Hüschelrath, Kai; Müller, Kathrin

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Low Cost Carriers and the Evolution of the U.S. Airline Industry

Kai Hüschelrath and Kathrin Müller

ZEW

Zentrum für Europäische Wirtschaftsforschung GmbH

Centre for European Economic Research

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Low Cost Carriers and the Evolution of the U.S. Airline Industry

Kai Hüschelrath and Kathrin Müller

NON-TECHNICAL SUMMARY

Since the deregulation of the U.S. airline industry in 1978, a substantial number of new carriers emerged; particularly those following a low cost strategy. Given those airlines' rapid growth and market success the U.S. Department of Transportation (DOT) already identified a so called `low cost airline service revolution' back in 1997.

Almost fifteen years after the drafting of the DOT report, the low cost airline service revolution has not only continued – reflected in an increase of the domestic passenger market share from about 13 percent in 1997 to about 28 percent in 2009 – but also led to a substantial rise in the competitive interaction between network carriers and low cost carriers. Against this background of a substantial and further increasing relevance of low cost carriers, the paper aims at developing a comprehensive perspective of the evolution of the domestic U.S. airline industry in recent years.

We find that network carriers (NWCs) und low-cost carrier (LCCs) each entered about 1,200 non-stop routes between 1996 and 2009. While entry activity of NWCs was much more pronounced between 1996 and 2003, LCCs have entered more markets per year since 2004. On the other hand, exit activity is much more pronounced for NWCs with in sum about 2,250 route exits, compared to only 391 exits on the side of the LCCs. A substantial fraction of the NWC exits were triggered by external and internal shocks such as recession or merger activity. Especially the entry activity in the largest 1,000 markets caused a general downward trend in concentration for the sample period as indicated by the Herfindahl-Hirschman Index developments.

Accordingly, we observed a substantial downward trend in average domestic fare prices. While NWC experienced a substantial increase in average cost (excluding fuel costs), LCCs managed to lower their average cost over the years even further. Not surprisingly, while none of the NWCs managed to realize a net operating profit in the period from 2000 to 2009, all LCCs can report such a net operating profit.

DAS WICHTIGSTE IN KÜRZE

Nach der Deregulierung des US-amerikanischen Luftverkehrs im Jahr 1978 trat eine Vielzahl an neuen Luftverkehrsunternehmen in den Markt ein, die überwiegend eine Niedrigkostenstrategie verfolgten. Da diese „Billigfluglinien“ ein rasantes Wachstum zu verzeichnen hatten und mit ihrem Geschäftsmodell erstaunlich erfolgreich waren, identifiziert das US-Verkehrsministerium (DOT) in einem Bericht bereits im Jahre 1997 eine „low cost airline service revolution“.

Beinahe fünfzehn Jahre nach der Veröffentlichung dieses Berichts zeigt sich, dass sich besagte “Revolution“ nicht nur fortgesetzt hat – so ist Marktanteil der Billigflieger am gesamten inneramerikanischen Markt im Zeitraum von 1997 bis 2009 von 13 v.H. auf 28 v.H. gestiegen – sondern dass sich insbesondere auch die wettbewerbliche Interaktion mit den etablierten Fluglinien deutlich intensiviert hat.

Vor diesem Hintergrund einer wachsenden Bedeutung der Billigfluglinien verfolgt diese Studie das Ziel, einen umfassenden Überblick über neuere Entwicklungen in der inneramerikanischen Luftverkehrsbranche zu geben.

Wir stellen fest, dass sowohl die traditionellen Fluggesellschaften als auch die Billigflieger im Zeitraum von 1996 bis 2009 jeweils etwa 1.200 neue Direktverbindungen starteten. In ihrer Summe stellten die traditionellen Fluggesellschaften im gleichen Zeitraum aber auch etwa 2.250 Verbindungen ein, während die Billigflieger in der Summe nur 391 Direktverbindungen einstellten. Ein substantieller Anteil dieser Austritte lässt sich in Zeiten schwerer externer und interner Schocks wie Rezessionen, der Terroranschläge vom 11. September 2001 und Fusionsaktivitäten diagnostizieren. Als Konsequenz der starken Markteintrittsaktivität in diesem Zeitraum ist ein eindeutiger Abwärtstrend in der Konzentration, gemessen durch den Herfindahl-Hirschman-Index, auf den Top 1,000 Strecken zu beobachten.

Dementsprechend sind auch die durchschnittlichen Flugpreise für Inlandsreisen im Zeitablauf deutlich gefallen. Während die durchschnittlichen Kosten (ohne Energiekosten) für die Gruppe der traditionellen Fluglinien in den letzten 15 Jahren deutlich angestiegen sind, konnten die Billigfluglinien ihren Kostenvorteil weiter ausbauen. Nicht überraschend ist daher, dass keine der traditionellen Fluggesellschaften zwischen 2000 und 2009 ein positives Geschäftsergebnis verzeichnen konnte, während dies allen amerikanischen Billigfluglinien gelang.

LOW COST CARRIERS AND THE EVOLUTION OF THE U.S. AIRLINE INDUSTRY

Kai Hüschelrath[♣] and Kathrin Müller[*]

July 2011

Abstract
The article studies the evolution of the U.S airline industry from 1995 to 2009 using T-100 traffic data and DB1B fare data from the U.S. Department of Transportation. Based on a differentiation in market size and major players, entry and exit, concentration, fares, service, costs and profits, the article provides a fresh look on recent developments in the structure, conduct and performance of the domestic U.S. airline industry in light of both the substantial growth of low cost carriers and severe internal and external shocks such as merger and bankruptcy activity or the recent recession. Unlike previous studies, a consistent split of the analysis in network carriers and low cost carriers is introduced. In general, we find that the competitive interaction between network carriers and low cost carriers increased substantially throughout the last decade and must be considered as the main driver of competition in the domestic U.S. airline industry.

Keywords Airline industry, deregulation, network carrier, low cost carrier

JEL Class L40, L93

[♣] Senior Researcher, ZEW Centre for European Economic Research, Department for Industrial Economics and International Management, P.O. Box 10 34 43, D-68034 Mannheim, Germany, E-mail: hueschelrath@zew.de; Assistant Professor for Industrial Organization and Competitive Strategy, WHU Otto Beisheim School of Management, Burgplatz 2, 56179 Vallendar, Germany.

[*] Researcher, ZEW Centre for European Economic Research, Department for Industrial Economics and International Management, P.O. Box 10 34 43, D-68034 Mannheim, Germany, E-mail: kathrin.mueller@zew.de. We are indebted to Volodymyr Bilotkach (University of California, Irvine, USA) for his advice during the construction of the data-set.

1 Introduction

In 1997, the U.S. Department of Transportation (DOT) published a report on the `low cost airline service revolution'. The report not only identified that a growing fraction of passengers are benefiting from low cost carriers through lower fares but also predicted that this "… watershed development in domestic aviation … is having a profound effect on efficiency, competition, consumers and industry structure." [1] In particular, although the report expects a certain co-existence of network carriers and low cost carriers, it suggests that substantial additional changes on the side of network carriers are necessary to successfully face the challenge of low cost competition.

Almost fifteen years after the drafting of the DOT report, the low cost airline service revolution has not only continued – reflected in an increase of the domestic passenger market share from about 13 percent in 1997 to about 28 percent in 2009 – but also led to a substantial rise in the competitive interaction between network carriers and low cost carriers. For example, while in 1997 the route overlap between network carriers and low cost carriers in the largest 1000 airport-pair routes lied at about 13 percent, the value increased to 31 percent in 2009. At the same time, the average cost (excluding fuel) for the group of network carriers increased from 8.8 cents per available seat mile to 11.0 cents. In contrast, the group of low cost carriers managed to further reduce their average cost level from 7.7 cents in 1997 to 6.6 cents in 2009.

Against this background of a substantial and further increasing relevance of low cost carriers, the article aims at developing a comprehensive perspective of the evolution of the domestic U.S. airline industry. Although substantial prior research on the U.S. airline industry in the post-deregulation era is available[2], the article provides several new perspectives. First, the data-set spans from 1995 to 2009 and therefore allows an investigation of both recent external shocks such as the 9/11 attacks or the economic recession, and internal shocks such as the mergers between American Airlines and Trans World Airlines in 2001 or US Airways and America West Airlines in 2005. Second, the constructed data-set not only allows a consistent split of the analysis between network carriers and low cost carriers but also, even more important, the recent market share gains of the latter group demands a detailed

[1] U.S. Department of Transportation (1997), p. 1.

[2] In addition to a large number of studies that focus on specific trends in the deregulated airline industry such as entry (see, e.g., Boguslaski et al., 2004), concentration (see, e.g., Belobaba and Van Acker, 1995; Lee, 2003), fares (see, e.g., Borenstein, 1989; Brueckner et al., 2011) or the increasing role of low cost carriers (see, e.g., Hofer et al., 2008; Ito and Lee, 2003; Dresner et al., 1996), several studies aim at painting a full picture of the evolution of the U.S. airline industry such as Borenstein (1992), Borenstein and Rose (2007), Morrison and Winston (1995) or the Transportation Research Board (1999).

economic assessment of the key characteristics of both major groups of carriers. Third, the quality of the data-set allows a revisit of important market structure, market conduct and market performance parameters and creates possibilities for innovative and informative new analyses such as entry and exit patterns or market concentration and fare developments differentiated by (route-level) market structure or mileage blocks.

The remainder of the article is structured as follows. The subsequent second section provides a first overview of market size and major players. A particular focus of this section lies on the introduction and characterization of the two major groups of carriers – network carriers (NWCs) and low cost carriers (LCCs) – with the help of various characteristics such as market share; average revenue; average cost; number of non-stop routes; average route length; average load factor; total fleet park; and number of employees. Subsequently, the third section focuses on route entry and exit patterns, followed by a detailed investigation of recent trends in concentration in the fourth section. Section five concentrates on an assessment of fare level developments between 1995 and 2009 by differentiating between different (route-level) market structures and mileage blocks. The sixth section investigates developments in several important service components, followed by assessments of the cost level and the cost structure in Section 7 and the resulting profit levels of both network carriers and low cost carriers in Section 8. The ninth section concludes the article by summarizing the key insights and discussing several important policy implications.

2 Size and major players

A suitable starting point for a characterization of the recent evolution of the U.S. airline industry is the presentation of basic data with respect to market size and major players. On average, in the sample period from 1995 to 2009, the domestic U.S. airline industry experienced a significant growth in demand reflected in major measures of output such as number of passengers or revenue passenger miles. For example, the number of passengers increased from about 502 million in 1995 to 621 million in 2009. In terms of revenue passenger miles, traffic experienced a rise from about 403 billion in 1995 to 552 billion in 2009. However, although these figures as such would support a general story of growth of the domestic U.S. airline industry, the time series for the entire sample period and especially a sample split between major network carriers (NWCs) and low cost carriers (LCCs) shown in Figure 1 suggest the need for a rather differentiated view.

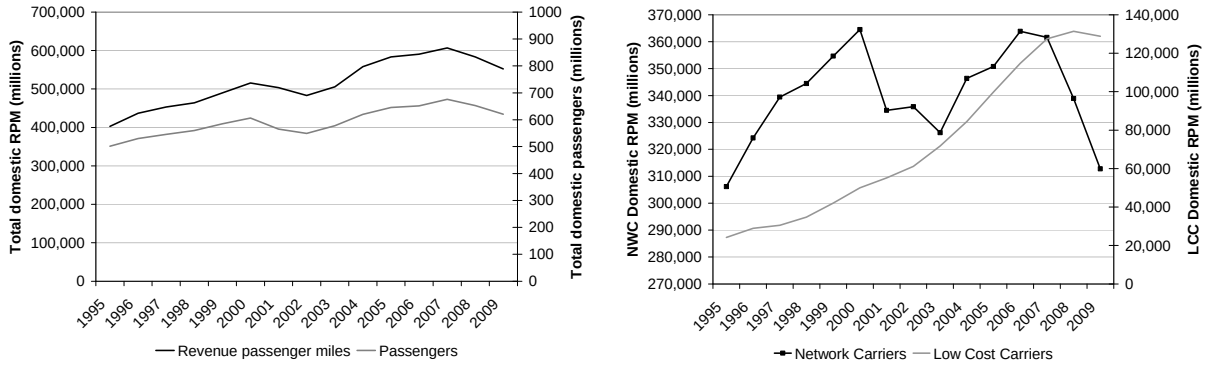

Figure 1: Passengers and revenue passenger miles for the total domestic U.S. airline industry and revenue passenger miles for major NWCs and LCCs (1995-2009)
Data source: U.S. DOT, T-100 Domestic Segment Data; authors' calculations

The first chart in Figure 1 plots the development of passengers and revenue passenger miles for the entire domestic U.S. airline industry. Both measures apparently follow the same trends and reveal that especially the 9/11 attacks had a significant but nevertheless only temporary impact on overall demand growth. Although the revenue passenger miles measure decreased from about 516 billion in the year 2000 to about 483 billion in 2002 (a drop of about 7 percent), it overtopped the 2000 level in 2004 with about 557 billion revenue passenger miles. After reaching the all-time high in 2007 with about 607 billion revenue passenger miles, the economic recession again led to a significant decrease in revenue passenger miles down to about 552 billion in 2009.

In addition to an analysis of the time-series for the entire domestic U.S. airline industry, a sample split by type of carrier allows a more detailed interpretation. The second chart in Figure 1 offers such a split by differentiating between major network carriers (NWCs) and major low cost carriers (LCCs). The chart reveals that the demand of NWCs is much more volatile than the demand of LCCs. While both of the very significant external shocks in sample period – the 9/11 attacks in 2001 and the economic recession in 2008/09 – appear to have a significant impact on the number of passengers travelling with NWCs, LCC demand only shows reduced (but largely still positive) growth rates.

In search for an explanation for this observation, it is necessary to characterize both groups of carriers further. Network carriers are typically large airlines with a long industry history. These carriers operate large hub-and-spoke networks which aim at connecting a large number of (national and international) cities through a small number of large hub airports.[3] Network

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

carriers typically offer business class and economy class services and also tie several amenities such as assigned seating or complementary food and beverages to their tickets (see, e.g., Cento, 2009, for a detailed assessment). The following airlines are classified as (the major) network carriers in the domestic U.S. airline industry: American Airlines, Continental Airlines, Delta Air Lines, Northwest Airlines, United Airlines and US Airways.

The term 'low cost carrier' already gives away more than a hint what the key differentiation criterion from the group of network carriers might be. However, although a significantly lower cost structure is indeed a very important and unifying feature of all members of this group, a more profound characterization of the group must remark first that their business is typically focusing on point-to-point traffic rather than channeling passengers through hubs. Further distinctive characteristics of low cost carriers are basically connected to their efforts to reduce costs and increase (ancillary) revenue, e.g., through the provision of a single passenger class, a reduced variety of small and more fuel efficient aircraft, operating services to secondary airports, no in-flight entertainment, unreserved seating, direct selling of (one-way and return) tickets through the internet or the selling of priority seats as well as food and beverages on board.[4] The following airlines are classified as (the major) LCCs in the domestic U.S. airline industry: AirTran Airways; Allegiant Air; Frontier Airlines; JetBlue Airways; Southwest Airlines; Spirit Airlines; Sun Country Airlines; and Virgin America.[5]

Coming back to possible explanations for the observed differences in demand volatility for both groups of carriers shown in the second chart in Figure 1 above, it is important to mention that especially a reduction in (national and international[6]) business traveler's demand typically puts the network carriers under pressure in turbulent economic times. In addition to an overall reduction in business flights, the effect might be aggravated by possibilities of firms to reduce travel expenses by switching from network carriers to low cost carriers. An alternative explanation for the observed differences could be seen in different positions of the NWC and

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of entry patterns below, regional airlines are excluded from the analysis. For all other analyses, regional carriers are merged to the respective major carrier for which they operate on a specific route.

4 See, e.g., Mason and Morrison (2008) for a detailed characterization of low cost carrier business models.

5 Although these characteristics provide a good fit for most LCCs, the delineation is not perfectly selective. For example, although AirTran Airways is usually classified as LCC, the airline offers business class services. Furthermore, although few would disagree that JetBlue Airways is a LCC, its business strategy focuses on increasing service quality through the provision of, e.g., in-flight entertainment or the use of primary airports. Despite these activities by low cost carriers to differentiate from each other through a deviation from the 'pure' low cost carrier concept, the unifying characteristic of all members of this group is a significantly lower cost level (measured in cents per available seat mile) compared to the group of network carriers.

6 Although the focus of this article is on U.S. domestic rather than international traffic, the latter certainly has implications for the former. For example, a passenger travelling from Frankfurt via New York (JFK) to San Francisco (SFO) is counted as U.S. domestic passenger on the route from JFK to SFO. As a consequence, fluctuations or even breaks in international demand can have substantial knock-on effects on the level of domestic demand of NWCs (while it leaves the demand situation of LCCs largely unaffected).

LCC business models in their respective ‘life cycles’. While the NWC business model might have a clear focus on keeping the existing business rather than additional growth, the LCC business model might not have reached maturity yet and has therefore better possibilities to expand its business even during the experienced economic downturns of the U.S. economy.

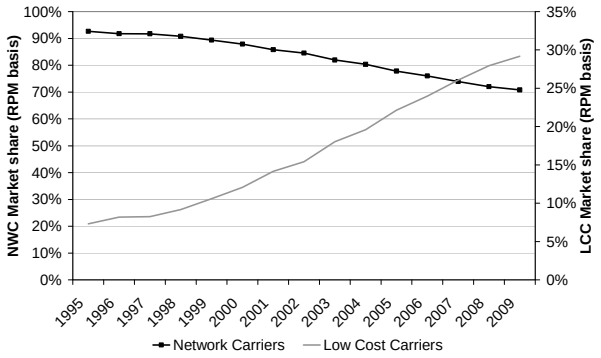
Before the focus of the analysis is turned to selected market structure, market conduct and market performance characteristics, it adds value to investigate the identified two major groups in the domestic U.S. airline industry – network carriers and low cost carriers – a little further. In particular, an interpretation of the developments of the following characteristics is offered in the next paragraphs: Market share (in percent of ‘revenue passenger miles’ (RPM)); Average revenue (in ‘revenue per available seat mile’ (RASM), 1995$); Average cost (in ‘cost per available seat mile’ (CASM), ex fuel); Number of non-stop routes (#); Average route length (in miles); Average load factor (in percent); Total fleet park (#); Number of employees (#). For these characteristics, Table 1 reports the 1995 and 2009 values for a selection of large network carriers and large low cost carriers, while Figure 2 presents the corresponding time-series for the different characteristics aggregated for the two major groups of carriers.

Table 1: Characterization of major network carriers (NWCs) and low cost carriers (LCCs) in 1995 and 2009

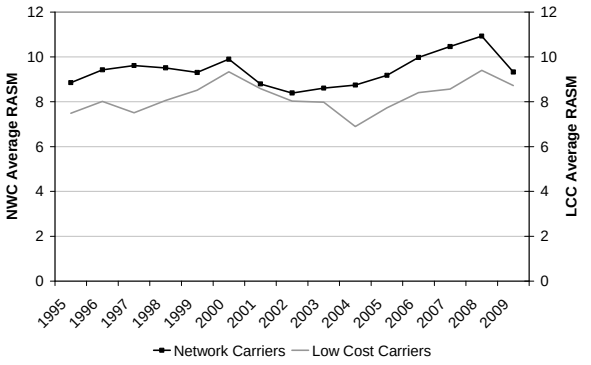
	Market share (% of RPM)		Average revenue (RASM)		Average cost (CASM, ex fuel)		Number of non-stop routes (#)		Average route length (miles)		Average load factor (%)		Total fleet park (#)		Number of employees (#)	
	1995	*2009*	*1995*	*2009*	*1995*	*2009*	*1995*	*2009*	*1995*	*2009*	*1995*	*2009*	*1995*	*2009*	*1995*	*2009*
Network Carriers																
American Airlines (* 1934)	21.0	16.7	8.6	9.9	8.5	10.7	298	377	838	854	65.1	82.6	649	606	83,463	66,519
Continental Airlines (* 1934)	8.8	9.2	8.0	9.4	7.6	10.5	233	254	697	805	65.1	84.8	300	337	30,228	38,720
Delta Air Lines (* 1928)	18.7	12.4	8.7	9.2	7.8	11.4	497	728	611	654	63.2	84.3	537	442	66,302	47,420
Northwest Airlines (* 1926)	10.8	7.6	8.9	9.1	8.0	10.6	208	170	796	962	68.4	84.8	370	303	43,581	29,124
United Airlines (* 1929)	20.5	12.7	8.2	9.2	7.9	10.5	296	490	855	708	69.3	83.7	553	382	75,695	46,587
US Airways (* 1939)	10.6	9.7	10.7	9.3	10.5	12.6	446	370	600	705	64.6	83.2	379	352	40,972	31,340
Sum / Average	*90.4*	*68.3*	*8.9*	*9.3*	*8.4*	*11.0*	*330*	*398*	*733*	*781*	*66.0*	*83.9*	*2,788*	*2,422*	*340,241*	*259,710*
Low Cost Carriers																
JetBlue Airways (* 1999)	n/a	5.0	n/a	9.2	n/a	6.6	n/a	135	n/a	1,077	n/a	80.3	n/a	148	n/a	10,583
Frontier Airlines (* 1994)	0.1	1.8	7.5	8.7	9.0	7.4	14	69	471	827	48.5	81.0	5	50	326	4,774
AirTran Airways (* 1992)	0.0	4.0	n/a	8.9	n/a	6.6	17	153	883	851	51.7	79.5	1	133	n/a	8,220
Allegiant Air (* 1997)	n/a	1.0	n/a	7.1	n/a	5.0	n/a	136	n/a	908	n/a	89.7	n/a	39	n/a	1,533
Southwest Airlines (* 1967)	7.0	16.3	7.5	9.7	6.0	7.3	176	442	482	837	64.5	76.0	251	541	18,930	34,874
Sum / Average	*7.1*	*28.1*	*7.5*	*8.7*	*7.5*	*6.6*	69	187	*612*	*900*	*54.9*	*81.3*	*257*	*911*	*19,256*	*59,984*

Legend: 'Average revenue', 'Average cost', 'Total fleet park' and 'number of employees' refer to entire airline systems, all other data to domestic traffic only; 2008 data used for Delta and Northwest in the category 'number of employees' due to merger activity in 2009; Alaska Airlines, Hawaiian Airlines and Midway Airlines are excluded from the analysis as they can neither be classified as NWC or LCC. As a consequence, the reported sums in the 'market share' category do not add up to 100%.

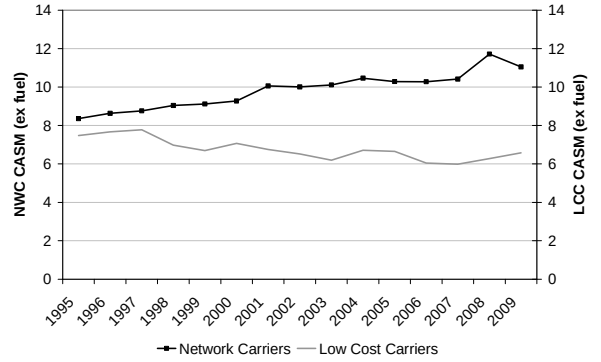
Data Sources: Various spreadsheets of the MIT Airline Data Project (http://web.mit.edu/airlinedata/www/default.html, accessed on 3 May 2011); 'Number of non-stop routes' and 'average route length' derived from U.S. DOT, T-100 Domestic Segment Data; regional carriers are assigned to their respective majors; authors' calculations.



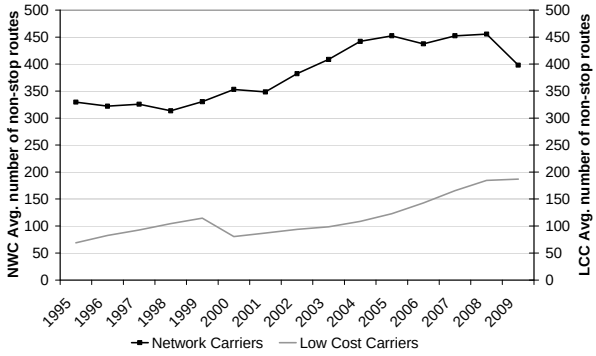
(1) Market share (RPM basis)



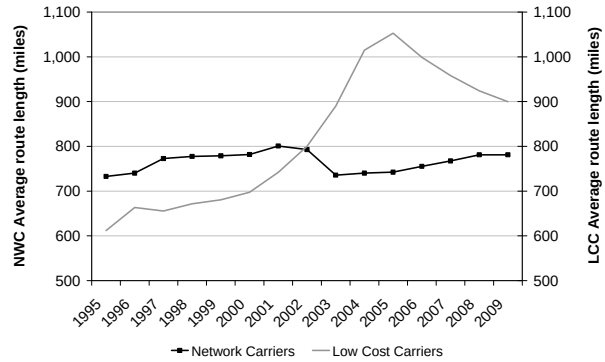
(2) Average revenue (RASM)



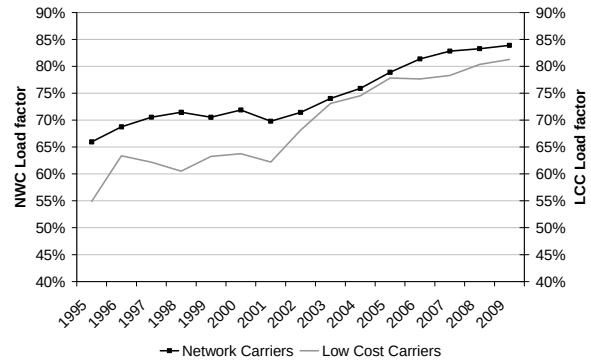
(3) Average cost (CASM)



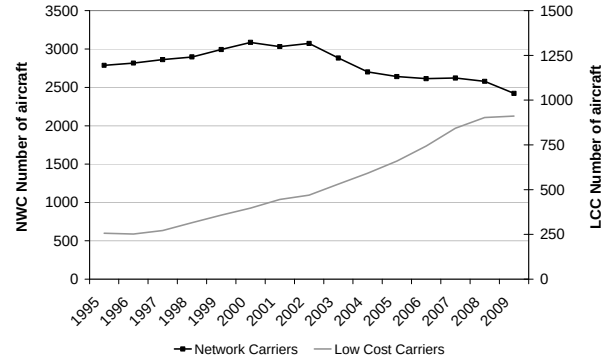
(4) Average number of non-stop routes



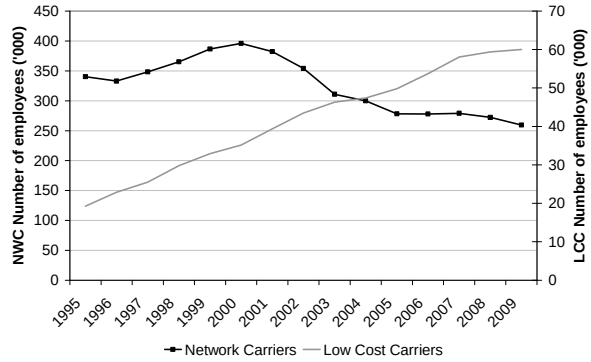
(5) Average route length



(6) Average load factor



(7) Fleet park



(8) Number of employees

Figure 2: Characterization of NWCs and LCCs (1995-2009)
Data sources: see Table 1; authors' calculations

Market shares can be calculated on various bases – such as number of passengers or revenue passenger miles (RPM) – and for various aggregation levels – such as the entire domestic U.S. airline industry, a particular airport or region or a particular city-pair or airport-pair. Focusing on the entire domestic U.S. airline industry, Chart (1) shows the market share developments for the largest NWCs and LCCs based on RPM. As revealed by the chart, the NWCs experienced a significant loss of market share from 90.4 percent in 1995 to 68.3 percent in 2009. With LCCs now contributing roughly a third of the RPMs in the domestic U.S. airline industry, the consistent split of the sample between NWCs and LCCs in this article is supported.

Average market revenue can be measured by the so-called 'revenue per available seat mile' (RASM) which is basically calculated by dividing the airline's total revenue by the available seat miles. Alternatively, the 'yield' measure can be derived by dividing passenger revenue by revenue passenger miles. Typically, both measures are presented in cents per mile. In general, the revenue situation is dependent on various factors such as the fare structure, the degree of competition, or average route length. Chart (2) uses the RASM measure to study recent trends in the average revenue situations of both NWCs and LCCs. As shown in the chart, the RASM values of NWCs and LCCs follow the same basic trend; however, the NWC revenues are generally on a higher level. While the group of NWCs increased their average revenue from 8.9 cents in 1995 to 9.3 cents in 2009, the group of LCCs experienced an increase from 7.5 cents to 8.7 cents in the same period. Interestingly, while the revenue situation for both groups of carriers was largely identical between 2000 and 2003, the group of LCCs experienced a drop in average revenue of more than one cent in 2004. This difference in the revenue situation was maintained in the following years which generally show a significant increase in the RASM for both groups of carriers.

Average cost probably is the most crucial differentiation criterion between NWCs and LCCs. The standard measure of unit cost in the airline industry is the 'cost per available seat mile' (CASM). The measure is calculated by taking the carrier's operating expenses and dividing it by the total number of available seat miles offered. In addition to reporting full costs, further cost measures are available to correct for the impact of fuel costs or stage length. Focusing on the CASM (excluding fuel cost) measure shown in Chart (3), it becomes apparent that the cost advantage of LCCs was relatively moderate in 1995 with less than one cent per mile. However, while the LCCs managed to reduce average cost in the coming years

from 7.5 cents in 1995 to 6.6 cents in 2009, the NWCs experienced an increase from 8.4 cents to 11.0 cents in the same time frame.[7]

The *number of non-stop routes* provided by a carrier can on the one hand be interpreted as a measure of network size. On the other hand, the measure can also be related to service quality as the larger the number of non-stop routes offered by a particular airline the higher the probability that a particular passenger is able to take a (direct) flight to a certain destination with the respective airline. Chart (4) in Figure 2 reports the average number of non-stop routes for both types of carriers. As shown in the chart, NWCs on average have a significantly larger number of non-stop routes compared to LCCs, basically reflecting the operation of large hub-and-spoke networks. However, as shown further in the chart, while the group of LCCs steadily increased their average number of routes over the last 15 years[8], the group of NWCs shows a rather constant trend since 2004. Furthermore, the reported increase in the average number of NWC non-stop routes between 1998 and 2003 is largely driven by exclusive agreements with regional carriers operating under brands such as 'Delta Connection' or 'American Connection' rather than internal growth of the parent company. The increase in the average number of non-stop routes for the group of LCCs, however, is associated with a substantial extension of the route networks of the respective parent companies and most prominently driven by Southwest Airlines which has increased its network from 176 non-stop routes in 1995 to 442 non-stop routes in 2009.

Average route length is an important parameter for various reasons. First, flight length is a key driver of revenues and costs. Second, in the early days of LCCs, the respective firms basically focused on short- and medium-haul routes. However, recently, LCCs not only increased their medium-haul presence further but also started to operate long-haul flights on a larger scale thereby putting additional pressure on NWCs. Against this background, Chart (5) reports the average route lengths of the respective carriers.[9] The chart reveals that in 1995, the group of NWCs had a significantly higher average route length (733 miles) than the group of

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[7] A comparison of the average revenue figures with the average cost figures reveals that the revenue measure is typically below the cost measure suggesting significant overall losses. However, given the highly aggregated data used for the comparison, this finding – which was also reported in previous studies such as Hazel et al. (2011) – should not be overrated.

[8] Please note that the discontinuity in the LCC trend in the year 2000 must be attributed to the market entry of JetBlue Airways and Allegiant Air. Given the 11 route entries of JetBlue and the 6 route entries of Allegiant in 2000, the LCC average value inevitably has to drop significantly.

[9] Although route length is an important factor as part of an initial characterization of both groups of carriers, the derivation of a useful measure is not straightforward. Simply taking the average route length per carrier can be equally misleading than using the median route length. For example, both concepts might cause problems in situations in which an airline offers frequent services on short-haul routes and less frequent services on long-haul routes. Given the potential problems with both measures, we follow the usual convention in the literature and base our analysis on average route lengths rather than median route lengths.

LCCs (612 miles). However, while the average route length of the NWCs only showed a slight increase over the entire sample period reaching an average of 781 miles in 2009, the group of low cost carriers substantially increased their average route length to 900 miles in 2009 suggesting significant market entry activity in medium- and long-haul markets.

The *load factor* represents the proportion of airline output that is actually consumed. It can generally be derived by dividing Revenue Passenger Miles (RPMs) by Available Seat Miles (ASMs) for the entire airline system or by dividing the number of passengers by the number of seats for a particular flight. Chart (6) shows the average load factor for both NWCs and LCCs and reveals an increasing trend for both types of carriers. While the average load factor for NWCs increased from 66.0 percent in 1995 to 83.9 percent in 2009, the group of LCCs shows an increase from 54.9 percent to 81.3 percent in the same time frame. Interestingly, the average load factor of the NWCs is always larger than the respective load factor of the LCC group. However, in recent years, the differences between both groups were rather small in the range of a few percentage points. In general, higher load factors of NWCs might be explained by the network concept which allows the respective airlines to fill the respective seats more easily than with the point-to-point concept largely followed by LCCs.

The *total fleet park* is a possible measure of the existing production facilities of the respective groups of carriers. However, as U.S. carriers do not differentiate their fleet statistics with respect to domestic or international operations, the recent trends shown in Chart (7) should not be overrated. This is also true because LCCs tend to reduce the different types of (smaller) aircraft in their fleet park to a minimum (in order to keep operating and maintaining costs low). Despite these limitations, the chart reveals that LCCs constantly increased their fleet from 257 aircrafts in 1995 to 911 aircrafts in 2009. In the same time frame, the group of NWC reduced their fleet slightly from 2,788 in 1995 to 2,422 in 2009. However, the group of NWCs has still roughly three times the aircraft capacity than the group of LCCs.

The *number of employees* is the last characteristic analyzed in Table 1 and Figure 2. As for the total fleet category, the carriers do not offer a split of their employees between domestic and international services. Furthermore, employment numbers are generally hard to compare due to the various possibilities to spin-off parts of the company into legally independent (but factually dependent) firms. Despite these limitations, Chart (8) reveals that the significant increase in traffic for the group of LCCs is accompanied by a corresponding increase in the number of employees. The number of employees in the group of NWC increased until 2000 and declined significantly since then. In addition to the possibilities to spin-off companies,

mergers such as the American Airlines - Trans World Airlines merger in 2001 or the US Airways - America West Airlines merger in 2005 are expected to be important drivers of this reduction in the number of employees to about 231,000 in 2009.

Given this initial characterization of the two groups of carriers, the focus of the forthcoming sections is a profound analysis of selected market structure, market conduct and market performance parameters. In particular, detailed analyses of the role of route entry and exit, concentration, fares, service, costs, and profits are provided. The quantitative analysis is largely based on the U.S. DOT T-100 Domestic Segment database. A data-set of non-directional non-stop airport-pair routes was constructed.[10] Airline-route observations with less than 12 quarterly departures and airline-route observations which were only served one quarter between 1995 and 2009 were dropped. Fare data was retrieved from the Origin and Destination Survey DB1B Market database. In calculating average fares, zero fares, abnormally high fares and fares which required the passenger to change the airplane more than twice were also excluded from the data-set.

3 Entry and exit

Market entry and exit is a crucial determinant of competition intensity. While market entry automatically leads to a reduction in market concentration, it typically also increases competitive pressures thereby triggering a downward trend in the average market price (and/or an increase in average product quality). Market exit is normally associated with inverted effects on concentration, fares and service.

Against this background, this section provides evidence on the patterns of entry and exit in non-stop U.S. airline markets between 1996 and 2009.[11] In addition to the study of entry and exit events by NWCs and LCCs in non-stop airport-pair markets, the section also analyses splits of entry data with respect to the type of market and the length of haul. It is important to remark that the analysis in this section focuses on single entry and exit decisions of NWCs and LCCs on a route level and therefore does not specifically discuss the drivers and consequences of multiple entry and exit events through new firm creation, merger or bankruptcy (see, e.g., Borenstein and Rose (2007) for an overview of recent evidence).

[10] Although there are good reasons for applying both market delineation concepts – airport-pairs and city-pairs – we follow the more conservative approach of airport-pairs. Every effect found at airport-pair level is expected to be even more pronounced at city-pair level. For a detailed discussion of airport-pairs vs. city-pairs, see Brueckner et al. (2010).

[11] An entry is determined by the quarter when we first observe an airline providing non-stop scheduled services. Since our data begins in 1995, all airlines enter by definition in 1995. Thus, we have to concentrate our entry analysis on the time frame from 1996 to 2009.

Entry and exit in non-stop airport-pair markets

A natural starting point of the study of entry patterns is a general analysis of all entry events on the non-stop airport-pair level. In this respect, T-100 Domestic Segment Data analysis reveals that the overall number of non-stop airport pairs operated by commercial airlines increased from 1,962 routes in 1995 to 2,658 routes in 2009. These numbers alone suggest a significant entry activity in the sample period. This finding is basically confirmed by Figure 3 which plots the number of route entries by NWCs and LCCs.

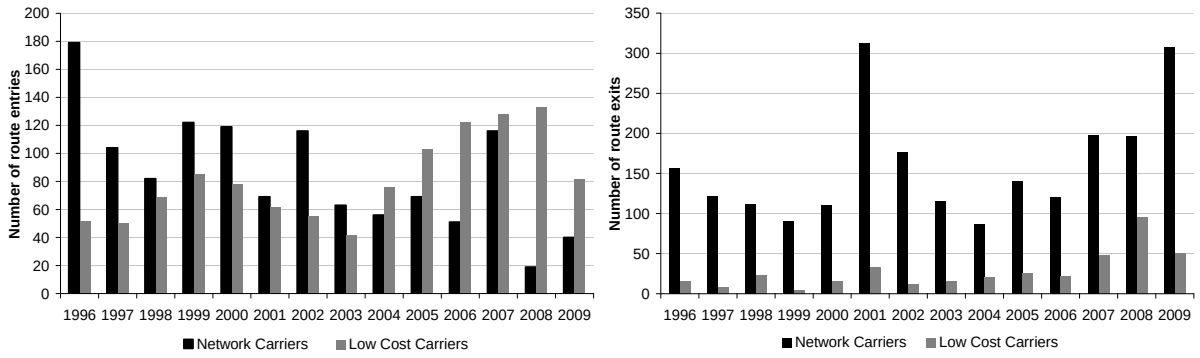


Figure 3: Route entries and exits of NWCs and LCCs (1996-2009)
Data source: U.S. DOT, T-100 Domestic Segment Data, authors' calculations

As shown in Figure 3, there are substantial differences in both the absolute number of entry events per year and the shares of entry events between NWCs and LCCs. On an absolute level, there have been on average 167 market entries per year with the years 2007 (244 entries) and 2003 (105 entries) delineating the value spectrum for the sample period. Focusing on the separation between NWCs and LCCs, the former group has launched entry into 1,205 markets between 1996 and 2009, while the entry activities of the latter group add up to 1,137 entry events. While the NWCs show significant entry activity between 1996 and 2000, the number of entries dropped significantly from 2003 onwards. Interestingly, since 2004 the group of LCCs has entered more markets per year than the group of NWCs. In the recession years 2008 and 2009, the difference in terms of entry events was particularly distinctive suggesting that the NWC business is more dependent on the general state of the economy than the LCC business.

Turning from recent entry activities to recent exit activities, prior research for various industries has shown that both activities are often closely related phenomena (see, e.g., Geroski, 1995). For example, entry into one market can demand exit in another market as, e.g., a particular aircraft can be operated more efficiently on the new route. Furthermore, any reorganization of the flight network typically triggers several entry and exit attempts. For example, airline mergers often lead to market exits either through the elimination of

overlapping parts of both networks or by the decommissioning of entire hubs of one of the merging airlines.[12]

In order to take account of the interdependencies between market entry and market exit, Figure 3 presents the number of route exits[13] by NWCs and LCCs in all markets between 1996 and 2009. As shown in Figure 3, there is significant variation in the number of route exits. On an absolute level, there have been on average 188 market exits per year with the years 2009 (359 exits) and 1999 (94 exits) delineating the value spectrum for the sample period. Focusing on the separation between NWCs and LCCs, the former group has experienced exits in 2,247 markets between 1996 and 2009, while the exit activities of the latter group add up to 391.[14] The substantial increase in NWC exit activity in the years 2001 and 2009 are very likely related to both external shocks in the form of the 9/11 attacks or the economic recession in 2008/9 and internal shocks in the form of the larger mergers between American Airlines and Trans World Airlines in 2001 and US Airways and America West Airlines in 2005.

Entry in new non-stop airport-pair markets

Providing airlines with the freedom to decide on market entry and exit was one of the key accomplishments of the liberalization of the U.S. airline industry. Since then, airlines made frequent use of the gained possibilities to optimize their route networks and to provide efficient air services to their customers. Complementary to bringing competition to existing routes, an important part of an individual airlines' market success is the identification and realization of additional profit opportunities through the entry into routes which have not been served directly before, i.e. entry into new markets. Although the entry decision of the airline is typically profit driven, such 'innovative entry' clearly has positive impacts on consumers who are able to travel on the newly established airport-pair. In order to investigate the role of innovative entry, the first chart in Figure 4 shows the percentages of entries by network carriers and low cost carriers in new markets between 1996 and 2009.

[12] A prominent example would be the merger between American Airlines and Trans World Airlines in April 2001. Due to the proximity of American's own hub at Chicago O'Hare to the Trans World hub in St. Louis, the latter was basically decommissioned after the merger and replaced by regional jet service. As a consequence, airline operations in St. Louis were reduced from over 800 operations a day to just over 200.

[13] An exit is defined to have taken place in the quarter when we last observed an airline serving a non-stop airport-pair between 1995 and 2009.

[14] Please note that the number of exits reported here refer to exits of particular airlines from particular routes. In most of the cases, the exited route remains to be operated by at least one other airline. As a consequence, it is not feasible to compare the exit rates derived here with the development in the number of non-stop airport pairs reported above.

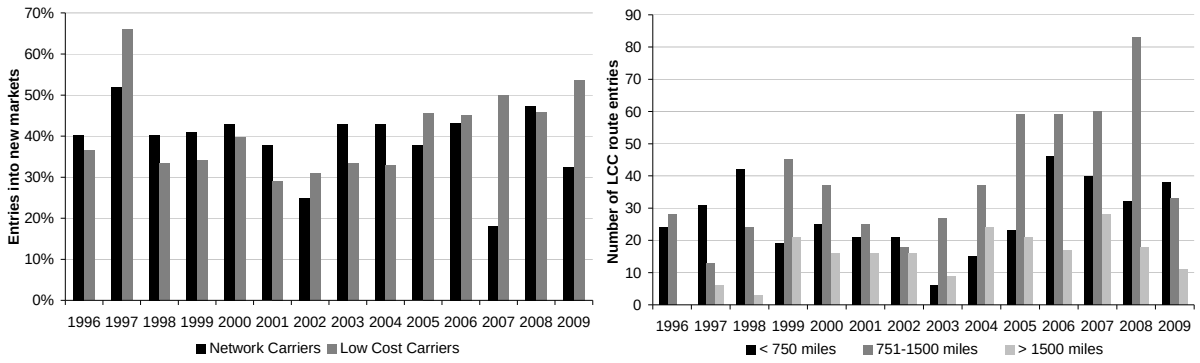


Figure 4: Selected route entry patterns of NWCs and LCCs (1996-2009)
Data source: U.S. DOT, T-100 Domestic Segment Data, authors' calculations

As shown in Figure 4, the percentage of entries in new markets is relatively high and constant. In sum, 937 of the 2,342 entry events in the sample period where 'first mover' entries in airport-pairs that have not been served before in the sample period by any other airline. 457 of these 'first mover entries' where conducted by NWCs while the remaining 480 first mover entries were undertaken by members of the group of LCCs. On average, the group of NWCs entered 33 new markets per year with 1996 (72 entries) and 2008 (9 entries) delineating the value spectrum. For the group of LCCs, 34 new markets entries were reported per year on average with the highest value of 64 entries in 2007 and the lowest value of 14 entries in 2003. As it can be expected that the more dense routes are rather mature markets, it is likely that the 'first mover' routes are relatively small and need time to develop a sufficient level of demand.

Entry in short-, medium and long-haul non-stop airport-pair markets

In its 1997 report on the 'Low Cost Airline Service Revolution', the U.S. DOT expected a coexistence of network carriers and low cost carriers with the latter providing local passengers the benefit of additional service and lower prices on short- and medium-haul markets, while the former, by continuing to link the spoke city with its network, "… provide local passengers who prefer to use the network carrier's service and connecting passengers who wish to travel beyond the hub city in other city-pair markets additional, competitive alternatives" (U.S. DOT, 1997, p. 17).

In order to investigate the actual relevance of such a coexistence of NWCs and LCCs, the second chart in Figure 4 above provides an overview of the market entries of LCCs in all markets split into short-haul markets (< 750 miles), medium-haul markets (750-1500 miles) and long-haul markets (> 1500 miles). As shown in the chart, there is significant variation in the entry behavior across short-, medium- and long-haul markets. In sum, between 1996 and 2009, low cost carriers entered 1,137 airport-pair markets. 383 entry events (about 34 percent)

took place in short-haul markets, 548 entry events (about 48 percent) in medium-haul markets and the remaining 206 entry events (about 18 percent) in long-haul markets. While short-haul entry played the by far largest role in 1997 and 1998 with percentage shares above 60 percent, its relative significance was reduced substantially since then reaching a low of 14 percent in 2003. Medium-haul entry activity is relatively strong across the entire sample period with the lowest share in 1997 (26 percent) and the highest share in 2003 (64 percent). This recent switch from short-haul to medium-haul entry could be explained by reduced possibilities for profitable short-haul entry forcing LCCs to look for business opportunities in the medium-haul segment. Finally, with respect to long-haul entry activity, the second chart in Figure 4 generally shows significant entry activity since 1997 with the lowest share of 4 percent in 1998 and the highest share of 32 percent of all LCC entry events in 2004. Therefore, it can be concluded that although the key business focus of LCCs remains on short- and medium-haul markets, even long-haul markets can be entered and operated on a permanent basis. This conclusion is supported by casting an eye on the respective exit rates. In the sample period, the long-haul segment experienced 59 market exits (equal to about 29 percent of all exits), compared to 159 (about 30 percent) in the medium-haul segment and 156 (about 41 percent) in the short-haul segment.

4 Concentration

The entry and exit activity studied in the previous section is directly reflected in various measures of market concentration. Ceteris paribus, if a further carrier is entering an airport-pair in which two airlines are already operating, market concentration typically decreases. In general, market concentration is viewed as one key determinant of competition intensity as, ceteris paribus, competition in a market with five airlines can be expected to be tougher than competition in a market with only two airlines. As a consequence, fares in the latter market are typically higher than in the former less concentrated market.

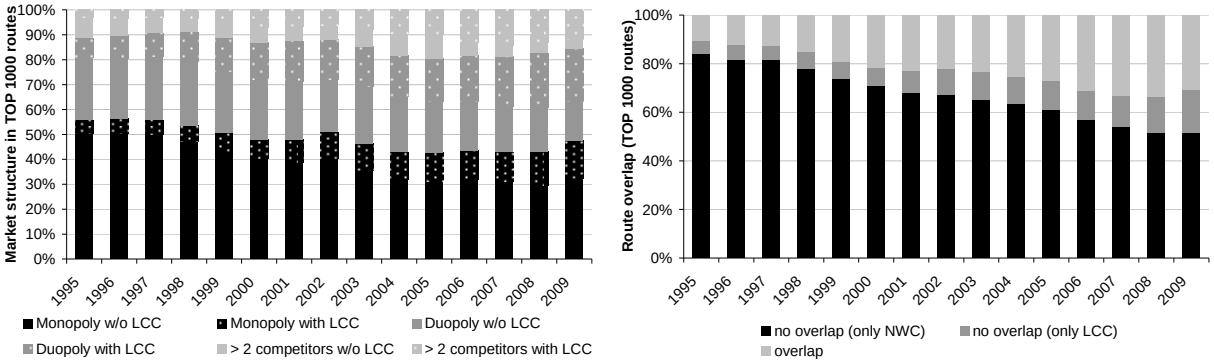
Given this potentially important role of market concentration, an initial overview of the number of non-stop airport-pairs together with the respective number of firms can provide first insights. Table 2 presents such an overview.

Table 2: Number of non-stop airport-pairs and firms in the domestic U.S. airline industry

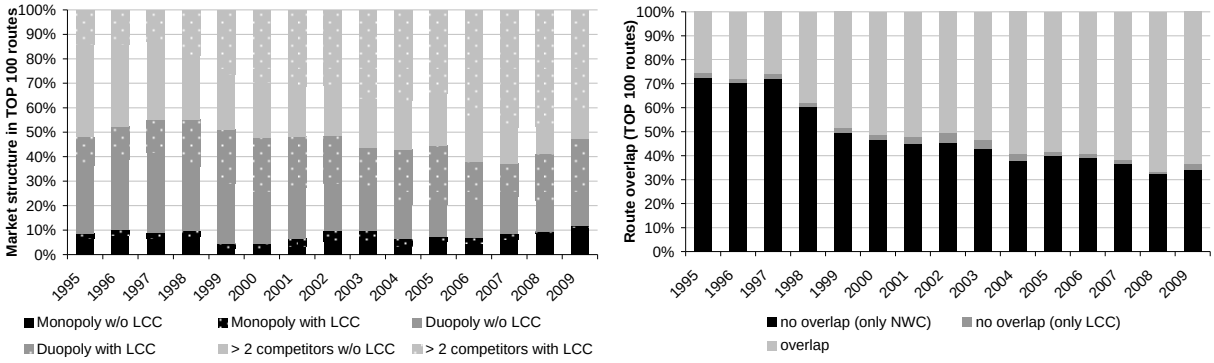
Year	Number of firms in the airport-pair									Sum
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	
1995	1445	398	95	12	6	2	2	1	1	1962
	73.6%	*20.3%*	*4.8%*	*0.6%*	*0.3%*	-	-	-	-	
2009	2020	478	134	20	5	1				2658
	76.0%	*18.0%*	*5.0%*	*0.8%*	*0.2%*	-				

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

As shown in Table 2, the overall number of airport-pairs with scheduled airline services increased from 1962 routes in 1995 to 2658 routes in 2009, i.e. the airline network has become denser in the last fifteen years. However, Table 2 also reveals that about 76 percent of all non-stop airport-pair routes in 2009 were operated by a single airline, an increase of about 2.4 percentage points compared to 1995. Although such a monopoly situation might look worrying at first glance, a closer look in the data reveals that, on the one hand, the large majority of these monopoly routes are actually very small (partly with only a few passengers per quarter) and, hence, market entry by a second airline would simply be unprofitable. On the other hand, focusing on the more dense domestic routes shows that, in 2009, 81.6 percent of all domestic passengers travelled on the largest 1000 routes. As shown in Figure 5, the share of monopoly routes is reduced slightly on those denser routes.



(1) TOP 1000 routes



(2) TOP 100 routes

Figure 5: Market structure and route overlap in the Top 1000 and TOP 100 routes (1995-2009)
Data source: U.S. DOT, T-100 Domestic Segment Data; authors' calculations

As shown in the first chart in Figure 5, between 1995 and 2009, the share of monopoly markets in the TOP 1000 route aggregate decreased from 56 percent to 48 percent while the share of duopoly markets increased accordingly from 33 percent to 37 percent and the share for markets with more than 2 competitors ('oligopoly markets') rose from 11 percent to 16 percent. However, even more important then the change in route-level market structure as such is the role of LCCs within these routes. As competition typically is intensified significantly by the entry of a LCC, the presence of LCCs in the different market structures is an important characteristic. In this respect, an analysis of the data reveals that the group of LCCs gained significance in all three subgroups. While only 10 percent of the monopoly markets in 1995 were LCC monopolies, the value increased to 32 percent in 2009. With respect to duopoly markets, only 23 percent included an LCC in 1995, compared to 58 percent in 2009. Finally, with respect to oligopoly routes, LCCs were present in 25 percent of the markets in 1995 and increased their presence to 76 percent in 2009. These results generally suggest a substantial increase in competitive pressure in the respective markets.

The same conclusion can basically be drawn from an analysis of the developments of the so-called route overlap. This measure basically identifies for a certain route aggregate the number of routes that show the presence of both NWCs and LCCs compared to the overall number of routes in the aggregate. As presented in the second chart in Figure 5, the route overlap between NWCs and LCCs in the TOP 1000 aggregate has increased significantly between 1995 and 2009. While only about 10 percent of the TOP 1000 routes were operated by both NWCs and LCCs in 1995, this value increased to about 31 percent in 2009. [15]

If the analysis is narrowed down from the TOP 1000 routes to the TOP 100 routes (representing about 23.4 percent of all domestic passengers in 2009), the third chart in Figure 5 shows that the share of monopoly routes is reduced even further to 12 percent while 35 percent of the markets are duopolies and the remaining 53 percent of the markets are operated by more than two airlines. As for the TOP 1000 routes, LCCs increased their presence in all three subgroups substantially. With respect to the route overlap, the bottom right chart in Figure 5 shows substantially higher values than for the TOP 1000 aggregate. While the route overlap lied at about 26 percent in 1995, it increased to 64 percent in 2009, i.e. in 64 of the largest 100 domestic routes, NWCs and LCCs compete directly against each other. The share

[15] Although the finding of an increased overlap between NWCs and LCCs as such is robust, it has to be reminded that the focus of the analysis in this article is on airport-pairs rather than city-pairs. Therefore, a flight between two primary airports (such as Chicago O'Hare and Houston Bush) is considered a separate market from a flight between two secondary airports of the respective cities (such as Chicago Midway and Houston Hobby). Given the LCCs focus on secondary airports, it can be expected that the degree of overlap has increased even further if city-pairs would be the focus of the analysis.

of routes in which only LCCs are operating, however, lies at about 2 percent only, basically reflecting the facts that, first, many routes out of secondary airports do not belong to the largest 100 routes and, second, many LCCs increasingly consider primary airports as a destination or even a hub (such as, e.g., JetBlue Airways in New York JFK).

Although the analysis so far provided useful insights in the development of market concentration since 1995, the assessment would be incomplete without a discussion of suitable concentration measures. After balancing the advantages and disadvantages of concentration rates and Herfindahl-Hirschman Indexes (HHI), Figure 6 provides an initial overview of the development of the average route HHI (based on number of passengers) for various aggregations from 1995 to 2009.

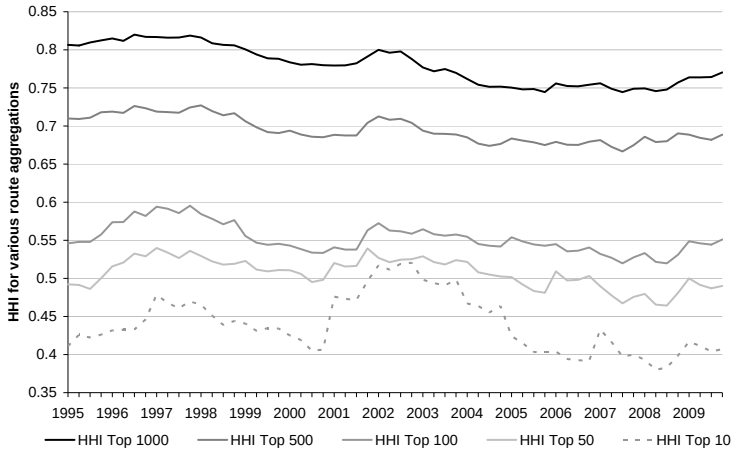
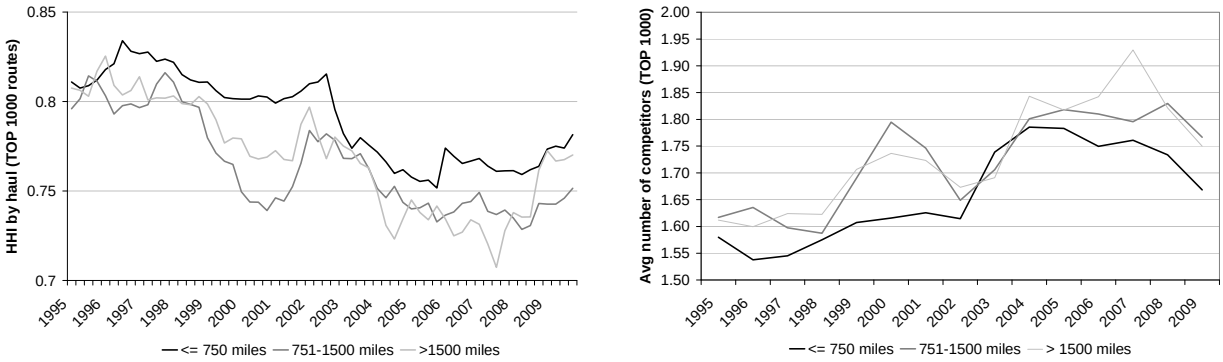


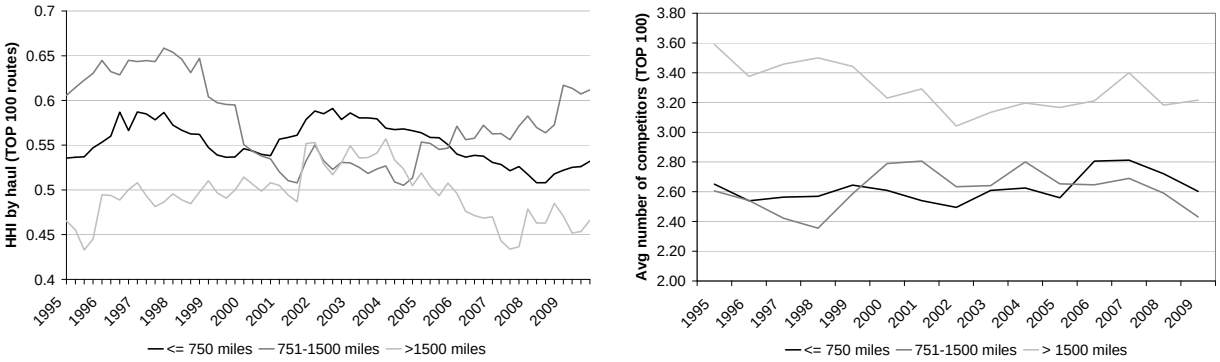
Figure 6: Route HHI for various route aggregations (1995-2009)
Data source: U.S. DOT, T-100 Domestic Segment Data; authors' calculations

As shown in Figure 6, the average HHI values differ substantially for the different route aggregates. While the average route HHI for the TOP 1000 markets lies in the range from 0.70 to 0.85, the respective values for the TOP 10 market are found in a range from 0.35 to 0.55. Generally, the larger the route aggregate, the larger is the average HHI basically due to the increasing dominance of highly concentrated routes. Furthermore, Figure 6 reveals further that the volatility of the respective time-series increase substantially with shrinking aggregate size. This observation can basically be explained by both the smaller selection of routes in the aggregate and the increased intensity of competition on these routes. Despite those differences between the different route aggregates, a unifying characteristic shown in Figure 6 are the underlying trends. All average HHI time-series show a significant increase in the aftermath of 9/11 (likely triggered by the substantial exit activity) and a trend of reduced average route concentration in the following years until the economic recession in 2008 again causes an increase in average route concentration for most route aggregates.

In addition to a general analysis of HHIs on an aggregate route level, a differentiation by length of haul can add value especially due to the identified increase in the presence of LCCs in medium- and long-haul routes. Ceteris paribus, such a development would suggest a decrease in the degree of market concentration. Figure 7 provides the HHI values for a split by length of haul again for the TOP 1000 and TOP 100 routes.



(1) TOP 1000 routes



(2) TOP 100 routes

Figure 7: Route HHI and average number of competitors by haul for TOP 1000 and TOP 100 routes (1995-2009)
Data source: U.S. DOT, T-100 Domestic Segment Data; authors' calculations

As shown in Figure 7, the analysis for the TOP 1000 routes shows a general downward trend in market concentration for all three mileage blocks when comparing the 1995 and 2009 values. However, interestingly, the market concentration development between 1995 and 2009 shows significant differences. For example, while the medium- and long-haul markets experienced as significant downward trend in concentration between 1998 and 2001, market concentration in short-haul markets stayed nearly constant. In the years after 2002, all three route types experienced a drop in market concentration until 2005 in case of short- and medium-haul routes and 2007 in case of long-haul routes. Since 2008, especially long-haul routes show a significant increase in market concentration (probably triggered by recession-induced market exits).

Turning from the TOP 1000 routes to the TOP 100 routes, it becomes immediately apparent that HHI variation is substantially increased. Even more important, the conclusions for the three mileage blocks are somewhat different. For the short-haul routes, the chart reveals that the general trend is largely comparable to the TOP 1000 category, the long-haul routes start off with a significantly lower concentration than medium-haul markets in 1995. In the following years, concentration in especially the medium-haul segment decreased substantially, leading to similar concentration values between 2002 and 2005. Interestingly, in 2005, both segments again started to diverge with the long-haul segment experiencing a substantial downward trend in concentration and the medium segment showing a substantial increase in average market concentration figures.

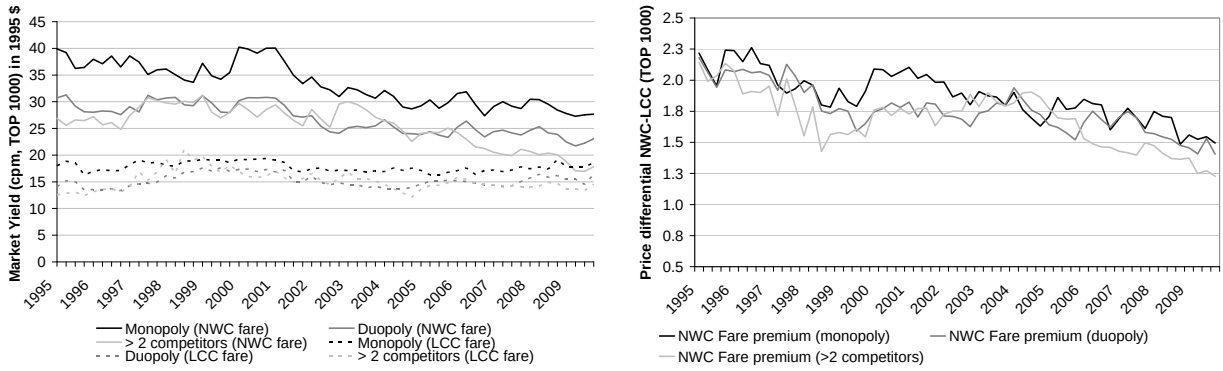
In an attempt to interpret the market concentration analysis based on HHI figures, it is important to recall the concept of HHI which takes into account the relative size and distribution of the firms on the respective route, i.e. the route HHI decreases with an increase in the number of carriers or a decrease in the disparity in size between those carriers. In order to ease an interpretation, Figure 7 also includes two charts which show the average number of competitors for the TOP 1000 and TOP 100 routes between 1995 and 2009. Taking this information into account, most increases and decreases of the average number of competitors is accompanied by a corresponding decrease and increase in the HHI. However, one puzzling observation is the substantial increase in market concentration in the medium-haul segment between 2005 and 2008 despite the significant LCC entry activity identified in the previous section. One possible explanation for this observation could be that the respective entries by LCCs lead to a quick gain in market share causing an overall increase in the HHI compared to the pre-entry situation. For example, a case study of the low cost carrier JetBlue Airways revealed that the airline managed to reach market shares of more than 60 percent already one year after entry took place.[16] In other words, low cost carrier entry might lead to a higher market concentration than before entry as low cost carriers can be extremely successful in growing fast taking away market share from the incumbent airlines (or even causing their exit from the respective route). The corresponding increase in the HHI, however, is of no particular concern from a welfare perspective given the incremental consumer benefits typically associated with low cost carrier entry.

[16] For example, in the quarter of the entry of JetBlue Airways in the medium-haul route from New York (JFK) to Fort Lauderdale (FLL) in the year 2000, the airline was already able to realize a market share of about 30 percent. One year after entry, the share increased to about 66 percent. The route-specific HHI lied at about 0.43 in the quarter before entry, dropped to 0.34 in the quarter of entry and then again increased reaching 0.51 one year after the entry of JetBlue Airways.

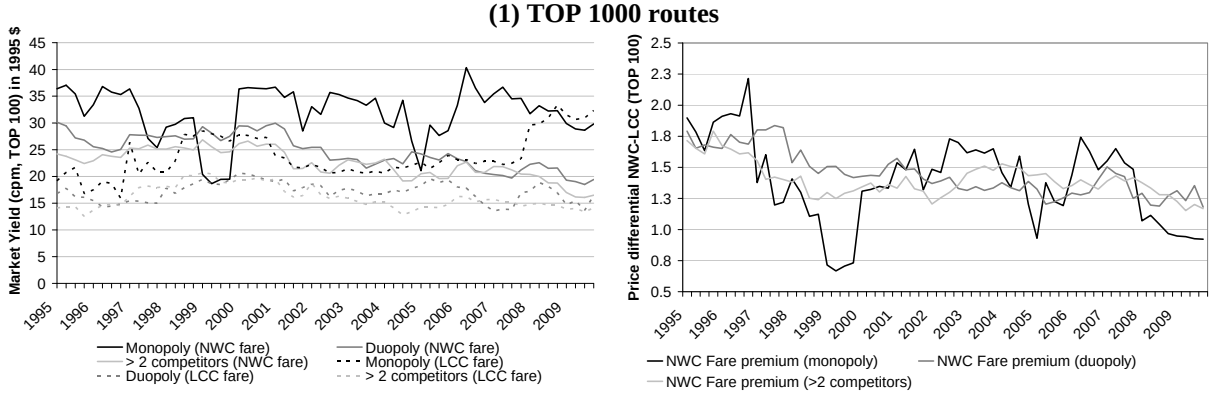
5 Fares

A key accomplishment of the first two decades after deregulation was a significant downward trend in the average fare level (see, e.g., Morrison and Winston, 1995). This trend basically continued in the period from 1995 to 2009. Although in nominal terms, the annual domestic U.S. average itinerary fare increased from $292 to $309, in real (1995$) terms, the average fare decreased from $292 in 1995 to $235 in 2009. Interestingly, the average fare increased significantly from 1995 to 2000, reaching an absolute high of $ 300 (in real terms) in 2000 before experiencing a rather continuous downward trend until the end of the sample period in 2009.

Although the identified downward trend of the average fare level is an important first insight, calculating an individual average fare for the entire domestic U.S. airline industry certainly masks more specific fare trends. Against this background, the preceding section already introduced the general argument that an increase in the number of (effective) competitors in a particular airport-pair market should expect a decrease in the average fare level. In order to investigate this hypothesis further, Figure 8 shows the market yield (defined as passenger revenue divided by revenue passenger miles) for NWCs and LCCs in monopoly markets, duopoly markets and markets with more than two competitors ('oligopoly markets') for the TOP 1000 and TOP 100 routes between 1995 and 2009.



(1) TOP 1000 routes



(2) TOP 100 routes

Figure 8: Market yield and fare premiums in monopoly, duopoly and oligopoly markets (TOP 1000 and TOP 100 routes, 1995-2009)

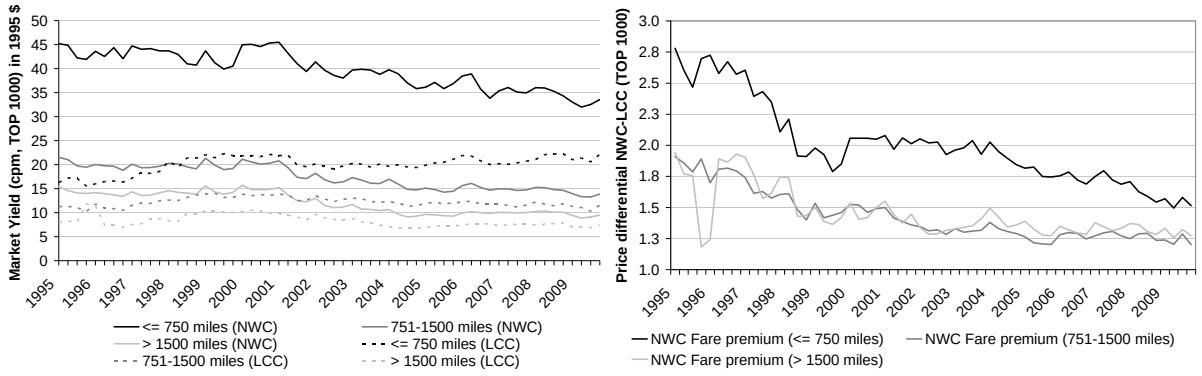
Data source: U.S. DOT, Airline Origin and Destination Survey (DB1B); authors' calculations

As shown in Figure 8, the monopoly markets in the TOP 1000 routes category generate a higher market yield than airport-pairs with more than one operating airline. Although this finding is basically true for both NWCs and LCCs, the yield level of NWCs is significantly above the yield level of LCCs. Furthermore, while the monopoly yield level of the NWCs shows a clear downward trend, the values for the LCCs largely remain constant. Comparing the average values for the years 1995 and 2009 and the TOP 1000 routes reveals that market yield in the monopoly markets was reduced from 38.0 cents to 27.6 cents (about 27 percent) for the group of NWCs, but stayed nearly constant for the group of LCCs realizing 17.9 cents in 1995 and 18.0 cents in 2009. For the duopoly and oligopoly markets among the TOP 1000 routes, comparable trends can be identified showing a decrease in NWC market yield from 29.8 cents in 1995 to 22.4 cents (about 25 percent) in 2009 for duopoly markets and from 26.4 cents in 1995 to 17.7 cents (about 33 percent) in 2009 for oligopoly markets. In the same time frame, the group of LCCs showed slightly increasing values from 14.5 cents (1995) to 15.4 (2009, about 6 percent) cents for duopoly markets and from 12.7 cents (1995) to 13.8 cents (2009, about 9 percent) for oligopoly markets. Generally, this development suggests that the NWCs face an increase in competitive pressure, at least partly triggered by the increasing market presence of LCCs. This finding is not only in line with the significant increase in route overlap between NWCs and LCCs identified in the preceding section but is also reflected in the price differential between NWCs and LCCs. As shown by the upper right chart in Figure 8, such a ‘NWC fare premium’ shows a clear downward trend from 1995 to 2009 for all three market structures. For example, while a NWC was able to generate (on average) 2.3 times (or 130 percent) the revenue in a monopoly market compared to a LCC in 1995, the premium dropped to about 1.5 (or 50 percent) in 2009.

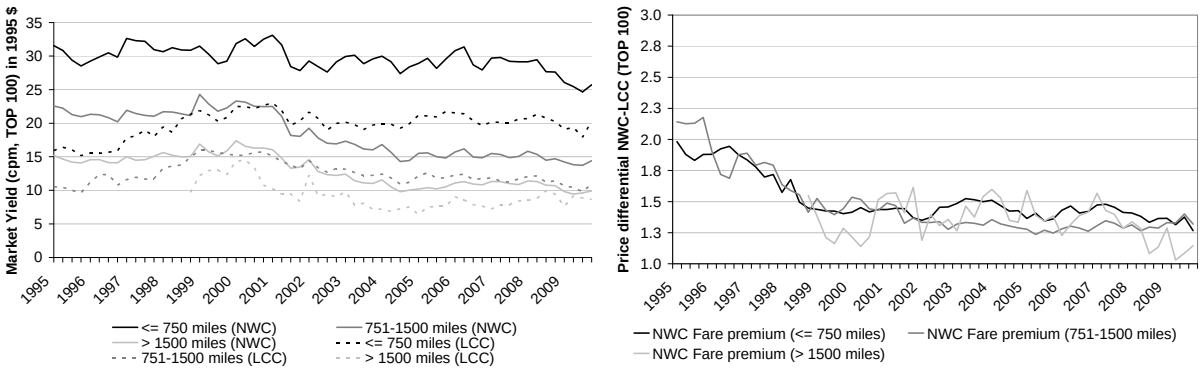
Turning from the TOP 1000 routes to the TOP 100 routes, it becomes apparent that not only the average yield level decreases but also that the yield variation increases significantly. Although this observation has partly to do with the smaller number of routes on which the reported average values are based, it nevertheless also suggests that competitive pressure in the TOP 100 markets is higher than in the TOP 1000 markets. This finding is also reflected in the NWC fare premium which shows significantly lower values for the TOP 100 routes. For monopoly routes, the measure is partly found to be below one suggesting that the LCCs are able to generate higher average revenues on these routes than the NWCs.

Complementary to an analysis of the average yield developments for various market structures, the analysis of market concentration in the preceding section suggests casting an

eye on the market yield and fare premium developments for short-, medium- and long-haul markets. Figure 9 shows the respective results, again for the TOP 1000 and TOP 100 routes.



(1) TOP 1000 routes



(2) TOP 100 routes

Figure 9: Market yield and fare premiums by haul (TOP 1000 and TOP 100 routes, 1995-2009)
Data source: U.S. DOT, Airline Origin and Destination Survey (DB1B); authors' calculations

As shown in Figure 9, short-haul routes create the by far largest average market yield in both route categories TOP 1000 and TOP 100. This observation as such is not surprising given the fact that the respective flight-specific fixed costs must be covered thereby demanding higher yields per unit of output. Comparing the average values for the years 1995 and 2009 and the TOP 1000 routes reveals that market yield in the short-haul markets was reduced from 43.6 cents to 32.8 cents (about 25 percent) for the group of NWCs, but increased from 16.5 cents to 21.3 cents (about 29 percent) for the group of LCCs. For the medium-haul markets among the TOP 1000 routes, comparable trends can be identified showing a decrease in market yield from 20.4 cents in 1995 to 13.6 cents (about 33 percent) in 2009 for the NWCs and an almost constant market yield for the groups of LCCs of 11.0 cents in 1995 compared to 11.1 cents in 2009. The third category – the long-haul markets – is the only category that consistently experienced market yield decreases for both types of carriers in the sample period. While the market yield for the group of NWCs decreased from 14.5 cents in 1995 to 9.2 cents (about 37 percent) in 2009, the group of LCCs experienced a yield reduction from 9.0 cents to 7.1 cents (about 23 percent) in the same time frame.

In terms of the NWC fare premium, the two charts in Figure 9 show a rather continuous downward trend for short-haul markets in both the TOP 1000 and the TOP 100 category. However, while the fare premium for medium-haul routes largely remained constant since 2002 for both route aggregates, the corresponding value for long-haul routes shows a downward trend starting in 2007 in the TOP 100 category. Again, the average fare premiums are systematically larger in the TOP 1000 markets than in the TOP 100 markets.

Although the focus of the article is on a high-level identification of recent trends in the evolution of the domestic U.S. airline industry, the significant number of previous studies on the existence and the size of a so-called hub premium, i.e. higher average fares charged by (often slot- or gate-constrained) hub airports, demands a brief revisit of this important issue (see, e.g., Borenstein, 1989). In order to study the recent developments in this respect, Figure 10 plots the average fares (in 1995 $) for selected hubs from 1995 to 2009.

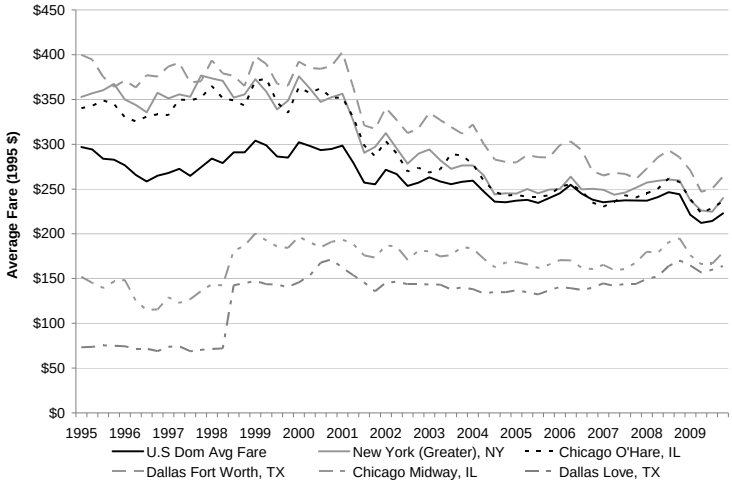


Figure 10: Average fares for selected hubs and secondary airports (1995-2009)
Data source: U.S. DOT, Bureau of Transportation Statistics; authors' calculations

As shown in Figure 10, although the respective hub premiums still exists, their size has recently been shrinking.[17] For example, for the airports in the Greater New York region, the average domestic fare in 1995 lied about 24.2 percent above the domestic average. In 2009, this difference was reduced to about 6.6 percent. Similar trends can be identified for the hub airports in Chicago and Dallas where the fare premiums have shrunk to 6.4 and 18.6 percent respectively in 2009.[18]

[17] Interestingly, in a recent working paper, Israel et al. (2011) reexamine hub-premiums by taking account of quality benefits that are associated with flights from hub airports. The authors find that the literature's conventional finding of a pattern of higher prices at hub airports is overturned when quality-adjusted fares are examined.

[18] Data Source: Bureau of Transportation Statistics at http://www.bts.gov/xml/atpi/src/indextop100.xml (accessed on 14 May 2011). Despite the recent trend of a shrinking fare premium at major hubs, BTS data reveals that the majority of the nearly 100 reported airports show higher average fares if the entire sample period from 1995 to 2009 is taken into account. Such an analysis finds, e.g., for Cincinnati an average fare

In addition to the average fares at selected hub airports, the figure also plots the average fares at two large secondary airports, namely Chicago Midway and Dallas Love Field, which both serve as focus cities of Southwest Airlines. As shown in Figure 10, the average fares were less than half of the average fares at the primary airports in 1995 and experienced a significant upward trend until 2009. For Chicago Midway, the average fare increased from on average $146 in 1995 to $172 in 2009, an increase in real terms of about 18 percent. The increase in the average fare for Dallas Love Field was even larger from on average $74 in 1995 to $161 in 2009 (about 118 percent). However, most of the increase in average fares at these airports results from the apparent fare jump in the third quarter in 1998.[19]

6 Service

Measuring the level of service in airline markets certainly is a multidimensional problem. While some studies focus on rather quantitative service indicators such as the number of departures or available seats from a particular city or region in a certain time frame, others develop an interest for rather qualitative indicators such as the type of connection (non-stop vs. one-stop) or the type of aircraft (jet flights vs. prop flights; see, e.g., Butler and Huston, 1990, U.S. General Accounting Office, 1996, and Mazzeo, 2003).

The existence and relevance of various indicators for service quality suggests the construction of a rating system that combines the respective criteria to an overall score. In this respect, Wichita State University (now in cooperation with Purdue University) started in 1991 to report an annual Airline Quality Rating (AQR). The AQR is characterized as an objective method of comparing airline quality on combined multiple performance criteria. AQR scores for the calendar year are based on 15 elements in four major categories of airline performance: On-time performance (OT), denied boardings (DB), mishandled baggage (MB)

premium of about 45.2 percent, for Charlotte an average fare premium of about 34.9 percent and for Newark an average fare premium of about 27.0 percent.

[19] It can only be guessed what factor(s) might have triggered the observed jumps in average fares in 1998 at both secondary airports. For Dallas Love Field, a faction of the increase could be explained by the (high fare) entry of Continental Express and American Airlines in 1998. In the years before, Southwest was the only carrier operating flights out of Dallas Love Field. Another possible explanation could be a significant increase in the average length for flights out of Dallas Love Field. However, the fact that traffic from this airport is limited to destinations within Texas and neighboring states via the so-called Wright Amendment substantially limits the explanatory power of this argument. For Chicago Midway, one possible explanation for the observed increase could be the so-called ‘Midway Airport Terminal Development Program’ that was launched in 1997 and that might have been (partly) financed with an increase in airport charges.

and customer complaints (CC).[20] The AQR Scores reported for the sample period from 1995 to 2009 are presented in Figure 11.[21]

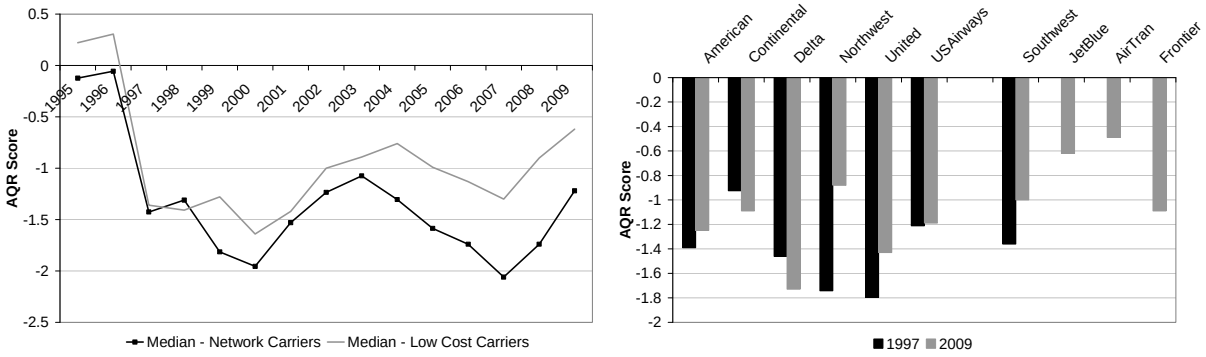


Figure 11: Airline Quality Rating (AQR) Scores for NWCs and LCCs (1995-2009)
Data sources: Various AQR Reports; authors' calculations

As shown in Figure 11, the AQR Scores vary significantly over the sample period. Following the significant drop in 1997 – caused by a change in the rating methodology – airline quality increased significantly between 2001 and 2003. After a steep decline in the years from 2004 to 2007, the last few years saw again increasing AQR scores. According to various AQR Reports, the reasons for increases and declines in the AQR are typically multi-faceted, i.e. they are the result of a better or worse performance in most or even all of the four major areas of airline performance covered by the AQR.

In addition to the aggregate AQR Scores, Figure 11 also reports the individual values for large NWCs and large LCCs. It becomes apparent that the good performance of the group of LCCs is largely driven by JetBlue Airways and AirTran Airways due to their substantially better scores. Within the group of NWCs, the improved quality performance of Northwest Airlines from 1997 to 2009 is as apparent as the continuously bad performance of its recent merger partner Delta Air Lines. Ceteris paribus, this finding suggests that the implementation of the merger might become a difficult exercise, at least as far as operational aspects are concerned.

Although the AQR concept includes major quality parameters such as on-time performance or customer complaints, the methodology is necessarily incomplete. If the AQR would capture all relevant service parameters in the relevant proportion, the immediate question would have to be raised why customers are still using low quality-high price NWC services. In addition to further service advantages of NWCs such as business class services,

[20] The category 'customer complaints' comprises the following 12 sub-categories: Flight Problems; Oversales; Reservations, Ticketing, and Boarding; Fares; Refunds; Baggage; Customer Service; Disability; Advertising; Discrimination; Animals; Other.

assigned seating, free food and beverages, or automatic transfer of luggage to connecting flights, the AQR concept does not take particular account of one major advantage of NWCs: the size of the network, which not only allows customers to reach many national and international destinations without changing the airline but might also – depending on the respective flight frequencies – reduce the overall travel time significantly. In an attempt to measure this important aspect of service quality, Figure 12 below shows the number of non-stop routes offered by NWCs and LCCs from 1995 to 2009.

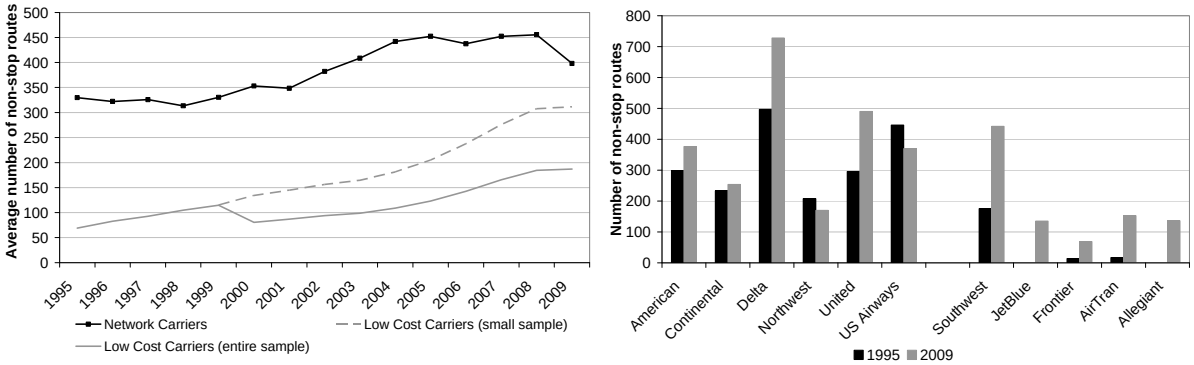


Figure 12: Number of non-stop routes operated by NWCs and LCCs (1995-2009)
Data source: U.S. DOT, T-100 Domestic Segment Data; authors' calculations

As shown in left chart in Figure 12, the group of NWCs on average operates a significantly larger number of non-stop routes compared to the group of LCCs (entire sample), basically reflecting the operation of large hub-and-spoke networks. In 2009, the average number of non-stop routes was 398 for the NWCs, while the LCCs (entire sample) on average served 187 non-stop routes. However, as shown further in Figure 12, while the LCCs steadily increased their average number of routes over the last 15 years, the NWCs show a rather constant trend since 2004. Furthermore, a comparison of both groups on the basis of simple average values is misleading given the entry of two new LCCs in the year 2000: JetBlue Airways and Allegiant Air. In order to correct for the substantial impact of those entries on the LCC average value, Figure 12 also reports the average number of non-stop routes for the small sample of LCCs that continuously operated from 1995 to 2009 (i.e., Southwest Airlines, Frontier Airlines, and AirTran Airways). As shown in the chart, this correction leads to a boost in the average number of non-stop routes for the group of LCCs from 187 non-stop routes (entire sample) to 312 non-stop routes (small sample) in 2009.

In addition to the average number of non-stop routes, Figure 12 also offers a comparison of the individual values for major NWCs and major LCCs in 1995 and 2009. In this respect, it becomes apparent that especially Delta Air Lines and United Airlines significantly extended

[21] The formula for calculating the AQR score is AQR=[(+8.63xOT)+(-8.03xDB)+(-7.92xMB)+(-7.17xCC)]/ [8.63+8.03+7.92+7.17]. For detailed information, see http://www.aqr.aero/ (accessed on 14 May 2011).

their networks between 1995 and 2009. As already discussed in Section 2 above, a large fraction of this growth, however, must be attributed to exclusive agreements with regional carriers rather than internal growth of the parent company. In the group of LCCs, the substantial increase in the average number of non-stop routes is driven by Southwest Airlines which has expanded its network from 176 non-stop routes in 1995 to 442 non-stop routes in 2009 and is now the third largest U.S. carrier in terms of number of non-stop connections.

7 Costs

The lack of possibilities and incentives to operate efficiently in the era of regulation was reflected in an elevated cost level of all major airlines. In the twenty years following deregulation, the network carriers manage to reorganize their operations in general and their route networks in particular. As a consequence, the average cost level decreased significantly (see, e.g., Borenstein, 1992). With the appearance and success of the low cost carrier concept, the importance of the cost side of operations reached a new level. By strictly optimizing their operations, low cost carriers manage to operate at costs per available seat mile which are significantly below the average of the network carriers. Figure 13 shows the average cost levels (full and excluding fuel) for NWCs and LCCs for the entire sample period from 1995 to 2009.

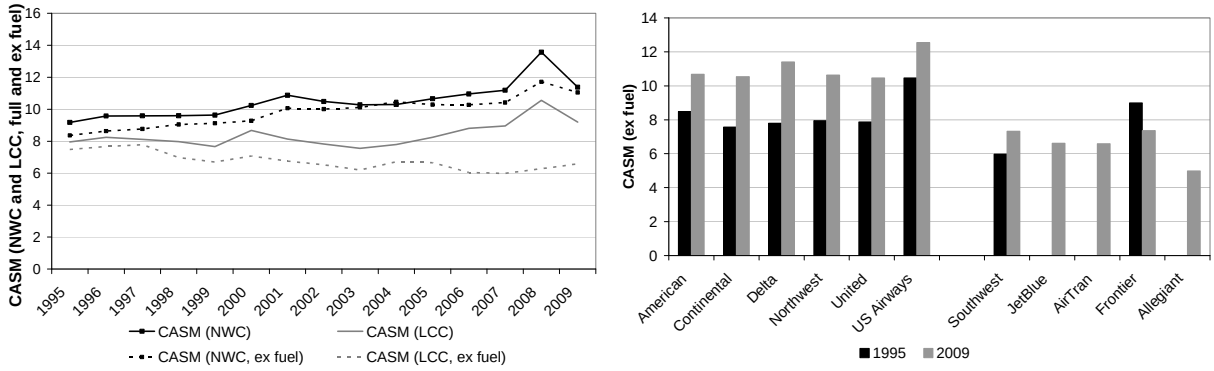


Figure 13: System total expense (full and excluding fuel) for NWCs and LCCs (1995-2009)
Data source: MIT Airline Data Project; authors' calculations

As shown in Figure 13, the cost advantage of LCCs was relatively moderate in 1995 with little more than one cent per mile. However, while the LCCs managed to reduce average cost in the coming years from 8.0 cents in 1995 to 9.2 cents in 2009, the NWCs experienced an increase from 9.2 cents to 11.4 cents in the same time frame. As shown further in the first chart of Figure 13, if the values are corrected for fuel costs, the LCCs even managed to reduce average costs from 7.48 cents in 1995 to 6.6 cents in 2009. In the same time frame, the NWCs experienced an increase from 8.4 cents to 11.1 cents.

In addition to aggregate cost data, Figure 13 also reports the individual values for large NWCs and large LCCs in 1995 and 2009. It becomes apparent that all carriers classified as LCCs do in fact show significantly lower costs per available seat mile (excluding fuel) than the group of NWCs. In the group of NWCs, the elevated cost level of US Airways is noticeable especially due to its merger with America West Airlines in 2005 that aimed at increasing the efficiency of the merged entity.

With respect to a breakdown of overall costs by type, Figure 13 already displays CASM including and excluding fuel costs. Although airlines can hardly influence fuel costs per unit of output (abstracting from fuel hedging activities and the use of more fuel-efficient aircrafts) the figure shows that the significance of fuel costs has increased substantially over the sample period. As reported by a recent study by Hazel et a. (2011), while in 2004, the breakdown of the CASM for the group of NWCs resulted in 37 percent labor costs, 20 percent fuel cost and 43 percent other costs, the respective 2009 values showed a breakdown of 29 percent labor cost, 28 percent fuel cost and 42 percent other costs. Interestingly, although the level of CASM is significantly lower for the group of LCCs, the percentage shares of the major cost blocks are very similar in both groups. In most years, the respective LCC values vary only by one or two percentage points.

8 Profits

After addressing revenues and costs in the preceding sections, the consequential final step is to cast an eye on the profitability of the U.S. airline industry. Generally, post-deregulation developments showed both periods of operating profits (1984-1989 and 1994-2000) and periods of operating losses (1980-1983 and 1990-1993; see Borenstein and Rose, 2007). The more recent developments plotted in Figure 14 reveal a similar pattern for the group of NWCs for the time frame from 2000 to 2009.

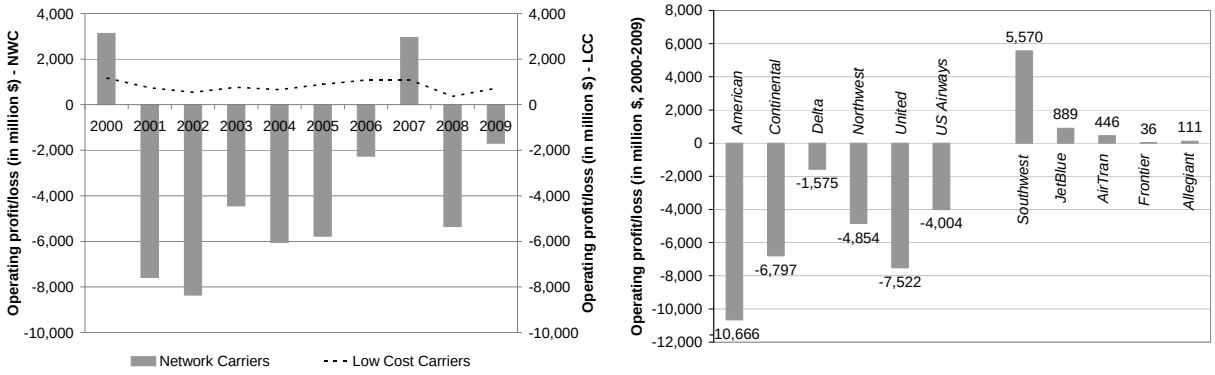


Figure 14: Operating profit (loss) of NWCs and LCCs (2000-2009)
Data source: U.S. Bureau of Transportation Statistics F41 Schedule P12 data; authors' calculations

As shown in Figure 14, the profitability situation of the NWCs experienced significant variation from a historic operating loss of $8,358 million in 2002 to a significant operating profit of $3,127 million in 2000. In sum, the group of NWCs lost $35,418 million in the period from 2000 of 2009. As shown in the second chart in Figure 14, all major NWCs experienced significant operating losses in the sample period with Continental (operating loss of $1,575 million) and American (operating loss of $10,666 million) delineating the spectrum. As a consequence, all major NWCs (with the exception of American Airlines) at some point needed the temporary protection of Chapter 11 bankruptcy regulation to be able to continue operations.

In the same time frame, the group of LCCs performed significantly better. Although several carriers experienced operating losses in several years, the entire group always realized a significant operating profit from at least $361 million in 2008 up to $1,168 million in 2000. In sum, the group of LCCs earned $8,038 million in the period from 2000 of 2009, with Southwest contributing the by far largest share of $5.570 million. In fact, Southwest is the only major carrier in the U.S. that managed to report an operating profit in every year since deregulation. However, on aggregate, all low cost carriers in the sample realized an operating profit from at least $36 million in case of Frontier up to $889 million in case of JetBlue.

In a recent article, Borenstein (2011) investigates several explanations for the apparent profitability issues of the group of network carriers. Differentiating between exogenous cost drivers, exogenous demand shocks and the expansion of low cost carriers, he basically concludes that although high taxes and fuel cost shocks surely contributed to the weak profitability performance of the group of network carriers, the two major drivers seem to be the severe demand downturn after the 9/11 attacks and the large cost differential between network carriers and low cost carriers which has persisted even as their price differentials have declined substantially. These key findings are consistent with the results presented in this article.

9 Conclusion

The deregulation of the U.S. airline industry in 1978 aimed at encouraging competition thereby realizing lower fares and improved services. While the entrepreneurial spirit of the first few years after deregulation – manifested in sweeping reorganization efforts and substantial new market entries – indeed triggered the desired increase in competitive interaction, the subsequent consolidation phase with increasing concentration and alarming airline financial performance tempted the first airline experts to argue that “[t]he time has come to roll back deregulation” (Dempsey, 1990, 407).

In the 20 years following the first serious requests to re-regulate the domestic U.S. airline industry, especially one industry development took wind out of the sails of the re-regulation supporters: the low cost airline service revolution. Between 1995 and 2009, the group of low cost carriers entered about 1,200 airport-pairs and increased its domestic passenger market share from about 11 percent to about 28 percent. Even more important, a substantial fraction of low cost carrier entry took place in mature markets in which network carriers were already present thereby increasing competitive interaction between both groups of carriers substantially. For example, while in 1995 the route overlap between network carriers and low cost carriers in the largest 1000 airport-pair routes lied at about 10 percent, the value increased to 31 percent in 2009. In the largest 100 airport-pairs, the overlap even increased from 26 percent in 1995 to 64 percent in 2009.

Against this background of a substantial and further increasing relevance of low cost carriers, the article aims at developing a comprehensive perspective of the evolution of the domestic U.S. airline industry between 1995 and 2009. Although substantial prior research on the U.S. airline industry in the post-deregulation era is available, the article provides several new perspectives such as the inclusion of recent external and internal shocks, a consistent split of the analysis between network carriers and low cost carriers, and the presentation of innovative and informative new analyses such as entry and exit patterns or concentration and fare developments differentiated by (route-level) market structure or mileage blocks.

Given this key aim of the article, the main results of the analysis are summarized in Table 3. The structure of the table follows the section structure of the article and differentiates between size and major players, entry and exit, concentration, fares, service, costs, and profits.

Table 3: Overview of the main results

Criteria	Main results
Size and major players	▪ Overall demand - measured in revenue passenger miles - increased by about 37 percent between 1995 and 2009. The majority of the demand increase must be attributed to LCCs. ▪ LCCs increased their domestic market share from about 11% in 1995 to about 28% in 2009. ▪ The growth of LCCs is not only reflected in increases of the number of non-stop routes operated, the size of the fleet park or the number of employees but also in a substantial increase in the average route length of LCC flights. ▪ Although NWCs and LCCs follow rather distinct business models, LCCs have started to include service components into their products which are normally attributed to network carriers (e.g., business class service, in-flight entertainment, primary airport operations).
Entry and exit	▪ NWCs and LCCs each entered about 1,200 non-stop routes between 1995 and 2009. ▪ Entry activity of NWCs was much more pronounced between 1996 and 2003, while LCCs have entered more markets per year since 2004. A fraction of at least 54% (in 2009) and at most 86% (in 2003) of the LCC entries took place in medium- or long-haul markets. ▪ Exit activity is much more pronounced for NWCs with in sum about 2,250 route exits, compared to only 391 exits on the side of the LCCs. A substantial fraction of the NWC exits were triggered by external and internal shocks such as recession or merger activity.
Concentration	▪ In 2009, about 76% of all airport-pairs were operated on a monopoly basis; however, the majority of passengers traveled on routes with more than one operating airline. ▪ Although the number of monopoly, duopoly and oligopoly routes only show moderate changes throughout the sample period, the presence of low cost carriers increased substantially in the largest 1000 routes (from 10% to 32% in monopoly routes, from 23% to 58% in duopoly routes; and from 25% to 76% in oligopoly routes). ▪ The NWC-LCC route overlap in the largest 1000 markets increased from about 10% in 1995 to 31% in 2009 (and from 26% in 1995 to 64% in 2009 for the TOP 100 routes). ▪ The route-based Herfindahl-Hirshman Indexes for the largest 1000 short-, medium- and long-haul routes revealed a general downward trend in concentration for the sample period; however, the 9/11 attacks and the recent recession triggered significant increases in market concentration, most recently especially in long-haul markets.
Fares	▪ The annual domestic U.S. average fare decreased from $292 in 1995 to $235 in 2009 (real). ▪ Monopoly routes consistently realize higher yields than all other routes; while LCC yields remained largely unchanged between 1995 and 2009 in the TOP 1000 routes, NWC yields show decreases of 27% for monopolies, 25% for duopolies and 33% for oligopolies. ▪ Short-haul routes consistently realize a higher yield than medium- or long-haul routes; short-haul NWC yields decreased by 25% while LCC yields *in*creased by 29% from 1995 to 2009; medium-haul NWC yields decreased by 33% while LCC yields stayed almost constant; long-haul yields decreased for both NWCs (-37%) and LCCs (-23%). ▪ The hub premium still exists but its size is shrinking, at least for the hubs in New York, Chicago and Dallas. Average fares at selected secondary airports increased substantially.
Service	▪ Following the Airline Quality Rating scores, LCCs on average perform systematically better than NWCs in a set of service categories including on-time performance, denied boardings, mishandled baggage and customer complaints throughout the sample period. ▪ Focusing on the number of non-stop routes as a measure for network size reveals that NWCs have a substantial service advantage in this category in addition to further service advantages such as business class services, assigned seating, free food etc.
Costs	▪ The costs per available seat mile (excluding fuel cost) show that the cost advantage of LCCs was relatively moderate in 1995 with little more than one cent per mile. ▪ In the sample period, LCCs managed to reduce average cost from 7.5 cents in 1995 to 6.6 cents in 2009 while NWCs experienced an increase from 8.4 cents to 11.0 cents. ▪ With respect to the cost breakdown, NWCs and LCCs show very similar percentage shares (changes). Between 2004 and 2009, the percentage share of fuel cost increased from about 20% to 28% while labor cost dropped from about 37% to 29% for both NWCs and LCCs.
Profits	▪ Between 2000 and 2009, NWCs realized an operating loss of $35,418 million with only two years (2000 and 2007) displaying an operating profit. ▪ In the same time frame, LCCs earned in sum $8,038 million, with Southwest contributing the largest share of $5,570 million. ▪ While none of the NWCs managed to realize a net operating profit in the period from 2000 to 2009, all LCCs can report such a net operating profit.

Given the overview of the main results presented in Table 3, it can be concluded that low cost carriers must be considered as the driving force of competition in the domestic U.S. airline industry. Although network carriers still have significant advantages – first and foremost with respect to the sizes of their networks and their higher quality products (in several dimensions) – especially the market entries of innovative new low cost carriers such as JetBlue Airways and most recently Virgin America are expected to increase competitive interaction further. This type of low cost carrier not only introduced large scale entry in medium- and especially long-haul markets – types of routes which have not been the focus of significant low cost carrier operations before – but also reduces the service disadvantages of low cost carriers in several dimensions such as in-flight amenities, the use of primary airports or close cooperation with international carriers. As a consequence, it is not unlikely that especially business travelers will more and more consider this new type of low cost carrier as a close substitute and will therefore increase the pressure on network carriers to rationalize their operations even further.

From a policy perspective, the growth and success of low cost carriers can be viewed as a clear sign that competition in the airline industry is alive and well. Although the recent mega mergers between Delta Air Lines and Northwest Airlines (2009) and United Airlines and Continental Airlines (2010) will certainly increase concentration in a significant number of routes, the low cost carrier service revolution is likely to continue thereby constraining the market power of the respective network carriers. The recently cleared merger of Southwest Airlines and AirTran Airways (2011) will further strengthen the position of low cost carriers in the domestic U.S. airline industry. Nevertheless, the antitrust authority should be aware of the substantial value of low cost carriers for competition in the domestic U.S. airline industry. As a consequence, it is crucial to constantly monitor the industry and to foreclose serious attempts of network carriers to reduce or even eliminate competitive pressure. Such an active antitrust policy is especially necessary for both proposed acquisitions of ‘maverick’ low cost carriers by network carriers as well as attempts of network carriers to apply instruments out of the tool box of anticompetitive behavior.

If these challenges are taken seriously, there is no doubt that the following 2002 statement by the late Alfred Kahn will continue to be proven correct: “Most disinterested observers agree that airline deregulation has been a success. The overwhelming majority of travelers have enjoyed the benefits that its proponents expected. Deregulation also has given rise to a number of problems, including congestion and a limited reemergence of monopoly power and, with it, the exploitation of a minority of customers. It would be a mistake, however, to regard

these developments merely as failures of deregulation: in important measure they are manifestations of its success" (Kahn, 2002).

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