps of our empirical approach in greater detail, our variables of interest are the exit variables which are captured by four dummy variables. We distinguish between two types of merger-related exits. In the first case, only the exiting carrier was active on the respective non-stop route and the resulting entity inherited this route. We call this a ‘route switching’ merger exit. In that case, the exit does not trigger a change in the number of carriers. If both of the two merging parties have provided non-stop service before, 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. Exits

[13] 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.

[14] We do not report the results for ‘seats’ as they are very closely related to ‘departures’.

which followed the liquidation of an airline are called liquidation exits. Operational exits are all other route exits which are not directly related to a firm exit. This category includes, e.g., network restructuring exits or exits due to unprofitability. Exits which were either observed in times of financial distress[15] or took place before the merger was settled are also classified as operational exits.

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

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

where y_{it} is either the non-stop yield (fare per passenger mile), the number of departures or the number of passengers transported. The variable *opEx* captures operational exits, *mExSw* captures switching merger exits, *mExOv* captures merger exits on overlapping routes, and *lqEx* captures exits due to the liquidation of a carrier. 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, departures, and passengers 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 and quantity four quarters after exit and long-term effects by following prices and quantities eight quarters after exit[16]. The introduction of such a 'dynamic' perspective allows us to investigate whether the observed short-term effects are permanent or rather disappear due to, e.g., realized merger efficiencies or competitive reactions by competitors. Thus, the coefficient estimates of the different exit variables report the average percentage change in prices and quantity 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*).

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[15] Since it is unclear whether financial distress, e.g., filing for Chapter 11, ends in the liquidation of a firm, exits which occur before the liquidation of an airline are interpreted as operational exits since they basically aim at restoring profitability. As a consequence, the group of operational exits is quite heterogeneous. However, as we aim at using this category for the purpose of comparison only, we refrain from a further differentiation.

[16] Since the dataset covers the period up to the third quarter of 2011, the long-term effects of the Delta-Northwest merger (and all other exits which took place either in the fourth quarter of 2009 or in the first quarter of 2010) refer to the first seven 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.[17] 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 analysis 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 a next 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

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

In this model approach, the coefficients of the exit dummies alone denote the average percentage change in prices or quantities, respectively, 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 the exit[18], the effects of exit can be calculated as the sum of the respective coefficients (e.g., $\beta_{opEx} + \beta_{opExM}$).

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[17] 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).

[18] The route might also stay a monopoly in case of switching route (merger) exits.

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 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.

In the fifth and last step, we exclude the three large mergers (Delta Air Lines – Northwest Airlines, US Airways - America West Airlines and American Airlines – Trans World Airlines) from the analysis and rerun the regressions. This step allows us to investigate whether our results hold for the sub-sample of smaller mergers.

4.3 DESCRIPTIVE STATISTICS

As already mentioned in Section 4.1, the dataset covers 1,258 route exits. The majority of these exits are operational exits (918 exits). We further observe 217 merger exits on switching routes and 79 merger exits on overlapping routes. 44 exits occurred because of carrier liquidations. Directly after exit we observe that about 40 percent of the routes are monopolies (see Table 3).

Table 3: Route exits included in the fixed effects regressions

	# of exits	share of post-exit monopolies
operational exits	918	42.48%
merger exits (switching)	217	27.65%
merger exits (overlap)	79	46.84%
liquidation exits	44	31.82%
Total	1,258	39.83%

Sources: U.S. DOT, T-100 Domestic Segment Data, authors' calculations.

About 28% of the switching route exits are monopolies. In contrast to the other exit types, these routes have also been monopolies before the exit event as no change in the number of carriers was triggered by the exit event. Further summary statistics for the variables included in the regressions can be retrieved from Table 4.

Table 4: Summary statistics

Variable	Quarter before/of exit mean	Quarter before/of exit s.d.	Quarter after exit mean	Quarter after exit s.d.	Period before exit mean	Period before exit s.d.	Period after exit mean	Period after exit s.d.
ln(non-stop yield)	2.787	(0.652)	2.818	(0.651)	2.823	(0.658)	2.825	(0.650)
non-stop yield	20.448	(16.323)	21.093	(16.684)	21.301	(16.994)	21.289	(17.089)
ln(departures)	7.008	(0.809)	6.922	(0.877)	7.005	(0.826)	6.960	(0.860)
Departures	1,497	(1,241)	1,425	(1,233)	1506	(1272)	1469	(1275)
ln(Passengers)	11.416	(0.898)	11.306	(0.970)	11.434	(0.899)	11.361	(0.950)
Passengers	131,621	(119,584)	123,061	(116,915)	133,567	(120637)	128,696	(121,496)
Δ # airlines w/o exit	0.045	(0.332)	0.217	(0.485)	0.012	(0.294)	0.028	(0.329)
operational exit	-	-	0.730	(0.444)	-	-	0.746	(0.436)
merger exit (switching)	-	-	0.172	(0.378)	-	-	0.166	(0.372)
merger exit (overlap)	-	-	0.063	(0.243)	-	-	0.052	(0.222)
liquidation exit	-	-	0.035	(0.184)	-	-	0.036	(0.187)
post-exit monopoly	0.398	(0.490)	0.398	(0.490)	0.398	(0.490)	0.393	(0.489)
# airlines w/o exit	1.417	(1.000)	1.634	(1.013)	1.354	(1.005)	1.662	(0.977)
# LCCs w/o exit	0.401	(0.551)	0.412	(0.563)	0.356	(0.526)	0.445	(0.592)
avg. plane size	122.185	(41.045)	119.790	(43.943)	126.164	(40.056)	120.170	(44.180)
ln(one-stop yield)	2.711	(1.077)	2.778	(0.950)	2.799	(0.960)	2.782	(0.970)
missing one-stop yield	0.021	(0.142)	0.013	(0.112)	0.013	(0.113)	0.014	(0.116)
airport size	1.890	(0.797)	1.881	(0.794)	1.899	(0.786)	1.886	(0.800)
ln(# establ.)	11.557	(0.714)	11.559	(0.715)	11.541	(0.714)	11.578	(0.718)
ln(avg. weekly wage)	6.696	(0.174)	6.702	(0.167)	6.666	(0.175)	6.721	(0.164)
ln(labor force)	14.465	(0.654)	14.467	(0.654)	14.455	(0.655)	14.478	(0.655)
Year	2004	(3.802)	2004	(3.898)	2003	(3.880)	2005	(3.817)
Quarter 2	0.208	(0.406)	0.183	(0.387)	0.250	(0.433)	0.258	(0.437)
Quarter 3	0.297	(0.457)	0.208	(0.406)	0.250	(0.433)	0.240	(0.427)
Quarter 4	0.312	(0.464)	0.297	(0.457)	0.249	(0.432)	0.244	(0.430)
Observations	1,258		1,258		10,037		9,752	

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.

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 4, in the quarter before/of exit, a passenger paid about 20.4 cents per mile. The yield has risen to 21.1 cents per mile on average in the quarter after exit. Comparing the average price over the entire period before the exit (7-8 quarters) with the average price over the entire period after exit, we do not observe a price increase in real terms. The second dependent variable is the number of quarterly departures which amounts to 1,497 departures on average in the quarter before/of exit. It drops to 1,425 departures in the quarter after exit. Although the extension of the observation period leads to a moderate increases in the number of departures, the pre-exit level remains unreached. The third dependent variable is the number of quarterly passengers. On average, about 132,000 passengers have been transported in the quarter before/of exit. Over the quarter after exit the number of passengers drops to about 123,000 passengers. Although an extension of the analysis to the entire observation period after exit shows an increase in the number of

passengers, this increase again turns out to be insufficient to restore pre-exit levels. For the regressions which aim to assess the entry-inducing effect of exit, the fourth dependent variable is the change in the number of other carriers. While in the quarter before/of exit, this number amounts to 0.045 exits on average it increases to 0.217 exits in the quarter after exit. Both values experience a substantial drop if the analysis is extended to the entire period before/after exit.

Descriptive statistics distinguished by the type of exit are provided in Table 9 to Table 12 in the Appendix. From these bivariate statistics the effect of exit seems to be more pronounced for operational and liquidation exits than for merger-related exits; this is true for price, quantity and entry-inducing effects. Interestingly, although bankrupt carriers were much smaller than most of the merging carriers, routes which are subject to the different exits do not differ substantially in size. Non-stop routes which were subject to a liquidation exit transported about 190,000 passengers in the quarter before/of exit, while routes subject to merger exits have been travelled less (switching: 161,000 passengers; overlapping: 129,000 passengers) in the quarter before/of exit.

4.4 Empirical Results and Interpretation

Based on the description of our dataset and the empirical approach, this section presents our empirical results and interpretation. We subdivide our discussion into the reporting of the key empirical results for firm exits through liquidation and through merger. Results of the regressions with route fixed effects on non-stop yield can be retrieved from Table 5. Table 6 depicts the results on the number of departures, and Table 7 presents the regression results with the number of passengers as our dependent variable. Each 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.[19]

4.4.1 Firm exit through liquidation

In the short run, exit through liquidation is found to have a substantial effect on market yield. On average, prices increase by 12 percent in the first two quarters after exit. When allowing for differences regarding the post-exit market structure, the effect does not differ significantly

[19] An average operational exit is found to have a similar ceteris paribus effect on non-stop yield in the short-, medium-, and long-term. After an operational exit, non-stop yield increase by 6 percent on average, the number of departures decrease by 19 to 20 percent, and passengers transported drop by about 17 percent.

between post-exit monopolies and routes with at least two competitors. Interestingly, the effect is found to be persistent over time. The substantial size of the effects of liquidation exits on price and quantity measures can be substantiated by a direct comparison to the results for the 'operational exit' group: in the short run, we find an average yield increase of about 6 percent which turns out to be quite robust for a narrower focus on monopoly routes post-exit, extensions of the observation window and the sub-sample containing only small mergers.

Turning from price effects to quantity effects, it is found that firm exits due to liquidation lead to the expected large decrease in capacity and demand. In the short run, liquidation exits cause an average decrease in the number of departures of 17.4 percent and an average decrease in demand of 14.8 percent. The effect for the number of passengers is significantly and substantially higher if only monopoly routes post-exit are taken into account (-28.4 percent) compared to an effect of -7.5 percent for routes with more than one competitor. Again, the results appear to be quite robust for extensions of the observation window and the sub-sample containing only smaller mergers. Interestingly, while price effects of exits due to firm liquidations were significantly higher than the price effects of operational exits, the quantity effects do not significantly differ between liquidation exits and operational exits.

Assessing the effect of liquidation exits on market entry, we find a substantial effect already in the short-run (see Table 8). The change in the number of carrier increases by 0.130 after a liquidation exit and controlling for other factors. This effect is smaller than for operational exits (0.192), but the two effects do not differ significantly. Again, the effect is persistent over time. In general, since market entry is expected to create a downward pressure on price (see, e.g., Hüschelrath and Müller, 2011, or Daraban and Fournier, 2009), the entry activity of other carriers induced by multiple market exits of liquidated carriers should act as a countervailing force regarding price increases and quantity reductions. However, consulting our descriptive results reported in Table 12 in the Appendix, it becomes apparent that the induced entry activity is not sufficient to fully compensate the price increase observed immediately after a liquidation exit. Even adjusted for inflation, we observe the yield to be about 1 cent per mile (in 1995$ terms) higher in the period after exit than in the period before exit (see Table 12).

In a nutshell, our empirical findings imply that, even if the total share of the failed firms' domestic passengers was negligible, these firms' market exits had a significant impact on the respective routes. These markets suffered, ceteris paribus, from substantial price increases and service reductions (in the form of lower flight frequencies). However, incentives for entry seem to be high since there is a substantial increase in the change of the number of other

carriers immediately after the observed liquidation exits. This finding suggests that liquidation exits may (at least partly) cause a welfare-improving replacement of the inefficient bankrupt carrier with a more efficient operating airline. However, this comes at a cost for consumers as entries after liquidation exits cannot fully reverse the price increase observed immediately after exit.

Table 5: 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	0.060***	(0.005)	0.055***	(0.006)	0.067***	(0.005)	0.059***	(0.006)	0.061***	(0.005)	0.054***	(0.006)
merger exit (switching)	0.027***	(0.008)	0.036***	(0.009)	0.027***	(0.009)	0.040***	(0.009)	0.010	(0.010)	0.030***	(0.010)
merger exit (overlap)	0.056***	(0.015)	0.025	(0.024)	0.047***	(0.016)	0.029	(0.023)	0.027	(0.018)	0.022	(0.024)
liquidation exit	0.120***	(0.017)	0.106***	(0.020)	0.127***	(0.016)	0.114***	(0.018)	0.117***	(0.017)	0.109***	(0.019)
op. exit # monopoly			0.013	(0.009)			0.018**	(0.009)			0.016*	(0.009)
m. ex. (sw.) # monopoly			-0.034**	(0.017)			-0.047**	(0.019)			-0.071***	(0.022)
m. ex. (ov.) # monopoly			0.068**	(0.029)			0.037	(0.030)			0.009	(0.035)
liq. exit # monopoly			0.042	(0.035)			0.040	(0.036)			0.025	(0.036)
# airlines w/o exit	-0.021***	(0.006)	-0.020***	(0.006)	-0.023***	(0.005)	-0.021***	(0.005)	-0.035***	(0.005)	-0.034***	(0.005)
# LCCs w/o exit	-0.101***	(0.014)	-0.100***	(0.014)	-0.103***	(0.012)	-0.102***	(0.012)	-0.093***	(0.011)	-0.092***	(0.011)
avg. plane size	-0.001***	(0.000)	-0.001***	(0.000)	-0.001***	(0.000)	-0.001***	(0.000)	-0.000***	(0.000)	-0.000***	(0.000)
ln(one-stop yield)	0.377***	(0.025)	0.376***	(0.025)	0.404***	(0.023)	0.403***	(0.023)	0.387***	(0.029)	0.386***	(0.029)
missing one-stop yield	2.600***	(0.176)	2.592***	(0.177)	2.798***	(0.166)	2.791***	(0.166)	2.672***	(0.206)	2.663***	(0.205)
airport size (mean)	-0.033*	(0.019)	-0.034*	(0.019)	-0.018	(0.018)	-0.021	(0.018)	0.013	(0.019)	0.008	(0.019)
ln(# establ.) (mean)	0.463***	(0.092)	0.461***	(0.093)	0.421***	(0.084)	0.414***	(0.086)	0.247***	(0.075)	0.232***	(0.076)
ln(avg. weekly wage)	0.228***	(0.050)	0.227***	(0.050)	0.216***	(0.046)	0.211***	(0.046)	0.254***	(0.048)	0.245***	(0.047)
ln(labor force) (mean)	0.579***	(0.188)	0.584***	(0.189)	0.528***	(0.183)	0.514***	(0.184)	0.490***	(0.167)	0.459***	(0.167)
Year	-0.055***	(0.004)	-0.055***	(0.004)	-0.048***	(0.004)	-0.048***	(0.004)	-0.031***	(0.003)	-0.031***	(0.003)
Quarter 2	-0.014***	(0.003)	-0.015***	(0.003)	-0.013***	(0.003)	-0.013***	(0.003)	-0.006**	(0.003)	-0.007**	(0.003)
Quarter 3	-0.039***	(0.004)	-0.038***	(0.004)	-0.031***	(0.004)	-0.031***	(0.004)	-0.023***	(0.003)	-0.024***	(0.003)
Quarter 4	-0.069***	(0.005)	-0.069***	(0.005)	-0.061***	(0.005)	-0.060***	(0.005)	-0.052***	(0.004)	-0.052***	(0.004)
Constant	96.151***	(7.352)	96.335***	(7.394)	84.022***	(6.470)	83.689***	(6.498)	52.762***	(5.093)	52.069***	(5.081)
R^2 (within/between/overall)	0.283/0.109/0.110		0.285/0.108/0.109		0.287/0.141/0.142		0.289/0.147/0.147		0.267/0.199/0.200		0.270/0.222/0.223	
Observations	12,553		12,553		15,069		15,069		19,789		19,789	
Routes	1,258		1,258		1,258		1,258		1,258		1,258	

*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.

Table 6: Fixed effects regressions for the effect of exits on number of departures

	ln(departures) - short term				ln(departures) - medium term				ln(departures) - long term			
Variable	**coef.**	**(s.e.)**	**coef.**	**(s.e.)**	**coef.**	**(s.e.)**	**coef.**	**(s.e.)**	**coef.**	**(s.e.)**	**coef.**	**(s.e.)**
operational exit	-0.200***	(0.011)	-0.123***	(0.011)	-0.192***	(0.011)	-0.121***	(0.011)	-0.189***	(0.011)	-0.129***	(0.012)
merger exit (switching)	-0.021*	(0.012)	-0.023	(0.014)	-0.026**	(0.012)	-0.036***	(0.013)	-0.035***	(0.013)	-0.045***	(0.015)
merger exit (overlap)	-0.031*	(0.017)	-0.055***	(0.019)	-0.033*	(0.017)	-0.059***	(0.021)	-0.046**	(0.018)	-0.076***	(0.023)
liquidation exit	-0.174***	(0.032)	-0.146***	(0.036)	-0.175***	(0.029)	-0.149***	(0.034)	-0.180***	(0.030)	-0.165***	(0.038)
Op. exit # monopoly			-0.170***	(0.024)			-0.158***	(0.022)			-0.137***	(0.021)
m. ex. (sw.) # monopoly			0.002	(0.027)			0.033	(0.027)			0.041	(0.028)
m. ex. (ov.) # monopoly			0.048	(0.032)			0.051	(0.032)			0.064*	(0.035)
liq. exit # monopoly			-0.079	(0.070)			-0.073	(0.054)			-0.039	(0.053)
# airlines w/o exit	0.151***	(0.014)	0.137***	(0.014)	0.149***	(0.014)	0.137***	(0.014)	0.142***	(0.014)	0.137***	(0.014)
# LCCs w/o exit	0.089***	(0.025)	0.088***	(0.025)	0.106***	(0.023)	0.103***	(0.023)	0.106***	(0.020)	0.101***	(0.020)
Avg. plane size	-0.003***	(0.001)	-0.004***	(0.001)	-0.004***	(0.001)	-0.004***	(0.001)	-0.004***	(0.001)	-0.004***	(0.000)
airport size (mean)	0.773***	(0.044)	0.776***	(0.043)	0.780***	(0.045)	0.786***	(0.043)	0.788***	(0.043)	0.791***	(0.041)
ln(# establ.) (mean)	0.201	(0.170)	0.123	(0.168)	0.332**	(0.166)	0.236	(0.162)	0.368**	(0.152)	0.286*	(0.149)
ln(avg. weekly wage) (mean)	0.527***	(0.093)	0.530***	(0.092)	0.594***	(0.089)	0.606***	(0.088)	0.587***	(0.087)	0.605***	(0.086)
ln(labor force) (mean)	0.443	(0.359)	0.452	(0.358)	0.234	(0.350)	0.285	(0.351)	0.001	(0.319)	0.068	(0.319)
Year	-0.005	(0.008)	-0.003	(0.007)	-0.005	(0.007)	-0.004	(0.007)	-0.004	(0.006)	-0.003	(0.006)
Quarter 2	0.061***	(0.006)	0.062***	(0.006)	0.060***	(0.006)	0.061***	(0.006)	0.062***	(0.006)	0.063***	(0.006)
Quarter 3	0.061***	(0.009)	0.062***	(0.009)	0.062***	(0.008)	0.063***	(0.008)	0.060***	(0.007)	0.062***	(0.007)
Quarter 4	-0.003	(0.008)	-0.001	(0.008)	-0.008	(0.008)	-0.007	(0.008)	-0.008	(0.007)	-0.007	(0.007)
Constant	2.945	(13.034)	0.935	(12.989)	4.803	(12.092)	3.239	(11.992)	5.197	(9.959)	4.357	(9.889)
R^2 (within/between/overall)	0.216/0.296/0.285		0.230/0.303/0.293		0.232/0.310/0.298		0.248/0.318/0.307		0.249/0.339/0.326		0.262/0.347/0.334	
Observations	12,553		12,553		15,069		15,069		19,789		19,789	
Routes	1,258		1,258		1,258		1,258		1,258		1,258	

*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.

Table 7: Fixed effects regressions for the effect of exits on number of passengers

	ln(passengers) – short term				ln(passengers) – medium term				ln(passengers) – long term			
Variable	**coef.**	**(s.e).**	**coef.**	**(s.e)**	**coef.**	**(s.e)**	**coef.**	**(s.e)**	**coef.**	**(s.e)**	**coef.**	**(s.e)**
operational exit	-0.172***	(0.011)	-0.097***	(0.011)	-0.167***	(0.011)	-0.095***	(0.011)	-0.170***	(0.011)	-0.108***	(0.011)
merger exit (switching)	-0.042***	(0.012)	-0.040***	(0.013)	-0.044***	(0.012)	-0.055***	(0.013)	-0.051***	(0.013)	-0.066***	(0.014)
merger exit (overlap)	-0.053***	(0.016)	-0.059***	(0.019)	-0.043**	(0.017)	-0.051**	(0.022)	-0.066***	(0.019)	-0.080***	(0.024)
liquidation exit	-0.148***	(0.040)	-0.075**	(0.037)	-0.159***	(0.039)	-0.091**	(0.037)	-0.179***	(0.036)	-0.129***	(0.040)
Op. exit # monopoly			-0.166***	(0.024)			-0.160***	(0.022)			-0.143***	(0.021)
m. ex. (sw.) # monopoly			-0.010	(0.026)			0.040	(0.026)			0.057**	(0.027)
m. ex. (ov.) # monopoly			0.008	(0.031)			0.014	(0.033)			0.030	(0.036)
liq. exit # monopoly			-0.219**	(0.091)			-0.205**	(0.084)			-0.149**	(0.069)
# airlines w/o exit	0.135***	(0.013)	0.122***	(0.013)	0.133***	(0.013)	0.121***	(0.013)	0.129***	(0.013)	0.124***	(0.012)
# LCCs w/o exit	0.115***	(0.026)	0.113***	(0.026)	0.133***	(0.023)	0.128***	(0.023)	0.133***	(0.021)	0.126***	(0.021)
Avg. plane size	0.005***	(0.001)	0.005***	(0.001)	0.005***	(0.001)	0.005***	(0.001)	0.004***	(0.001)	0.004***	(0.001)
airport size (mean)	1.051***	(0.047)	1.052***	(0.046)	1.032***	(0.048)	1.036***	(0.046)	0.996***	(0.045)	0.999***	(0.044)
ln(# establ.) (mean)	0.192	(0.168)	0.121	(0.163)	0.385**	(0.163)	0.298*	(0.157)	0.477***	(0.150)	0.400***	(0.147)
ln(avg. weekly wage) (mean)	0.367***	(0.096)	0.366***	(0.095)	0.475***	(0.092)	0.484***	(0.091)	0.513***	(0.088)	0.529***	(0.088)
ln(labor force) (mean)	0.725**	(0.359)	0.709**	(0.357)			0.431	(0.347)			0.179	(0.314)
Year	0.004	(0.008)	0.006	(0.008)	0.003	(0.007)	0.004	(0.007)	0.006	(0.006)	0.007	(0.006)
Quarter 2	0.143***	(0.007)	0.144***	(0.007)	0.143***	(0.007)	0.144***	(0.007)	0.147***	(0.006)	0.148***	(0.006)
Quarter 3	0.130***	(0.009)	0.130***	(0.009)	0.132***	(0.008)	0.133***	(0.008)	0.133***	(0.008)	0.134***	(0.008)
Quarter 4	0.035***	(0.008)	0.036***	(0.008)	0.026***	(0.008)	0.028***	(0.008)	0.028***	(0.007)	0.029***	(0.007)
Constant	-14.581	(13.345)	-17.182	(13.301)	-10.094	(12.454)	-12.047	(12.378)	-14.374	(10.294)	-15.403	(10.280)
R^2 (within/between/overall)	0.296/0.352/0.340		0.308/0.361/0.350		0.296/0.375/0.361		0.311/0.382/0.369		0.294/0.405/0.388		0.307/0.410/0.394	
Observations	12,553		12,553		15,069		15,069		19,789		19,789	
Routes	1,258		1,258		1,258		1,258		1,258		1,258	

*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.

Table 8: Fixed effects regressions for the effects of exits on entry

Variable	Δ # airlines w/o exiting/merger – short term coef.	(s.e.)	Δ # airlines w/o exiting/merger – medium term coef.	(s.e.)	Δ # airlines w/o exiting/merger - long term coef.	(s.e.)
operational exit	0.192***	(0.014)	0.152***	(0.012)	0.141***	(0.011)
merger exit (switching)	-0.017	(0.014)	0.011	(0.012)	0.056***	(0.011)
merger exit (overlap)	0.003	(0.024)	0.012	(0.018)	0.049***	(0.016)
liquidation exit	0.130***	(0.042)	0.107**	(0.044)	0.137***	(0.040)
# airlines w/o exit (lag)	-0.392***	(0.017)	-0.350***	(0.014)	-0.303***	(0.012)
# LCCs w/o exit (lag)	-0.045	(0.029)	-0.028	(0.025)	-0.021	(0.020)
Avg. plane size	-0.003***	(0.000)	-0.003***	(0.000)	-0.003***	(0.000)
airport size (mean)	0.325***	(0.042)	0.297***	(0.037)	0.268***	(0.029)
ln(# establ.) (mean)	0.047	(0.236)	0.069	(0.194)	0.049	(0.126)
ln(avg. weekly wage) (mean)	0.161	(0.117)	0.020	(0.097)	-0.010	(0.080)
ln(labor force)	-1.633***	(0.389)	-1.273***	(0.329)	-0.923***	(0.237)
Year	0.025***	(0.008)	0.009	(0.007)	-0.009**	(0.005)
Quarter 2	0.022**	(0.009)	0.013	(0.008)	0.015**	(0.007)
Quarter 3	-0.017*	(0.009)	-0.028***	(0.008)	-0.026***	(0.007)
Quarter 4	0.018*	(0.011)	0.015	(0.010)	0.008	(0.008)
Constant	-27.270**	(13.365)	-0.367	(12.281)	31.832***	(8.924)
R^2 (within/between/overall)	0.214 / 0.001 / 0.004		0.191 / 0.000 / 0.005		0.170 / 0.001 / 0.007	
Observations	12,512		15,028		19,748	
Routes	1,258		1,258		1,258	

*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.

4.4.2 FIRM EXIT THROUGH MERGER

Following our conceptual framework derived in Section 2, the analysis of the effects of firm exits through merger must differentiate between two route types: overlapping routes and switching routes. In the short run, exit through merger has a significant effect on both route types: while prices increase by on average about 5.6 percent on overlapping routes, switching routes experience a yield increase of about 2.7 percent. The extension of the observation window, however, reveals that these effects vanish in the long run. While effects are still significantly different from zero in the medium term, prices are not significantly higher for both types of merger exits in the long term.

Interestingly, if the focus is narrowed down to monopoly routes post-exit, the effect on switching routes is found to be zero (as the coefficient of the interaction term is negatively significant and of approximately the same absolute size) in the short run and even negative (-4.1 percent) in the long run. While the above effect on overlapping routes is in the short run mostly driven by post-exit monopolies, results diverge in the medium and long run. The extension of the observation window reveals that the effect is of only half the size and no

longer significant. For the sub-sample of small mergers (see Table 13), we do not find any significant effects of merger exits on average yield. While one should refrain from interpreting the results for overlapping routes due to the low number of observations in this category[20], the insignificant effect found on switching routes is not surprising since the possible drivers for the positive effect in case of larger mergers, i.e., reduced competition due to multimarket contact and the elimination of potential entrants, might be negligible for small firm acquisitions.

Turning from the price effects to the quantity effects (see Table 6 and Table 7), it is found that firm exits through merger lead to smaller reductions in capacity and demand than liquidation-related and operational exits. In the short run, the number of departures is reduced by about 3.1 percent on overlapping routes and 2.1 percent on switching routes. In markets which turn to a monopoly post-exit, we fail to find any significant effect (for both route types) on the number of departures since the sum of the coefficients is not significantly different from zero (as indicated by the Wald test). Demand declines in both cases, however, the effects do not significantly differ between post-exit monopolies and post-exit oligopolies. Furthermore, these demand decreases in post-exit monopolies are only found in the short term as the sum of the merger exit coefficients and the coefficients of the respective interaction terms are not significantly different from zero in the medium and long run. In contrast, the analysis of the non-monopoly routes provides a different picture. The short-term reductions in the number of departures and the number of passengers are found to be even more pronounced in the medium and long run: the reduction in the number of departures increase from about 5.5 percent (short-term) to 7.6 percent (long-term) for the overlapping routes and from about 2.3 percent (short-term, insignificant) to 4.5 percent (long-term, highly significant) for the switching routes. For the sub-sample of smaller mergers (see Table 14 and Table 15), the quantity effects found for the switching routes in non-monopoly markets are even more pronounced than for the whole sample showing reductions in the number of departures from 7.2 percent in the short-term to 9.3 percent in the long-term and reductions in the number of passengers from 7.3 percent in the short-term to 10 percent in the long-term.

Regarding potential entry-inducing effects, we find that the change in the number of carriers does not react after merger-related exits in the short- and medium-term, but increases

[20] After excluding the exits of the six carriers involved in the large mergers, 38 routes for merger exits on switching routes, 9 routes for merger exits on overlapping routes and 799 routes for operational exits remain in the dataset.

by 0.056 carriers (switching routes) and 0.049 carriers (overlapping routes) in the long-term. On the contrary, for the sub-sample of small-mergers (see Table 16) we find that entry materializes even in the medium and short run. Furthermore, the entry-inducing effects of small mergers are substantially larger than for the group of all mergers and of similar size as the entry-inducing effects of liquidation exits and operational exits. As we see from the descriptive statistics both for the merger exits with route switching (Table 10) and the merger exits on overlapping routes (Table 11), the countervailing effect of induced entries seems to be sufficient to drive down real prices (at least in the long term) to pre-exit levels.

In a nutshell, our analysis of the effects of merger-related firm exits shows that price increases and quantity reductions are not only an issue on the overlapping parts of the merging firm's networks but can also play a role on its complementary parts (so-called switching routes). These results support previous findings on reduced competition due to an increase in multimarket contact, however, might also be explained by changes in the pricing strategy of the acquired carrier, increased airport dominance, or the increase in quality achieved by the interconnection of the two networks. Interestingly, in case of monopoly routes (in which prices have already been high before the merger was settled) we do not observe any price increases post-merger but even a price decrease in the long run. Although this finding might not be too surprising – basically because the merged entity would reduce profits by raising the price above the existing monopoly level – the observed yield reductions can be interpreted as an indication for the realization of merger efficiencies (which also a monopolist is partly passing-on downstream to the final customers in the form of price reductions).

The observed effects on overlapping routes are largely found to be driven by the large mergers (especially the Delta Air Lines – Northwest Airlines merger) since networks have been (almost) fully complementary for the smaller mergers. Although quantity effects have been persistent and concentration has risen substantially, the price effects are mostly found in the short run and vanish over time. This can also be interpreted as a further indication for realized merger efficiencies.

Entry is found to take place rather quickly in case of liquidation exits and small mergers. However, for the entire group of mergers entry-inducing effects only materialize in the long run. It can therefore be concluded that particularly large mergers appear to (temporarily) reduce the incentives of other carriers to enter the respective routes. This observation is

reasonable as the merger led to increased market shares of the merged entity thereby, ceteris paribus, reducing the entry incentives of competitors. However, in the long run, entry might become attractive again, e.g., due to restructuring activities of the merged carrier and/or quality problems that materialize during the post-merger integration process.

4.5 POLICY IMPLICATIONS

Our empirical results allow the derivation of several important policy conclusions especially for unilateral effects analysis as part of horizontal merger assessments. First, given our result that the price and quantity effects of liquidation exits are much more pronounced than the respective effects of merger-related exits, on the surface, it could be concluded that avoiding liquidation through merger benefits consumers and society. In other words, our results apparently support the so-called failing firm defense which allows the clearance of (partly) anticompetitive mergers in cases in which one of the merging firms is at the verge of bankruptcy. However, despite the obvious advantages of smaller price increases and better service options, the net welfare effects of such 'failing firm mergers' remain unclear, e.g., due to possible negative effects on the merged carrier and the industry triggered by the prevention of the exit of (inefficient) capacity from the industry (and dissuading entry by potential competitors) or substantial problems in the integration of the merging carriers. Furthermore, it must be reminded that our data set only contains mergers which have been approved by the Department of Justice (DOJ). Although wrong decisions on the side of the DOJ cannot be ruled out completely, it seems very unlikely that the approved mergers were in fact anticompetitive and should have been prohibited.

Second, with respect to mergers, our results reveal that larger mergers, ceteris paribus, lead to significant and partly permanent price increases first and foremost not – as expected by theory – on the overlapping parts of the route network but on routes in which the operating airline simply switched as a consequence of the merger. Any analyst studying the competitive effects of a horizontal merger is therefore well advised to consider potential effects not only on the overlapping part of the network but on non-overlapping parts as well in order to come to meaningful conclusions on the unilateral effects of the merger proposal.

Third, still focusing on mergers, we find evidence for the realization of merger efficiencies for large mergers only. While in the short run, significant price increases on both switching and overlapping routes were observed, these effects either disappear or are reduced substantially in the long run. As we control for the number of firms (and the other key yield

drivers) in our regressions, the observed price reductions must be associated with the realization and the pass-on of merger efficiencies. Furthermore, our finding of significant price reductions for the case of monopoly routes – in which by definition competition is excluded as alternative driver of price reductions – can be interpreted as further indication for the existence of merger efficiencies which are (at least partly) passed on to the customers in the form of lower prices. Although antitrust policy might still be well-advised to keep up the rather skeptical approach with respect to merger efficiencies when it comes to a weighting of pro- and anticompetitive effects as part of the merger control procedure, our study suggests that these efficiencies are existent to a degree that allows the reversion of the price increases observed immediately after the completion of the merger.

Fourth, our analysis shows that especially large mergers have an entry-dissuading effect in the short and medium run. In contrast, liquidation-related exits are found to cause immediate entry-inducing effects. Although an econometric analysis of the price effects of these subsequent entries is beyond the scope of this paper, theory and descriptive evidence presented above suggests for the group of merger-related exits that they are strong enough to reverse the short-term price increases post-merger.[21] Although this finding is an encouraging sign for the workability of competition in the U.S. airline industry, horizontal merger assessments remain an important part of public policy in the U.S. airline industry. This is particularly true as our merger sample only includes mergers with largely complementary networks (which received antitrust clearance beforehand) and other (potentially anticompetitive) mergers would have faced severe difficulties to receive clearance from the antitrust authority.[22]

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[21] For the group of liquidation-related exits, our analysis reveals that entry activities cannot drive average prices down to the pre-exit level.

[22] 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.

5 SUMMARY AND CONCLUSION

In the last decade, the domestic U.S. airline industry has experienced a substantial consolidation trend. In addition to a number of high level mergers such as American Airlines – Trans World Airlines (2001), America West – US Airways (2005) and Delta Air Lines – Northwest Airlines (2009), several smaller carriers such as National Airlines (2002), Independence Air (2006) and ATA Airlines (2008) had to leave the industry.

Despite this high relevance of firm exits for the recent development of the domestic U.S. airline industry, empirical evidence on the effects of these consolidations is rare. Studies focusing on the market impact of liquidations do not exist to the best of our knowledge and existing studies on the competitive effects of airline mergers almost exclusively stem from the 1980s and focus on the specific case of a largely overlapping route network of the merging parties (due to a shared hub). However, such a network structure is rather uncommon in recent mergers and therefore raises the demand for both a new conceptual framework for investigating firm exits in the airline industry and a corresponding new empirical analysis of the effects of such firm exits.

Against this background, we study the effects of firm exits on prices, different measures of quantity and entry in the domestic U.S. airline industry from 1995 to 2010. Applying fixed effects models we find that liquidation-related exits have, in the short run, a substantial effect on average yield. Interestingly, the effect is found to be persistent over time. Turning to the effects on quantity, our analysis reveals that firm exits due to liquidation lead to a large decrease in capacity and demand. Furthermore, a large and quite persistent entry-inducing effect is observed shortly after liquidation exits.

The effects of merger-related exits are assessed for two different route types: overlapping routes and switching routes (i.e., routes which experience a merger-induced switch of the operating airline). In the short run, estimation results show a significant price increase on both route types. In the long run, however, it is found that these price increases vanish. Prices even decrease on switching monopoly routes. Both findings can be interpreted as clear indications for the realization and pass-on of merger efficiencies. The capacity and demand reductions following firm exit through merger are generally smaller than those for liquidation-related exits. Entry is only induced to a small degree in the long run. However, for the sub-sample of

small mergers moderate entry takes place relatively early after the completion of the merger.

Finally, it is worth mentioning that our approach to study the competitive effects of firm exit allows the derivation of several avenues for future research. In addition to possible changes in the empirical strategy or the application of alternative estimation approaches, a particularly interesting research area is econometric case studies of the effects of particularly large mergers. Such investigations would not only allow a much more detailed assessment of the competitive effects, e.g., through the construction of much more detailed route categories, but would also enable ex-post evaluations of the respective merger decisions of the antitrust authority. Such case-study related research is therefore likely to create important positive spillover effects on the welfare-improving impact of antitrust policy in general and the quality of future merger assessments in particular.

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APPENDIX

Table 9: 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)	2.829	(0.662)	2.859	(0.661)	2.867	(0.665)	2.872	(0.665)
non-stop yield	21.471	(17.321)	22.089	(17.532)	22.337	(17.832)	22.508	(18.177)
ln(departures)	6.991	(0.812)	6.882	(0.904)	6.990	(0.838)	6.922	(0.875)
departures	1,476	(1,236)	1,392	(1,229)	1,494	(1275)	1,430	(1268)
ln(Passengers)	11.328	(0.911)	11.203	(0.994)	11.352	(0.917)	11.256	(0.964)
Passengers	122,031	(113,940)	112,891	(109,714)	124,630	(114,913)	117,285	(113,523)
Δ # airlines w/o exit	0.064	(0.370)	0.283	(0.520)	0.018	(0.306)	0.031	(0.349)
post-exit monopoly	0.425	(0.495)	0.425	(0.495)	0.425	(0.494)	0.423	(0.494)
# airlines w/o exit	1.541	(0.950)	1.825	(0.910)	1.447	(0.959)	1.817	(0.882)
# LCCs w/o exit	0.398	(0.564)	0.404	(0.571)	0.339	(0.526)	0.429	(0.596)
avg. plane size	117.156	(42.346)	114.341	(45.406)	121.731	(41.209)	114.559	(45.722)
ln(one-stop yield)	2.733	(1.151)	2.798	(1.019)	2.840	(1.006)	2.807	(1.032)
missing one-stop yield	0.025	(0.156)	0.016	(0.127)	0.015	(0.122)	0.017	(0.128)
airport size	1.843	(0.807)	1.827	(0.800)	1.848	(0.797)	1.831	(0.800)
ln(# establ.)	11.589	(0.743)	11.593	(0.744)	11.573	(0.743)	11.607	(0.745)
ln(avg. weekly wage)	6.682	(0.170)	6.695	(0.167)	6.658	(0.175)	6.716	(0.165)
ln(labor force)	14.492	(0.685)	14.494	(0.684)	14.482	(0.686)	14.502	(0.684)
Year	2004	(3.737)	2004	(3.756)	2003	(3.766)	2005	(3.753)
Quarter 2	0.228	(0.420)	0.219	(0.414)	0.251	(0.433)	0.252	(0.434)
Quarter 3	0.285	(0.452)	0.228	(0.420)	0.250	(0.433)	0.246	(0.430)
Quarter 4	0.268	(0.443)	0.285	(0.452)	0.249	(0.432)	0.249	(0.433)
Observations	918		918		7,319		7,271	

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 10: 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)	2.594	(0.527)	2.603	(0.512)	2.607	(0.538)	2.609	(0.489)
non-stop yield	15.477	(9.338)	15.512	(9.221)	15.820	(9.966)	15.389	(8.364)
ln(departures)	7.010	(0.852)	7.025	(0.827)	6.994	(0.830)	7.057	(0.844)
departures	1,525	(1,206)	1,532	(1,223)	1,486	(1,179)	1,598	(1,275)
ln(Passengers)	11.687	(0.827)	11.660	(0.826)	11.673	(0.815)	11.709	(0.838)
Passengers	161,172	(122,384)	157,622	(122,376)	158,124	(120,170)	167,396	(132,690)
Δ # airlines w/o exit	-0.005	(0.204)	0.005	(0.297)	-0.008	(0.274)	0.014	(0.242)
post-exit monopoly	0.276	(0.448)	0.276	(0.448)	0.276	(0.447)	0.259	(0.438)
# airlines w/o exit	1.005	(0.814)	1.009	(0.844)	1.051	(0.860)	1.083	(0.865)
# LCCs w/o exit	0.498	(0.528)	0.493	(0.554)	0.503	(0.550)	0.543	(0.582)
avg. plane size	143.387	(23.694)	142.432	(24.771)	144.700	(25.261)	141.724	(24.495)
ln(one-stop yield)	2.645	(0.625)	2.658	(0.616)	2.635	(0.705)	2.679	(0.603)
missing one-stop yield	0.000	(0.000)	0.000	(0.000)	0.003	(0.059)	0.000	(0.000)
airport size	2.107	(0.759)	2.140	(0.770)	2.125	(0.740)	2.141	(0.799)
ln(# establ.)	11.389	(0.583)	11.391	(0.579)	11.369	(0.583)	11.405	(0.576)
ln(avg. weekly wage)	6.690	(0.175)	6.682	(0.166)	6.647	(0.172)	6.703	(0.157)
ln(labor force)	14.310	(0.515)	14.312	(0.515)	14.297	(0.517)	14.320	(0.513)
Year	2004	(3.915)	2004	(4.096)	2003	(4.079)	2005	(3.931)
Quarter 2	0.207	(0.406)	0.069	(0.254)	0.250	(0.433)	0.267	(0.443)
Quarter 3	0.373	(0.485)	0.207	(0.406)	0.249	(0.433)	0.231	(0.422)
Quarter 4	0.350	(0.478)	0.373	(0.485)	0.250	(0.433)	0.233	(0.423)
Observations	217		217		1,734		1,620	

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 11: 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)	3.060	(0.687)	3.121	(0.713)	3.132	(0.689)	3.079	(0.700)
non-stop yield	26.741	(18.466)	28.805	(20.195)	28.813	(19.850)	27.600	(19.625)
ln(departures)	7.059	(0.671)	7.032	(0.661)	7.061	(0.654)	7.070	(0.658)
departures	1,492	(1,338)	1,449	(1,328)	1,480	(1299)	1,506	(1420)
ln(Passengers)	11.414	(0.795)	11.309	(0.838)	11.471	(0.771)	11.441	(0.813)
Passengers	129,407	(139,133)	121,612	(142,607)	135,024	(141,801)	134,591	(149,189)
Δ # airlines w/o exit	-0.025	(0.158)	0.038	(0.250)	0.005	(0.222)	0.016	(0.226)
post-exit monopoly	0.468	(0.502)	0.468	(0.502)	0.468	(0.499)	0.448	(0.498)
# airlines w/o exit	0.772	(1.208)	0.810	(1.220)	0.739	(1.180)	0.890	(1.281)
# LCCs w/o exit	0.241	(0.459)	0.278	(0.505)	0.201	(0.413)	0.310	(0.515)
avg. plane size	108.889	(38.023)	105.433	(39.557)	114.517	(37.854)	111.790	(41.470)
ln(one-stop yield)	2.760	(1.311)	2.973	(0.964)	2.925	(1.079)	2.921	(1.124)
missing one-stop yield	0.038	(0.192)	0.013	(0.113)	0.021	(0.142)	0.022	(0.146)
airport size	1.745	(0.697)	1.759	(0.688)	1.789	(0.694)	1.781	(0.689)
ln(# establ.)	11.502	(0.672)	11.492	(0.679)	11.503	(0.661)	11.535	(0.690)
ln(avg. weekly wage)	6.841	(0.132)	6.800	(0.132)	6.791	(0.128)	6.819	(0.124)
ln(labor force)	14.460	(0.600)	14.456	(0.602)	14.458	(0.594)	14.488	(0.609)
Year	2008	(2.885)	2008	(3.226)	2007	(3.099)	2009	(3.299)
Quarter 2	0.101	(0.304)	0.025	(0.158)	0.250	(0.433)	0.310	(0.463)
Quarter 3	0.139	(0.348)	0.101	(0.304)	0.250	(0.433)	0.183	(0.387)
Quarter 4	0.734	(0.445)	0.139	(0.348)	0.250	(0.433)	0.196	(0.398)
Observations	79		79		632		509	

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 12: Summary statistics – liquidation exits

	before/of exit		after exit		period before exit		period after exit	
	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.
ln(non-stop yield)	2.373	(0.525)	2.487	(0.534)	2.420	(0.534)	2.483	(0.547)
non-stop yield	12.337	(6.898)	13.997	(8.709)	13.250	(9.549)	14.157	(9.439)
ln(departures)	7.263	(0.733)	7.059	(0.841)	7.263	(0.790)	7.133	(0.798)
Departures	1,819	(1,323)	1,560	(1,182)	1,900	(1523)	1,639	(1145)
ln(Passengers)	11.896	(0.743)	11.699	(0.853)	11.903	(0.773)	11.798	(0.810)
Passengers	189,951	(144,791)	167,394	(143,222)	195,816	(157,550)	177,768	(132,856)
Δ # airlines w/o exit	0.023	(0.151)	0.205	(0.408)	0.006	(0.262)	0.031	(0.365)
post-exit monopoly	0.318	(0.471)	0.318	(0.471)	0.318	(0.466)	0.318	(0.466)
# airlines w/o exit	2.023	(1.285)	2.227	(1.309)	2.034	(1.331)	2.230	(1.155)
# LCCs w/o exit	0.295	(0.462)	0.409	(0.497)	0.276	(0.447)	0.517	(0.594)
avg. plane size	146.421	(42.781)	147.572	(46.584)	147.936	(43.786)	149.001	(44.010)
ln(one-stop yield)	2.492	(0.678)	2.583	(0.668)	2.532	(0.659)	2.536	(0.660)
missing one-stop yield	0.000	(0.000)	0.000	(0.000)	0.000	(0.000)	0.000	(0.000)
airport size	2.057	(0.735)	1.945	(0.715)	2.051	(0.722)	1.996	(0.725)
ln(# establ.)	11.809	(0.619)	11.815	(0.618)	11.788	(0.620)	11.832	(0.614)
ln(avg. weekly wage)	6.746	(0.180)	6.764	(0.147)	6.710	(0.147)	6.771	(0.152)
ln(labor force)	14.684	(0.578)	14.689	(0.577)	14.672	(0.571)	14.695	(0.569)
Year	2004	(2.548)	2004	(2.726)	2003	(2.566)	2005	(2.566)
Quarter 2	0.000	(0.000)	0.273	(0.451)	0.250	(0.434)	0.250	(0.434)
Quarter 3	0.432	(0.501)	0.000	(0.000)	0.250	(0.434)	0.250	(0.434)
Quarter 4	0.295	(0.462)	0.432	(0.501)	0.250	(0.434)	0.250	(0.434)
Observations	44		44		352		352	

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 13: Fixed effects regressions for the effect of exits on non-stop yield (excluding large mergers)

	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	0.065***	(0.006)	0.057***	(0.007)	0.071***	(0.006)	0.060***	(0.007)	0.060***	(0.006)	0.050***	(0.007)
merger exit (switching)	0.003	(0.022)	0.000	(0.023)	0.003	(0.022)	-0.003	(0.023)	0.011	(0.025)	0.006	(0.027)
merger exit (overlap)	-0.086	(0.054)	-0.087	(0.054)	-0.066	(0.054)	-0.067	(0.054)	-0.066	(0.056)	-0.067	(0.056)
liquidation exit	0.125***	(0.017)	0.111***	(0.020)	0.129***	(0.017)	0.117***	(0.018)	0.113***	(0.017)	0.105***	(0.019)
Op. exit # monopoly			0.018*	(0.010)			0.025**	(0.010)			0.023**	(0.010)
m. ex. (sw.) # monopoly			0.033	(0.055)			0.075	(0.062)			0.061	(0.052)
m. ex. (ov.) # monopoly			-				-				-	
liquid. exit # monopoly			0.042	(0.035)			0.039	(0.037)			0.023	(0.036)
# airlines w/o exit	-0.019***	(0.006)	-0.018***	(0.006)	-0.022***	(0.006)	-0.019***	(0.006)	-0.035***	(0.005)	-0.034***	(0.005)
# LCCs w/o exit	-0.103***	(0.016)	-0.102***	(0.016)	-0.104***	(0.014)	-0.103***	(0.014)	-0.094***	(0.013)	-0.093***	(0.013)
Avg. plane size	-0.001***	(0.000)	-0.001***	(0.000)	-0.000**	(0.000)	-0.000**	(0.000)	-0.000*	(0.000)	-0.000*	(0.000)
ln(one-stop yield)	0.355***	(0.029)	0.354***	(0.029)	0.383***	(0.027)	0.382***	(0.027)	0.368***	(0.033)	0.369***	(0.033)
missing one-stop yield	2.439***	(0.204)	2.434***	(0.205)	2.642***	(0.194)	2.639***	(0.194)	2.533***	(0.236)	2.532***	(0.237)
airport size (mean)	-0.042*	(0.022)	-0.042*	(0.022)	-0.036*	(0.021)	-0.036*	(0.021)	-0.028	(0.020)	-0.028	(0.020)
ln(# establ.) (mean)	0.452***	(0.119)	0.461***	(0.119)	0.337***	(0.109)	0.359***	(0.110)	0.118	(0.096)	0.139	(0.097)
ln(avg. weekly wage)	0.171***	(0.066)	0.172***	(0.066)	0.178***	(0.057)	0.180***	(0.057)	0.190***	(0.058)	0.190***	(0.058)
ln(labor force)	0.615**	(0.250)	0.621**	(0.250)	0.605**	(0.241)	0.600**	(0.241)	0.676***	(0.208)	0.664***	(0.208)
Year	-0.057***	(0.006)	-0.058***	(0.006)	-0.048***	(0.005)	-0.049***	(0.005)	-0.027***	(0.004)	-0.028***	(0.004)
Quarter 2	-0.016***	(0.004)	-0.016***	(0.004)	-0.015***	(0.004)	-0.015***	(0.004)	-0.007**	(0.003)	-0.007**	(0.003)
Quarter 3	-0.043***	(0.006)	-0.043***	(0.006)	-0.038***	(0.005)	-0.038***	(0.005)	-0.025***	(0.004)	-0.025***	(0.004)
Quarter 4	-0.068***	(0.007)	-0.068***	(0.007)	-0.060***	(0.006)	-0.061***	(0.006)	-0.045***	(0.005)	-0.045***	(0.005)
Constant	101.280***	(10.025)	101.959***	(10.046)	84.567***	(8.546)	85.556***	(8.562)	44.498***	(6.281)	45.015***	(6.280)
R^2	0.264/0.108/0.109		0.265/0.105/0.105		0.274/0.150/0.150		0.276/0.144/0.144		0.254/0.186/0.185		0.256/0.181/0.180	
Observations	8,875		8,875		10,655		10,655		14,152		14,152	
Routes	890		890		890		890		890		890	

*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.

Table 14: Fixed effects regressions for the effect of exits on number of departures (excluding large mergers)

	ln(departures) – short term				ln(departures) – medium term				ln(departures) – long term			
Variables	**coef.**	**(s.e.)**	**coef.**	**(s.e.)**	**coef.**	**(s.e.)**	**coef.**	**(s.e.)**	**coef.**	**(s.e.)**	**coef.**	**(s.e.)**
operational exit	-0.216***	(0.013)	-0.133***	(0.013)	-0.209***	(0.013)	-0.131***	(0.013)	-0.210***	(0.013)	-0.142***	(0.013)
merger exit (switching)	-0.089***	(0.032)	-0.072**	(0.031)	-0.060*	(0.031)	-0.062*	(0.032)	-0.077**	(0.037)	-0.093**	(0.038)
merger exit (overlap)	-0.044	(0.045)	-0.036	(0.045)	-0.036	(0.055)	-0.029	(0.056)	-0.044	(0.065)	-0.039	(0.065)
liquidation exit	-0.173***	(0.033)	-0.143***	(0.036)	-0.175***	(0.029)	-0.148***	(0.035)	-0.186***	(0.031)	-0.169***	(0.039)
op. exit # monopoly			-0.186***	(0.027)			-0.175***	(0.024)			-0.157***	(0.022)
m. exit (sw.)#monopoly			-0.193	(0.130)			0.039	(0.072)			0.212**	(0.095)
m. exit (ov.) # monopoly												
liq. exit # monopoly			-0.082	(0.070)			-0.076	(0.055)			-0.037	(0.053)
# airlines w/o exit	0.158***	(0.015)	0.140***	(0.015)	0.155***	(0.015)	0.139***	(0.015)	0.146***	(0.015)	0.137***	(0.015)
# LCCs w/o exit	0.058**	(0.029)	0.052*	(0.029)	0.084***	(0.026)	0.075***	(0.026)	0.094***	(0.023)	0.085***	(0.023)
Avg. plane size	-0.004***	(0.001)	-0.004***	(0.001)	-0.004***	(0.001)	-0.004***	(0.001)	-0.005***	(0.001)	-0.005***	(0.001)
airport size (mean)	0.769***	(0.051)	0.773***	(0.049)	0.781***	(0.053)	0.787***	(0.050)	0.791***	(0.052)	0.795***	(0.049)
ln(# establ.) (mean)	0.433**	(0.218)	0.308	(0.212)	0.675***	(0.209)	0.511**	(0.201)	0.690***	(0.188)	0.558***	(0.184)
ln(avg. weekly wage) (mean)	0.718***	(0.128)	0.720***	(0.125)	0.747***	(0.120)	0.756***	(0.119)	0.714***	(0.109)	0.737***	(0.108)
ln(labor force) (mean)	0.906*	(0.474)	0.891*	(0.468)	0.523	(0.454)	0.561	(0.453)	0.159	(0.399)	0.211	(0.397)
Year	-0.021**	(0.010)	-0.018*	(0.010)	-0.020**	(0.009)	-0.016*	(0.009)	-0.012*	(0.007)	-0.011	(0.007)
Quarter 2	0.068***	(0.009)	0.069***	(0.009)	0.065***	(0.009)	0.066***	(0.008)	0.065***	(0.007)	0.067***	(0.007)
Quarter 3	0.068***	(0.011)	0.070***	(0.011)	0.065***	(0.010)	0.067***	(0.010)	0.062***	(0.009)	0.064***	(0.009)
Quarter 4	-0.014	(0.010)	-0.011	(0.010)	-0.021**	(0.009)	-0.018*	(0.009)	-0.019**	(0.008)	-0.017**	(0.008)
Constant	25.667	(16.458)	19.999	(16.467)	24.827	(15.124)	19.125	(15.019)	15.670	(12.391)	13.304	(12.270)
R^2 (within/between/overall)	0.220/0.203/0.194		0.237/0.215/0.207		0.239/0.221/0.211		0.259/0.236/0.227		0.257/0.264/0.254		0.275/0.283/0.272	
Observations	8,875		8,875		10,655		10,655		14,152		14,152	
Routes	890		890		890		890		890		890	

*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.

Table 15: Fixed effects regressions for the effect of exits on number of passengers (excluding large mergers)

	ln(passengers) – short term				ln(passengers) – medium term				ln(passengers) – long term			
Variables	**coef.**	**(s.e.)**	**coef.**	**(s.e.)**	**coef.**	**(s.e.)**	**coef.**	**(s.e.)**	**coef.**	**(s.e.)**	**coef.**	**(s.e.)**
operational exit	-0.186***	(0.012)	-0.104***	(0.013)	-0.181***	(0.013)	-0.102***	(0.013)	-0.187***	(0.013)	-0.117***	(0.013)
merger exit (switching)	-0.091***	(0.029)	-0.073***	(0.028)	-0.060**	(0.028)	-0.064**	(0.029)	-0.075**	(0.034)	-0.100***	(0.033)
merger exit (overlap)	-0.053	(0.041)	-0.044	(0.041)	-0.013	(0.053)	-0.006	(0.053)	-0.035	(0.060)	-0.030	(0.060)
liquidation exit	-0.150***	(0.040)	-0.075**	(0.037)	-0.161***	(0.039)	-0.091**	(0.037)	-0.182***	(0.036)	-0.131***	(0.040)
op. exit # monopoly			-0.183***	(0.027)			-0.177***	(0.025)			-0.160***	(0.022)
m. ex. (sw.) # monopoly			-0.202*	(0.111)			0.067	(0.093)			0.338***	(0.091)
m. ex. (ov.) # monopoly												
liq. exit # monopoly			-0.223**	(0.089)			-0.208**	(0.083)			-0.147**	(0.067)
# airlines w/o exit	0.139***	(0.014)	0.122***	(0.014)	0.136***	(0.014)	0.121***	(0.014)	0.130***	(0.014)	0.122***	(0.013)
# LCCs w/o exit	0.084***	(0.030)	0.076**	(0.030)	0.111***	(0.027)	0.100***	(0.026)	0.119***	(0.023)	0.108***	(0.023)
avg. plane size	0.005***	(0.001)	0.005***	(0.001)	0.004***	(0.001)	0.004***	(0.001)	0.004***	(0.001)	0.004***	(0.001)
airport size (mean)	1.014***	(0.054)	1.018***	(0.052)	1.003***	(0.057)	1.008***	(0.054)	0.981***	(0.054)	0.985***	(0.051)
ln(# establ.) (mean)	0.272	(0.214)	0.169	(0.205)	0.544***	(0.206)	0.398**	(0.195)	0.605***	(0.187)	0.484***	(0.180)
ln(avg. weekly wage) (mean)	0.560***	(0.131)	0.557***	(0.129)	0.649***	(0.123)	0.652***	(0.123)	0.695***	(0.111)	0.714***	(0.112)
ln(labor force) (mean)	1.080**	(0.474)	1.047**	(0.465)	0.595	(0.451)	0.617	(0.444)	0.180	(0.393)	0.219	(0.384)
Year	-0.007	(0.010)	-0.003	(0.010)	-0.007	(0.009)	-0.003	(0.009)	-0.000	(0.007)	0.002	(0.007)
Quarter 2	0.152***	(0.009)	0.153***	(0.009)	0.149***	(0.009)	0.150***	(0.009)	0.153***	(0.007)	0.155***	(0.007)
Quarter 3	0.137***	(0.012)	0.139***	(0.012)	0.136***	(0.010)	0.138***	(0.010)	0.138***	(0.009)	0.140***	(0.009)
Quarter 4	0.026**	(0.011)	0.029***	(0.011)	0.016	(0.010)	0.020**	(0.010)	0.017*	(0.009)	0.019**	(0.009)
Constant	0.129	(16.776)	-5.666	(16.807)	3.813	(15.627)	-2.274	(15.571)	-5.273	(12.860)	-7.886	(12.813)
R^2 (within/between/overall)	0.271/0.270/0.260		0.287/0.283/0.273		0.272/0.300/0.288		0.292/0.315/0.303		0.272/0.348/0.333		0.290/0.363/0.349	
Observations	8,875		8,875		10,655		10,655		14,152		14,152	
Routes	890		890		890		890		890		890	

*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.

Table 16: Fixed effects regressions for the effects of exits on entry (excluding large mergers)

	Δ airlines w/o exiting/merger - short term		**Δ airlines w/o exiting/merger – medium term**		**Δ airlines w/o exiting/merger - long term**	
	coef.	(s.e.)	coef.	(s.e.)	coef.	(s.e.)
operational exit	0.204***	(0.015)	0.167***	(0.014)	0.170***	(0.013)
merger exit (switching)	0.058	(0.039)	0.063**	(0.029)	0.110***	(0.027)
merger exit (overlap)	0.182**	(0.088)	0.150**	(0.065)	0.184***	(0.048)
liquidation exit	0.125***	(0.043)	0.111**	(0.044)	0.157***	(0.040)
# airlines w/o exit (lag)	-0.390***	(0.019)	-0.350***	(0.016)	-0.303***	(0.013)
# LCCs w/o exit (lag)	0.027	(0.031)	0.029	(0.026)	0.018	(0.020)
avg. plane size	-0.004***	(0.001)	-0.004***	(0.000)	-0.004***	(0.000)
airport size (mean)	0.289***	(0.046)	0.264***	(0.041)	0.258***	(0.033)
ln(# establ.) (mean)	-0.371	(0.312)	-0.281	(0.250)	-0.243	(0.161)
ln(avg. weekly wage) (mean)	0.013	(0.155)	-0.125	(0.121)	-0.066	(0.095)
ln(labor force) (mean)	-2.197***	(0.521)	-1.768***	(0.424)	-1.244***	(0.295)
Year	0.044***	(0.011)	0.020**	(0.009)	-0.011*	(0.006)
Quarter 2	0.011	(0.012)	0.001	(0.010)	0.006	(0.008)
Quarter 3	-0.015	(0.012)	-0.032***	(0.010)	-0.031***	(0.008)
Quarter 4	0.038***	(0.014)	0.027**	(0.012)	0.008	(0.010)
Constant	-51.711***	(18.160)	-8.963	(15.949)	44.411***	(10.974)
R^2 (within/between/overall)	0.215 / 0.002 / 0.002		0.192 / 0.002 / 0.003		0.172 / 0.002 / 0.004	
Observations	8,838		10,618		14,115	
Routes	890		890		890	

*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.