Discussion Paper No. 12-072

# The Value of Bluer Skies

## How Much do Consumers Gain from Entry by JetBlue Airways in Long-haul U.S. Airline Markets?

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**Non-technical summary**

In the last decade, the domestic U.S airline industry has experienced a pronounced consolidation trend reflected in three high-profile mergers and the demise of several smaller players such as ATA Airlines or National Airlines. The only significant countervailing force was the market entry and growth of JetBlue Airways. Since its first market appearance in February 2000 until the end of 2009, the low-cost airline managed to build up a route network with 60 destinations in 21 US states and transported about 20 million domestic passengers (in 2009) making it the 9th largest airline in the United States. Furthermore, despite its rapid growth, JetBlue Airways still managed to realize an overall net income of USD 201 million, and therefore belongs to the small group of profitable airlines.

Against this background, the paper estimates the effects of entry by the low-cost carrier JetBlue Airways in long-haul domestic U.S. airline markets. For the period from 2000 to 2009, we find that non-stop fares are on average about 21 percent lower post-entry; however, the magnitude of the price effect depends on the pre-entry market structure. While entry into monopoly markets triggered an average price decrease of about 25 percent, the respective average price drop for entries into oligopoly markets lied at about 15 percent. Based on additional estimates of the price and income elasticities for long-haul domestic U.S. flights, we are able to calculate that JetBlue's long-haul entries alone led to an increase in consumer welfare of about USD 661 million, only referring to the effects in the first year after the respective entry events. Our empirical analysis reveals further that although the largest percentage price decreases are observed for entries in monopoly markets, the largest absolute increases in consumer welfare are realized by entries in oligopoly markets.

**Das Wichtigste in Kürze**

Im Laufe des vergangenen Jahrzehnts war in der US-amerikanischen Luftverkehrsindustrie ein substanzieller Konsolidierungstrend zu beobachten. Dieser spiegelt sich nicht nur in drei größeren Fusionen wider, sondern auch im Marktaustritt einiger kleinerer Fluggesellschaften wie ATA Airlines oder National Airlines. Als einzige nennenswerte gegenläufige Entwicklung ist der Markteintritt und das Wachstum von JetBlue Airways anzusehen. Im Zeitraum von ihrem ersten Streckeneintritt im Februar 2000 bis zum Ende des Jahres 2009 schaffte es die junge Niedrigpreis-Fluggesellschaft, ein Streckennetz mit 60 Zielen in 21 US-Bundesstaaten aufzubauen und zuletzt (im Jahr 2009) ungefähr 20 Millionen Passagiere zu befördern. Sie ist damit die neuntgrößte Fluggesellschaft in den Vereinigten Staaten. Trotz ihres schnellen Wachstums hat es JetBlue dennoch geschafft, im Laufe ihrer Existenz einen Gewinn von insgesamt rund 201 Million US-Dollar zu erwirtschaften und gehört damit zum kleinen Kreis der insgesamt profitablen Fluggesellschaften.

Vor diesem Hintergrund verfolgt die Studie das Ziel, die Markteintrittseffekte von JetBlue Airways auf Langstreckenmärkten in den Vereinigten Staaten abzuschätzen. Für den Zeitraum von 2000 bis 2009 finden wir, dass nach einem Markteintritt die durchschnittlichen Preise für Direktflüge um rund 21 Prozent niedriger sind, wobei allerdings die genaue Ausprägung von der vor dem Eintritt von JetBlue herrschenden Marktstruktur abhängt. Während ein Eintritt in einen Monopolmarkt zu einem Preisrückgang von durchschnittlich 25 Prozent führt, liegt der entsprechende Wert für Markteintritte in oligopolistische Märkte bei rund 15 Prozent. Auf der Basis zusätzlicher Schätzungen der Preis- und Einkommenselastizitäten für Langstreckenflüge innerhalb der Vereinigten Staaten kommen wir zu dem Ergebnis, dass die entsprechenden Markteintritte von JetBlue zu einer Erhöhung der Konsumentenwohlfahrt von rund 661 Millionen US-Dollar geführt haben, nur bezugnehmend auf das jeweils erste Jahr nach dem Markteintritt. Unsere empirische Analyse zeigt weiterhin, dass obwohl die höchsten prozentualen Preisrückgänge für Markteintritte in Monopolmärkte beobachtet wurden, die höchsten absoluten Anstiege in der Konsumentenwohlfahrt durch Eintritte in Oligopolmärkte realisiert wurden.

# THE VALUE OF BLUER SKIES

## *HOW MUCH DO CONSUMERS GAIN FROM ENTRY BY JETBLUE AIRWAYS IN LONG-HAUL U.S. AIRLINE MARKETS?*

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November 2012

**Abstract**
The paper estimates the effects of entry by low-cost carrier JetBlue Airways in long-haul domestic U.S. airline markets. For the period from 2000 to 2009, we find that non-stop fares were on average about 21 percent lower post-entry; however, the magnitude of the price effect depends on the pre-entry market structure. While entry into monopoly markets triggered an average price decrease of about 25 percent, the respective average price drop for entries into oligopoly markets lied at about 15 percent. Based on additional estimates of the price and income elasticities for long-haul domestic U.S. flights, we conclude that JetBlue's long-haul entries alone led to an increase in consumer welfare of about USD 661 million.

**Keywords** Airline industry, entry, low-cost carrier, consumer welfare effects
**JEL Class** L40, L93

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[*] *Researcher*, Competition and Regulation Research Group, ZEW Centre for European Economic Research and MaCCI Mannheim Centre for Competition and Innovation, P.O. Box 10 34 43, D-68034 Mannheim, Germany, E-mail: kathrin.mueller@zew.de. We would like to thank the audiences at the 2011 International Industrial Organization Conference in Boston and the 2011 Conference of the Hong Kong Society for Transportation Studies for valuable comments. We are particularly indebted to Jan Brueckner, Jieun Chang, David Gillen, Daniel Höwer, Lars Persson and Hannes Ullrich for valuable comments on previous versions of the paper. The usual disclaimer applies.

# 1 INTRODUCTION

In 1997, the U.S. Department of Transportation (DOT) published a report on the `low-cost airline service revolution'. Although the report clearly identifies low-cost carriers as the rising stars of the U.S. airline industry, it also expects a certain co-existence between network carriers – focusing on long-haul and international network markets – and low-cost carriers – focusing on short- and medium-haul point-to-point markets (U.S. Department of Transportation, 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 13 percent in 1997 to 28 percent in 2009 – but recently also experienced a paradigm shift with low-cost carriers starting to enter long-haul airline markets above 1,500 miles on a larger scale. For example, while in 1997 none of the long-haul non-stop routes in the largest 1,000 U.S. domestic markets was served by a low-cost carrier, route overlap increased to 32 percent in 2009.

Although several low-cost carriers recently identified long-haul markets as a possible source of revenue, JetBlue Airways certainly followed the most rigorous approach in entering these markets. Since its first market appearance in February 2000 until the end of 2009, JetBlue Airways entered a record 42 long-haul domestic non-stop routes leading to a substantially higher median stage length of 1,028 miles (in 2009) compared to 718 miles for the largest low-cost carrier Southwest Airlines. Furthermore, again referring to the year 2009, 23 percent of the 20 million JetBlue Airways passengers traveled on long-haul flights compared to only 8 percent in case of Southwest.

From an economic perspective, the introduction of significant low-cost carrier services in long-haul markets in general and the appearance and growth of JetBlue Airways in particular creates an appealing environment for an econometric study on the effects of entry for at least two reasons. First, the existing empirical evidence on the effects of low-cost carrier entry in short- and medium-haul markets suggests that consumers gain substantially from entry and competition by low-cost carriers in long-haul routes. Second, it can be expected that the recent market developments will put additional pressure on the revenue and net income situation of network carriers probably triggering a further shakeout in the industry in the medium and long run.

Against this background, the paper estimates the effects of entry by JetBlue Airways in long-haul domestic U.S. airline markets. Based on publicly available traffic and fare data from the U.S. Department of Transportation (DOT) we constructed a quarterly panel data set

which covers non-directional domestic U.S. airport-pairs from 1995 to 2009. We find that non-stop fares were on average about 21 percent lower post-entry; however, the magnitude of the price effect depends on the pre-entry market structure. While JetBlue's entry into monopoly markets triggered an average price decrease of about 25 percent, the respective average price drop for entries into oligopoly markets lied at about 15 percent. Based on additional estimates of the price and income elasticities for long-haul domestic U.S. flights, we are able to calculate that JetBlue's long-haul entries alone led to an increase in consumer welfare of about USD 661 million (in 1995 dollars) only referring to the effects in the first year after the respective entry events. Our empirical analysis reveals further that although the largest percentage price decreases are observed for entries in monopoly markets, the largest absolute increases in consumer welfare are realized by entries in oligopoly markets.

The paper is structured as follows. The second section provides a brief review of existing evidence on the effects of entry in U.S. airline markets, followed by the provision of some background information on JetBlue Airways in general and their patterns and effects of entry in particular in the third section. The subsequent fourth section estimates the price effects of entry by JetBlue Airways. An estimation of the general price effects of entry in short-, medium- and long-haul markets (using a fixed-effects panel data model) is followed by a more narrow estimation approach which concentrates on the effects of entries in monopolistic and oligopolistic long-haul markets. The fifth section derives a consumer welfare estimate for long-haul entries by JetBlue Airways. Based on a description of our empirical approach in Section 5.1, a further fixed-effects panel data model is applied to estimate the price and income elasticities for long-haul domestic U.S. flights in Section 5.2. Merging the results of both sections subsequently allows the calculation of the compensating variation for each of the existing non-stop long-haul markets entered by JetBlue. Section 6 concludes the paper by reviewing the key results and discussing important policy implications.

# 2 THE EFFECTS OF ENTRY IN U.S. AIRLINE MARKETS

The liberalization of the U.S. airline industry in 1978 together with the availability of (route-level) traffic and fare data collected by the U.S. Department of Transportation provides a fruitful environment for empirical research. With respect to market entry, existing research can broadly be subdivided into two strands: the 'determinants of entry' literature and the 'effects of entry' literature. While the former set of papers investigates the key drivers of airline's decisions to enter particular routes by either estimating structural models (see, e.g., Berry (1992), Ciliberto and Tamer (2009), Dunn (2008)) or – following an reduced form

approach – estimating the likelihood of entry as a function of firm and market characteristics (see, e.g., Boguslaski et al. (2004), Lederman and Januszewski (2003), Sinclair (1995)), the 'effects of entry' literature can be subdivided further into studies of the general effects of entry and studies with a particular focus on the incumbent's reactions to entry (see, e.g., Daraban and Fournier (2008), Goolsbee and Syverson (2008), Lin et al. (2002)). Given the focus of this paper on the general effects of entry, the remainder of this section will concentrate on a review of papers belonging to this sub-set of literature.

The earlier studies on the general effects of entry basically investigate the impact of route entries of particular low-cost carriers on fares and passenger numbers. For example, Whinston and Collins (1992) investigate route-level entries of low-cost carrier People Express and find that entry on average caused a drop in the mean fare of 34 percent in 15 airport-pairs between 1984 and 1985. Windle and Dresner (1995) follow a similar research question and investigate the effects of route entry by Southwest Airlines on fares and passenger numbers. Based on a data set for the period from 1991 to 1994, they find an average price decline of 48 percent, accompanied by an average increase in passenger numbers of 200 percent.

In addition to studies that concentrate on the direct price and quantity effects of (low-cost) entry, several studies took a broader perspective and investigate the impact of low-cost carriers on airport and route competition. Most prominently, the study by Dresner et al. (1996) extends previous research by analyzing the impact of low-cost entry on, first, carriers operating on other routes at the airport where entry occurred and, second, the impact of low-cost entry on carriers operating at airports in close proximity to the airport where entry occurred. The authors find that low-cost carrier entry on a route caused significant spill-over effects on both types of adjacent routes in a range of 8 to 45 percent lower average fares (for the case of Southwest Airlines). These results suggest that the real consumer benefits of low-cost carrier entry and competition are significantly larger than previously thought by focusing on the direct effects of entry in the respective airport-pairs.

Morrison (2001) builds on Dresner et al.'s (1996) approach to actually estimate the consumer savings of the presence of Southwest Airlines in U.S. airline markets. Based on an original set of competition variables, he finds that the savings due to actual, adjacent, and potential competition from Southwest sum up to USD 12.9 billion. Southwest's low fares were directly responsible for USD 3.4 billion of these savings to passengers. The remaining USD 9.5 billion represents the effect that actual, adjacent, and potential competition from Southwest had on other carriers' fares. These savings amount to 20 percent of the airline

industry's 1998 domestic scheduled passenger revenue and slightly more than half the fare reductions attributed to airline deregulation.

In addition to contributions that investigate the route-level entry effects of particular carriers, several studies provide a broader perspective. In a rather descriptive paper, Joskow et al. (1994) examine quarterly data for 27 major, non-stop city pairs in the US between 1985 and 1987 and generally find that entry reduces fares and increases output. In particular, the authors conclude that entry reduced yield by on average about 9.2 percent and led to a corresponding increase in the number of passengers of about 56 percent. However, Joskow et al. (1994) further find that entry generally is not induced by price levels substantially above the norm.

In a recent study, Brueckner et al. (2011) not only follow a much more sophisticated econometric approach to investigate the general effects of entry, but also introduce a differentiation of the fare effects between network carriers and low-cost carriers. Based on a data-set consisting of four quarters for the period from 2007 and 2008, the authors conclude that "[t]he presence of in-market, nonstop LCC competition reduces fares by as much as 34 percent in the nonstop markets, and adjacent LCC competition in these markets reduces fares by as much as 20 percent" (Brueckner et al. (2011), p. 4). The effect of a second network carrier in non-stop markets is substantially smaller, reducing fares by at most 5.3 percent; adding a third network carrier has no significant further effect on fares. Interestingly, the authors also find that the small competitive effect of entry by legacy carriers is a fairly recent phenomenon and might be explained by, first, the widening price discipline resulting from lower LCC costs and rapid LCC expansion, second, the greater price transparency due to Internet-based airline search; and, third, changes in corporate buying patterns and travel policies.

Given this short foray through the existing literature, our paper aims at contributing to the case-based strand of research. In addition to the provision of new evidence on the effects of entry by the innovative new low-cost carrier JetBlue Airways, we specifically make use of the availability of route-level panel data to estimate the average effects of entry by JetBlue from inception in 2000 up to the end of 2009. Furthermore, we are able to provide more specific insights on the impact of JetBlue entries by estimating models which include a differentiation in short-, medium-, and long-haul markets on the one hand and a differentiation in monopoly and oligopoly markets (with or without the presence of other low-cost carriers pre-entry) on the other hand. These results will provide the basis for the estimation of the consumer welfare effects of entry by JetBlue Airways in long-haul markets in Section 5.

# 3 THE ENTRY AND GROWTH OF JETBLUE AIRWAYS

This section aims at providing some background information on the market entry and growth of JetBlue Airways. In particular, after a brief general characterization of JetBlue Airways in Section 3.1, the subsequent Section 3.2 focuses on the presentation and discussion of anecdotal evidence on its patterns and effects of entry.

## 3.1 A BRIEF CHARACTERIZATION OF JETBLUE AIRLINES

JetBlue Airways was founded by David Neeleman in February 1999. Neeleman as well as several other JetBlue key executives were former Southwest employees. In September 1999, JetBlue was awarded 75 take-off and landing slots at New York's JFK airport, followed by the granting of formal U.S. authorization in February 2000. JetBlue started operations on 11 February 2000 with services from New York JFK to Buffalo and Fort Lauderdale, rapidly extending its route network in the following years. As of December 2009, the carrier's network included 60 destinations in 21 U.S. states, complemented by destinations in eleven countries in the Caribbean and Latin America. JetBlue operates a base at New York's JFK airport, and has developed focus city[1] operations in Boston, Orlando, Fort Lauderdale, Long Beach, and San Juan (Puerto Rico). In 2004, JetBlue transported about 11.6 million passengers on U.S. domestic flights. This number increased to about 20 million passengers in 2009 - a share of about 3 percent of all domestic passengers - making JetBlue the 9th largest airline in the United States.[2] Despite the rapid growth of JetBlue in partly difficult periods for the U.S. economy, the airline realized an overall net income of $201 million from inception until the end of 2009 (after subtracting the net losses experienced in four of the ten business years[3]).

Although JetBlue is usually classified as low-cost carrier, its business strategy has several specific characteristics. First, the airline provides high quality service in several important service dimensions, such as in-flight entertainment and pre-assigned leather seats with more legroom. Second, JetBlue does not only concentrate - like most other low-cost carriers - on short- and medium-haul markets, but also entered long-haul markets. Third, JetBlue has recently started entering into alliance agreements with foreign and domestic network carriers

1 A focus city is typically defined as a location that is not a hub, but from which the airline has non-stop flights to several destinations other than its hubs.

2 Data source: Bureau of Transportation Statistics at http://www.transtats.bts.gov/carriers.asp (accessed on 22 April 2012).

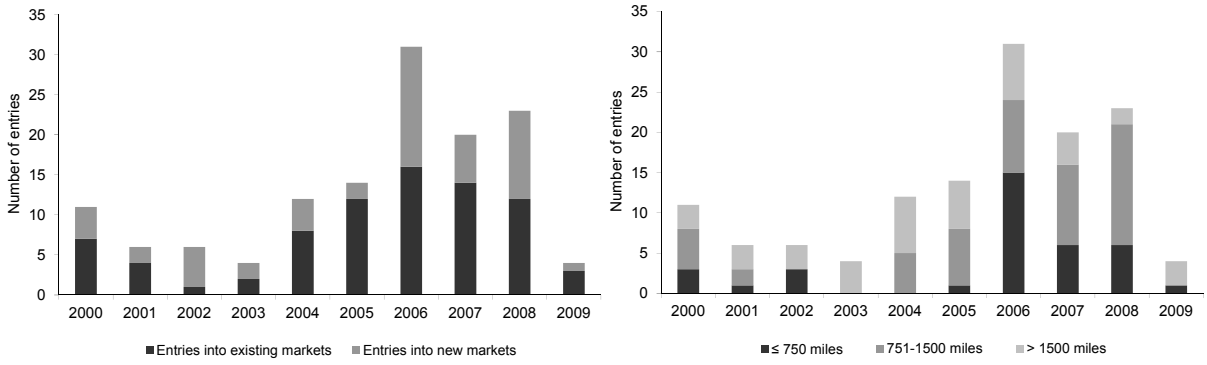
3 The net losses were realized in 2000 (USD 21 million), 2005 (USD 20 million), 2006 (USD 1 million) and 2008 (USD 76 million). For the raw data, see http://www.transtats.bts.gov/ (accessed on 22 April 2012).

such as Lufthansa, Aer Lingus and Icelandair (code-share agreements) or American Airlines (interline agreement).[4] JetBlue is considered a likely future member of one of the three large global airlines alliances: Star Alliance, SkyTeam and oneworld.[5]

Despite its rather unconventional business strategy, a quick look at the cost side of JetBlue reveals that it actually is a `low-cost' airline. While the network carriers show average costs of 10.96 cents per available seat mile (excluding fuel) in 2009, the average value for the low-cost carrier group drops to 7.06 cents. In 2009, JetBlue averaged 6.62 cents per available seat mile, which is clearly below even the average cost level in the group of low-cost carriers.[6] Complementary to the low-cost–low-fare approach, JetBlue offers a high quality product as confirmed, e.g., by the Airline Quality Rating (AQR) Scores[7], which always show a top rank for JetBlue Airways in both the entire group of major airlines, and the sub-group of low-cost airlines since its first appearance in the rating in 2003.

## 3.2 PATTERNS AND EFFECTS OF ENTRY BY JETBLUE AIRWAYS

Given the brief general characterization of JetBlue Airways as a rather untypical low-cost carrier, this section narrows the focus down to the patterns and effects of entry by JetBlue Airways. As a starting point of such a discussion, Figure 1 provides an overview of the entry activities of JetBlue Airways between 2000 and 2009.




(a) Entries by type of market (b) Entries by haul

**Figure 1: Entry activity of JetBlue Airways (2000-2009)**
*Source: U.S. DOT, T-100 Domestic Segment Data, authors' calculations*

[4] See http://www.jetblue.com/about/ourcompany/lufthansa/ for a detailed characterization of the agreement with Lufthansa (accessed on 22 April 2012).

[5] Since Lufthansa acquired a 19 percent stake in JetBlue in December 2007, Star Alliance is the most likely choice.

[6] Data source: US DOT Form 41 via BTS, Schedule T2 & P6 & P52.

[7] The AQR is a common 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:

In panel (a) of Figure 1, the number of market entries by JetBlue Airways between 2000 and 2009 is plotted. In addition to the respective overall numbers, the chart also provides a differentiation between market entries in existing markets (i.e., markets which were already operated by another airline when JetBlue entered) and market entries in new markets (i.e., markets which have not been operated by another airline in the year prior to the entry of JetBlue). As shown in the panel, overall entry activity by JetBlue Airways has been substantial. Between 2000 and 2009, the airline entered 131 domestic markets[8] with a clear peak in 2006 where 31 new routes were introduced. As revealed further by the panel, entry into new markets plays a significant role in the business strategy of JetBlue Airways. On average, about 40 percent of all entries created new air routes, with 14 percent in 2005 and 83 percent in 2002 delineating the spectrum.

Turning to panel (b) in Figure 1, the number of entries is broken down by length of haul. As shown in the panel, entry activity has been substantial in all three categories. In sum, over the entire sample period, 42 entries (about 32 percent) took place in long-haul markets above 1,500 miles, while 53 entries (about 40 percent) were observed in medium-haul markets (751-1,500 miles) and the remaining 36 entries (about 28 percent) in short-haul markets of up to 750 miles. As further shown in the panel, there is significant variation in the entry activity of JetBlue Airways. While long-haul routes is the only category that shows entry activity in every year since the birth of JetBlue Airways, short-haul and medium-haul markets show higher absolute peaks (in 2006 and 2008 with 15 entries each).

Additionally, descriptive data analysis reveals that the share of long-haul passengers for JetBlue Airways is significantly larger than for Southwest. Although JetBlue's entry waves in short-haul markets in 2006 and medium-haul markets in 2008 inevitably led to a drop in the share of long-haul passengers from its peak with 36 percent in 2005 to 23 percent in 2009, its share is still substantially larger than in case of Southwest (8 percent). Although future growth of JetBlue Airways will likely lead to a further convergence – basically because the number of (potentially profitable) long-haul market entries is limited – the focus of JetBlue Airways on long-haul routes in its first years of existence is clearly reflected in the data.[9]

Given this initial description of the patterns of entry by JetBlue Airways together with the characterization of JetBlue's business strategy in the preceding section suggests a first quick

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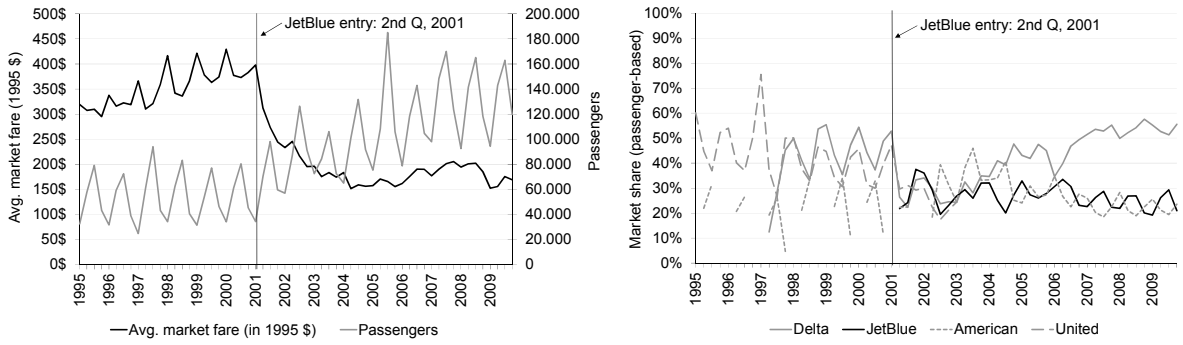
On-time performance (OT), denied boardings (DB), mishandled baggage (MB) and customer complaints (CC). The AQR is derived by Wichita State University (now in cooperation with Purdue University).

[8] Non-stop services to unincorporated territories, such as Puerto Rico, are not counted as domestic entries. Between 2000 and 2009, JetBlue started 11 non-stop services to destinations in Puerto Rico.

[9] These figures exclude JetBlue Airways' (mostly long-haul) routes to Puerto Rico and its international flights to the Caribbean and Latin America.

look on the effects of entry. In this respect, previous research showed that the introduction of low-cost carrier competition in short- and medium-haul markets typically led to substantial average price reductions. Given the minor role of low-cost carrier competition in long-haul markets before the entry of JetBlue, it can therefore be expected that comparable price reductions are observed in long-haul markets. Although the econometric analysis below will provide detailed answers to this question, the example of JetBlue's entry in the New York JFK-Seattle route shown in Figure 2 already provides first anecdotal evidence.




(a) Average market fare and passengers

(b) Market shares (passenger-based)

**Figure 2: Effects of entry by JetBlue Airways on the New York JFK-Seattle route**
*Source: U.S. DOT, T-100 Domestic Segment Data and DB1B Origin and Destination Survey, authors' calculations*

As shown in panel (a) of Figure 2, the entry of JetBlue Airways had a significant impact on the average market price leading to a drop from USD 381 to USD 267 (about 42 percent) in the first year after entry. This effect is particularly remarkable as the route was already served by two network carriers in the winter (United Airlines and Delta Air Lines) and even three network carriers in the summer (United Airlines, Delta Air Lines and American Airlines) before the entry of JetBlue Airways. With respect to the number of passengers traveling between New York JFK and Seattle, large seasonal effects can be observed. The entry of JetBlue appears to have caused a clear increase in passengers from on average about 221,500 passengers in the year before entry to about 285,150 passengers in the year after entry. Without being able to provide further evidence, the (pre-entry) average market fare movements suggest further that it is rather unlikely that the New York JFK - Seattle route experienced fierce (price) competition prior to the entry of JetBlue Airways in 2001. As a consequence, the example suggests that low-cost carrier entry into an already oligopolistic market can cause significant positive effects on average fares and demand in cases in which competition intensity between the incumbent airlines appears to be low.

Panel (b) in Figure 2 displays the market share developments for the New York JFK-Seattle route. As shown in the panel, although JetBlue managed to gain a passenger market

share of up to 37.4 percent in the first four quarters after entry, the average market share for the entire period of its market presence lied at about 26.4 percent. Interestingly, since 2004, Delta managed to increase its passenger market share from on average 29.1 percent to 49.2 percent, leaving both American and JetBlue with market share losses. This example therefore suggests that low-cost carrier entry does not guarantee a 'sweeping victory' over the respective network carriers as sometimes observed in short- and medium-haul markets. In fact, the example of the New York JFK-Seattle route shows that network carriers are not only able to defend their market share but also have possibilities to extend it despite the presence of a low-cost carrier on the respective route. It is further worth noting that the entry of JetBlue led to a permanent presence of three carriers in the market over the entire year thereby increasing flight options for the customers.

# 4 ESTIMATING THE PRICE EFFECTS OF ENTRY BY JETBLUE AIRWAYS

Based on the characterization of the business strategy of JetBlue Airways and the presentation of first anecdotal evidence on the effects of entry in the preceding section, this section aims at estimating the price effects of entry by JetBlue Airways. After describing the data set in the subsequent section, we first estimate the general price effects of entry by JetBlue Airways in short-, medium- and long-haul markets. Given the minor role of low-cost carrier competition in long-haul markets before the entry of JetBlue Airways, we expect a larger percentage fare reduction due to entry in such markets compared to short- and medium-haul markets in which several generations of low-cost carriers have been active since the liberalization of the airline industry in 1978. In a second step, we narrow the focus down to the entries of JetBlue Airways in long-haul markets and estimate the price effects of entry by separating between three types of pre-entry market structures: monopoly, oligopoly without low-cost carrier presence and oligopoly with low-cost carrier presence. Given the insights provided by standard oligopoly theory, we expect to find larger price reductions for entries into monopoly markets compared to entries into more competitive oligopoly markets.

## 4.1 DESCRIPTION OF THE DATA SET

The empirical analysis is based on data sets from several sources. Traffic data is retrieved from the U.S. DOT T-100 Domestic Segment database for the years from 1995 to 2009. This data set contains monthly domestic non-stop segment data reported by U.S. airlines when

both origin and destination airports are located within the boundaries of the United States and its territories. We used T-100's information on origin, destination, available capacity, number of departures, and number of passengers for each of the major carriers[10] to construct a quarterly panel data-set of non-directional non-stop airport-pair markets. We dropped airline-route observations with less than 12 quarterly departures and airline-route observations which were only served one quarter between 1995 and 2009. We used fare data from the U.S. DOT DB1B Market Origin and Destination Survey to enrich the constructed panel data with quarterly route-level fare data. In calculating average fares, zero fares, abnormally high fares and fares which required the passenger to change the airplane more than twice were excluded from the data-set. We add information on population, average income, and unemployment of the respective Metropolitan Statistical Areas from the U.S. Census Bureau and the Bureau of Labour Statistics. In all our estimations in Sections 4 and 5, we include only routes which connect the 100 largest Metropolitan Statistical Areas. Due to entry and exit activities of carriers other than JetBlue Airways, our panel data set is highly unbalanced. An entry event of JetBlue Airways is determined by the quarter when we first observe the carrier providing non-stop scheduled services. Since we aim to estimate the price and resulting welfare effects, entries which created a new non-stop connection not served by at least one other carrier in the quarter before entry (i.e., entries into new markets) are excluded from the analysis.

## 4.2 THE PRICE EFFECTS OF ENTRY IN SHORT-, MEDIUM- AND LONG-HAUL MARKETS

In this section we estimate the general price effects of entry by JetBlue Airways in short-, medium- and long-haul markets. Given the minor role of low-cost carrier competition in long-haul markets before the entry of JetBlue Airways, we expect a larger percentage fare reduction due to entry in such markets compared to short- and medium-haul markets in which several generations of low-cost carriers have been active since the liberalization of the airline industry in 1978. We apply two fixed effects regression models. With the first model, we aim to estimate the relative average price effect of JetBlue's entry into existing routes. The average absolute effect is estimated in the second model. The model used for estimating entry effects is of the following form:

[10] The T-100 data set also includes traffic data for regional carriers who support the major airlines. Although most of these typically small carriers are legally independent, their economic existence is often tied to a large network carrier. For example, in many instances, regional carriers do not issue their own tickets but refer to the network carrier for all flight bookings. For our analysis, regional carriers are merged to the respective major carrier for which they operate on a specific route.

$$y_{it} = \beta_0 + \beta_1 I_{it} + \beta_2 I_{it} \cdot S_i + \beta_3 I_{it} \cdot M_i + \beta_4 Z_{it} + \sum_{q=2}^{4} \gamma_q Q_{qt} + \beta_5 Y_t + \alpha_i + \varepsilon_{it} \quad (1)$$

In order to measure the relative effect, the dependent variable $y_{it}$ is the logarithm of the non-stop fare in route $i$ at time $t$. It displays the non-stop fare when the absolute price effect is quantified. All prices are measured in U.S. Dollars (USD) and deflated to the 1995 price level using the Consumer Price Index provided by the Bureau of Labor Statistics. The indicator variable $I_{it}$ becomes one if JetBlue Airways serves route $i$ at time $t$. The indicator variable is interacted with two dummy variables $S_i$ and $M_i$ which take the value one if the distance is below 750 miles (short-haul routes) or between 750 and 1,500 miles (medium-haul routes), i.e., entries into long-haul routes (distance above 1,500 miles) serve as the reference group. Other route characteristics such as market structure, average plane size, average load factor, and the presence of competitors flying under Chapter 11 bankruptcy protection are captured in $Z_{it}$. Average plane sizes and average load factors are important to include since both factors substantially influence unit costs. Presence of a carrier flying under Chapter 11 protection might reduce average non-stop fares since Chapter 11 protection can provide the respective carriers with possibilities to negotiate hard-to-cut costs with employees, suppliers, and contractors leading to fare reductions. We further include dummy variables for three quarters (the first quarter being the reference group) in order to control for seasonality in air fares. A trend variable $Y_t$ is included to capture common price trends in the domestic U.S. airline industry. The variable $i$ captures the unobserved route-specific fixed effect. The route fixed effect accounts for all factors affecting air fares that do not change over time such as especially distance. In all estimations, a heteroscedasticity-robust variance-covariance matrix is estimated. Results of the fixed effects estimations are shown in Table 1.

**Table 1: Price effects of JetBlue entry events**

| | ln(non-stop fare) | | non-stop fare | |
|---|---|---|---|---|
| | coeff. | s.e. | coeff. | s.e. |
| B6 serves | -0.268*** | (0.044) | -76.140*** | (11.993) |
| B6 serves × Short-haul | 0.079 | (0.060) | 60.814*** | (13.267) |
| B6 serves × Medium-haul | 0.251*** | (0.046) | 79.837*** | (12.184) |
| Oligopoly w/o LCC | -0.027*** | (0.007) | -4.179*** | (1.357) |
| Oligopoly with LCC | -0.151*** | (0.011) | -23.297*** | (1.675) |
| Avg. plane size | -0.000*** | (0.000) | -0.065*** | (0.019) |
| Avg. load factor | -0.003*** | (0.000) | -0.538*** | (0.038) |
| Chapter 11 route | -0.041*** | (0.005) | -9.947*** | (0.984) |
| Quarter 2 | -0.005** | (0.002) | -1.391*** | (0.310) |
| Quarter 3 | -0.038*** | (0.002) | -6.415*** | (0.347) |
| Quarter 4 | -0.053*** | (0.002) | -9.785*** | (0.257) |
| Trend | -0.014*** | (0.001) | -2.557*** | (0.096) |
| Constant | 33.523*** | (1.274) | 5.338*** | (192.552) |
| Observations | 76,831 | | 76,831 | |
| Number of markets | 1,690 | | 1,690 | |
| F(12,1689) | 253.70 | | 239.18 | |
| $\sigma_u$ | 0.427 | | 61.370 | |
| $\sigma_e$ | 0.177 | | 27.375 | |
| $\rho$ | 0.853 | | 0.834 | |

*Notes: *** p<0.01, ** p<0.05, * p<0.1, robust standard errors in parentheses.*
*Source: U.S. DOT T100 Market Segment Data and DB1B Origin and Destination Survey, authors' calculations.*

Marginal effects with respect to route distance can be found in Table 2. A description and summary statistics of all variables included in the empirical analysis can be found in Tables 7 and 8 in the Appendix.

**Table 2: Average marginal effects of JetBlue market entries by haul**

| | ln(non-stop fare) | | non-stop fare | |
|---|---|---|---|---|
| Distance | dE(y)/dx | s.e. | dE(y)/dx | s.e. |
| Short-haul (<= 750 miles) | -0.189*** | (0.041) | -15.326*** | (5.729) |
| Medium-haul (751-1500 miles) | -0.017 | (0.014) | 3.697 | (2.318) |
| Long-haul (>1,500 miles) | -0.268*** | (0.044) | -76.140*** | (11.993) |
| Average JetBlue effect | -0.145*** | (0.024) | -26.953 | (6.164) |

*Notes: *** p<0.01, ** p<0.05, * p<0.1, robust standard errors in parentheses.*
*Source: U.S. DOT T100 Market Segment Data and DB1B Origin and Destination Survey, authors' calculations.*

Our regressions show that non-stop prices decrease by 15 percent (27 USD) on average after JetBlue entered a route. The effects are largest for entries into long-haul markets leading to fare decreases of on average 27 percent (76 USD). For short-haul routes, the price decrease is found to be 19 percent, while the effects of entry into medium-haul markets are not significantly different from zero. As shown further by the regression analysis, fares are highest in monopoly markets and lowest in oligopoly markets with competitive pressure of low-cost carriers. Furthermore, cost reductions through larger aircrafts or higher load factors are translated into lower fares. One additional seat in the aircraft lowers the price by 7 cents while an increase in the average load factor of one percentage point lowers the fares by 54 cents; flying under Chapter 11 protection lowers the fare by 4 percent or 10 USD,

respectively. The regressions furthermore confirm seasonality of air fares and a common downward trend in prices over the past 15 years.

In a nutshell, the empirical results in this section support the significance of market entry of JetBlue Airways in general and the importance of entry into long-haul markets in particular even when controlling for other effects on prices within an econometric framework.

## 4.3 THE PRICE EFFECTS OF ENTRY IN MONOPOLY AND OLIGOPOLY LONG-HAUL MARKETS

In this section, we narrow the focus down to the entries of JetBlue Airways in long-haul markets and estimate the price effects of entry by separating between three types of pre-entry market structures: monopoly, oligopoly without low-cost carrier presence and oligopoly with low-cost carrier presence.[11] Given the insights provided by standard oligopoly theory, we expect to find larger price reductions for entries into monopoly markets compared to entries into more competitive oligopoly markets.

The model specification is similar to the approach conducted in Section 4.2 except that we now allow the price effect of entry to differ with respect to the market structure before or in the absence of JetBlue Airways. The model specification becomes

$$y_{it} = \beta_0 + \beta_1 I_{it} + \beta_2 I_{it} \cdot ON_{it} + \beta_3 I_{it} \cdot OL_{it} + \beta_4 Z_{it} + \sum_{q=2}^{4} \gamma_q Q_{qt} + \beta_5 Y_t + \alpha_i + \varepsilon_{it} \qquad (2)$$

We interact the indicator variable of JetBlue serving a route $i$ in time $t$ with the type of the market before JetBlue entered the route. $ON_{it}$ becomes one if the market is an oligopoly market of network carriers only while $OL_{it}$ takes the value of one if the market is an oligopoly market with at least one low-cost carrier as competitor. Thus, monopoly markets serve as reference category. We expect $\beta_2$ and $\beta_3$ to be positive. Table 3 depicts the results of the fixed effects regressions.

**Table 3: Price effects of JetBlue entry events into long-haul markets**

| | ln(non-stop fare) | |
|---|---|---|
| | coeff. | s.e. |
| B6 serves | -0.250*** | (0.041) |
| Oligopoly w/o LCC | -0.018 | (0.017) |
| Oligopoly with LCC | -0.083*** | (0.018) |
| B6 serves × Oligopoly w/o LCC | 0.074 | (0.070) |
| B6 serves × Oligopoly with LCC | 0.123** | (0.057) |
| Avg. plane size | -0.001** | (0.000) |
| Avg. load factor | -0.003*** | (0.000) |
| Chapter 11 route | -0.074*** | (0.008) |
| Quarter 2 | -0.018*** | (0.004) |
| Quarter 3 | -0.032*** | (0.005) |
| Quarter 4 | -0.051*** | (0.003) |
| Trend | -0.022*** | (0.001) |
| Constant | 49.629*** | (2.351) |
| Observations | 12,832 | |
| Number of markets | 298 | |
| F(12, 297) | 80.53 | |
| $\sigma_u$ | 0.277 | |
| $\sigma_e$ | 0.140 | |
| $\rho$ | 0.796 | |

*Notes: *** p<0.01, ** p<0.05, * p<0.1, robust standard errors in parentheses.*
*Source: U.S. DOT T100 Market Segment Data and DB1B Origin and Destination Survey, authors' calculations.*

Summary statistics of the variables included for the estimation of the coefficients of equation 2 can also be found in Table 8 in the Appendix. Marginal effects of JetBlue entry events on non-stop long-haul fares with respect to market structure are presented in Table 4.

**Table 4: Average marginal effects of JetBlue long-haul market entries by market structure**

| | ln(non-stop fare) | |
|---|---|---|
| Market structure w/o JetBlue | | |
| Monopoly | -0.250*** | (0,041) |
| Oligopoly w/o LCC | -0.176** | (0.077) |
| Oligopoly with LCC | -0.128*** | (0.046) |
| Average JetBlue Effect | -0.219*** | (0.047) |

*Notes: *** p<0.01, ** p<0.05, * p<0.1, robust standard errors in parentheses.*
*Source: U.S. DOT T100 Market Segment Data and DB1B Origin and Destination Survey, authors' calculations.*

The largest effect on prices can be observed for entries in monopoly markets. If JetBlue enters a monopoly route of a competitor, non-stop air fares decrease by 25 percent on average. The effect is smaller if entry takes place in oligopolistic markets. On average, we observe an 18 percent drop in prices for entries into oligopolies of network carriers and a drop of on average 13 percent in oligopolies in which at least one low-cost carrier was active in the quarter before the entry of JetBlue Airways. The effects of the control variables are by and large of the same

[11] Precisely, the variable displays the market structure in the absence of JetBlue Airways serving the route non-stop.

size as in the analysis in Section 4.2. However, the common price effects over the years and the effect of Chapter 11 protection on fares seem to be larger in long-haul markets.

# 5 ESTIMATING THE CONSUMER WELFARE EFFECTS OF ENTRY BY JETBLUE AIRWAYS IN LONG-HAUL MARKETS

The estimations of the general price effects of entry by JetBlue Airways in the preceding section already provided important insights into the general consumer welfare effects of entry. However, although it is straightforward to assume that consumer surplus raises with decreasing prices, the dimension of consumer savings realized by the entries of JetBlue had to remain open. In this section, we aim at estimating the consumer welfare effects of JetBlue's entry into 21 existing long-haul markets between 2000 and 2009. Based on a description of our empirical approach in Section 5.1, a further fixed-effects panel data model is applied to estimate the price and income elasticities for long-haul U.S. domestic flights in Section 5.2. Merging the results of both sections subsequently allows the calculation of the compensating variation for each of the existing non-stop long-haul markets entered by JetBlue Airways.

## 5.1 DESCRIPTION OF THE EMPIRICAL APPROACH

In his seminal paper, Hausman (1981) developed exact measures of welfare changes for simple demand specifications. He especially showed that knowledge of the Marshallian demand function is sufficient to measure the consumer welfare effects of price changes expressed in either the compensating variation (CV) or the equivalent variation (EV). Focusing on the compensating variation in the remainder of this paper, it is basically defined as the amount of money which must be taken from the consumer after a price drop in order to make him as well off as he was in the initial situation.

In order estimate the consumer welfare effects of JetBlue's entries into existing long-haul markets, we follow the basic approach introduced by Hausman (1981) and successfully applied by several studies (see e.g. Brynjolfsson et al., 2003; Hausman et al., 1997). For the case of a log-linear demand function, which is usually assumed for empirical studies of the airline industry (see, e.g., Gillen et al. (2003)), the compensating variation is then given by

$$CV = \left\{ \frac{(1-\delta)}{(1-\alpha)\, y_0^{\delta}} \left[ \widehat{p_1}\,\widehat{x_1} - p_0 x_0 + y_0^{(1-\delta)} \right] \right\}^{1/(1-\delta)} - y_0 \qquad (3)$$

with $p_0$ and $p_1$ and $q_0$ and $q_1$ being the non-stop fare and number of passengers before and after JetBlue's entry. The variable $y_0$ denotes income, $\alpha$ is the price elasticity of demand, and $\delta$ is the income elasticity of demand. In the following, we follow equation 3 and estimate the

consumer welfare effects of entry by, first, estimating the price and income elasticities for long-haul U.S. domestic flights and, second, deriving the desired estimate of the overall welfare effects of entry by JetBlue Airways.

## 5.2 Estimation of the price and income elasticities for long-haul flights

A precondition for an application of Hausman's (1981) expression for the compensating variation is the estimation of price and income elasticities. In a review of prior studies on air travel demand elasticities in various countries, Gillen et al. (2003) differentiate between different market segments (short- and long-haul, domestic and international, business and leisure) and find for the segment long-haul domestic business a range of values for own-price elasticities of demand from -1.428 and -0.836 (Median: -1.15) and for the segment long-haul domestic leisure a range of values from -1.228 and -0.787 (Median: -1.104). Given the similar results for the business and leisure segments, we refrain from separating both groups in our estimation below.

With respect to income elasticities, prior research by, e.g., Brynjolfsson et al. (2003) suggests that income elasticities can be ignored for typical consumer products where purchases are a small fraction of the consumer's annual income. However, as this assumption might not hold for air travel, an estimate of the income elasticity of demand should be included into the derivation of the consumer welfare effects of entry. Again referring to the study by Gillen et al. (2003), they find a median income elasticity across all market segments and countries of 1.390, however, with a large variation between the studies reaching from -1.21 to 11.58.

Based on this review of existing empirical evidence, we make use of the data set described above to estimate price and income elasticities of long-haul domestic U.S. air travel demand. In contrast to the analyses in Sections 4.2 and 4.3, we examine both demand for non-stop and multiple stop connections. This extension – compared to our focus on non-stop services so far – increases the number of long-haul markets between the 100 largest MSAs from 298 markets to 1,015 markets (see Table 8).

Since Hausman's (1981) expression of the compensating variation assumes a constant elasticity specification of the demand curve, we apply the following fixed-effects regression model:

$$\log(x_{it}) = \beta_0 + \beta_1 \log(p_{it}) + \beta_2 \log(inc_{it}) + \beta_3 Z_{it} + \sum_{q=2}^{4} \gamma_q Q_{qt} + \beta_5 Y_t + \alpha_i + \varepsilon_{it} \qquad (4)$$

Our dependent variable is the logarithm of total origin-destination passengers as reported by the DB1B market data. Long-haul demand is explained by the average fare $p_{it}$ (one- and multiple-stop fares) and average income $inc_{it}$ within the two MSAs. Total demand is further influenced by a set of variables $Z_{it}$ which include potential demand (population), unemployment, and dominance of one carrier at a particular airport. As in the previous regressions, we control for seasonality and a common trend. The regression results are presented in Table 5. A detailed description of the variables and summary statistics can be found in Tables 7 and 8 in the Appendix.

**Table 5: Long-haul air travel demand estimation**

| | **ln(passengers)** | |
|---|---|---|
| | coeff. | s.e. |
| ln(MktFare) | -0.722*** | (0.052) |
| ln(income) | 0.415*** | (0.078) |
| ln(Population) | 0.749*** | (0.259) |
| Avg. unemployment rate | -0.050*** | (0.004) |
| Avg. airport HHI | -0.012*** | (0.002) |
| Quarter 2 | 0.212*** | (0.009) |
| Quarter 3 | 0.173*** | (0.014) |
| Quarter 4 | 0.086*** | (0.009) |
| Trend | 0.009* | (0.005) |
| Constant | -19.213** | (8.243) |
| Observations | 56,128 | |
| Number of markets | 1,015 | |
| F(9, 1014) | 330.07 | |
| $\sigma_u$ | 1.659 | |
| $\sigma_e$ | 0.434 | |
| $\rho$ | 0.936 | |

*Notes: *** p<0.01, ** p<0.05, * p<0.1, robust standard errors in parentheses.*
*Source: U.S. DOT T100 Market Segment Data and DB1B Origin and Destination Survey, U.S. Census Bureau, Bureau of Labor Statistics, authors' calculations.*

As shown in Table 5, the own-price elasticity of demand for long-haul domestic flights is estimated to -0.722 while the respective income elasticity is 0.415. Comparing our results with the value spectrum of the Gillen et al. (2003) study reported above reveals that our own-price elasticity estimate is at the lower end of the range of values. The estimate of the income elasticity shows the expected positive sign, however, is clearly below the median value of 1.390 reported above. However, the fact that the values collected by Gillen et al. (2003) stem from various studies referring to different market segments and countries might explain a significant part of this divergence. For the estimation of the consumer welfare effects of entry by JetBlue Airways in long-haul markets in the following section, we apply our estimates of own-price and income elasticities reported in Table 5 above.

## 5.3 ESTIMATION OF THE CONSUMER WELFARE EFFECTS

Given the description of our empirical approach and the estimation of price and income elasticities for long-haul flights, this section brings both previous sections together to estimate the consumer welfare effects of entry of JetBlue Airways in 21 existing long-haul domestic U.S. airline markets. We derive our results on an aggregate basis distinguishing the three market structures monopoly, oligopoly with low-cost carrier presence and oligopoly without low-cost carrier presence. Following Brynjolfsson et al. (2003), the fare after JetBlue's entry $\widehat{p}_{1j}$ (with $j$ depicting the different pre-entry market structures) is calculated as $\left(1+\theta_j\right)\cdot p_{0j}$. From Section 4.3, we have $\theta = -0.250$ for entry into monopoly markets, $\theta = -0.18$ for entry into oligopoly markets without low-cost carrier presence, and $\theta = -0.13$ for entry into oligopoly markets with low-cost carrier presence. Using the estimate for the price elasticity of long-haul itineraries ($\alpha = -0.722$), yearly demand following the entry events is calculated as $\hat{x}_{1j} = \left(1+\theta_j \cdot \alpha\right) x_{0j}$. Average prices ($p_{0j}$) and total non-stop demand ($x_{0j}$) in the year before JetBlue started services on existing routes are retrieved from DB1B and T-100 data-sets respectively. Finally, equation 3 is applied in order to calculate the change in consumer welfare. The results of these calculations are presented in Table 6.

**Table 6: Change in consumer welfare as measured by compensating variation**

| Market structure w/o JetBlue | $p_0$ | $x_0$ | $\widehat{p}_1$ | $\widehat{x}_1$ | Welfare effect (in m USD) |
|---|---|---|---|---|---|
| Monopoly | 221.36 | 2,559,580 | 165.92 | 3,022,206 | *234.0* |
| Oligopoly w/o LCC | 285.45 | 3,562,210 | 235.12 | 4,015,514 | *261.2* |
| Oligopoly with LCC | 314.45 | 3,099,373 | 274.31 | 3,384,877 | *165.5* |
| Total effect | 277.41 | 9,221,163 | 227.78 | 10,422,597 | *660.7* |

*Notes: Effects of JetBlue entry events into 21 long-haul markets. Increase in consumer welfare as measured by compensating variation. All prices in constant (1995) USD.*
*Source: U.S. DOT T100 Market Segment Data and DB1B Origin and Destination Survey, authors' calculations.*

As shown in Table 6, the overall change in consumer welfare measured by the compensating variation can be estimated to USD 661 million only referring to the effects of long-haul entry by JetBlue Airways in the first year after the respective entry events. As revealed further by Table 6, the contribution of entries into oligopoly markets without low-cost carrier presence is the largest with USD 261 million (about 40 percent), followed by entries into monopoly markets with consumer savings of USD 234 million (about 35 percent) and entries into oligopoly markets with low-cost carrier presence with USD 166 million (about 25 percent). However, it is important for the interpretation of these results to remind that the number of entries is not shared equally between the three different pre-entry market structures. While 12

of the 21 long-haul entries of JetBlue Airways took place in monopoly markets, 7 were observed in oligopoly markets without low-cost carrier presence and only 2 into the remaining category of entry into oligopoly markets with low-cost carrier presence. On an `average effect per entry' basis, it becomes apparent that the two entries into oligopoly markets with low-cost carrier presence realized the by far largest absolute contribution in consumer welfare of about USD 83 million, followed by entries into oligopolies without low-cost carrier presence with USD 37 million and entry into monopoly markets with about USD 20 million. It can therefore be concluded that although entering monopoly markets causes the largest percentage price reductions, the average consumer welfare effects of entry are substantially larger for entries into denser oligopoly markets. Interestingly, the largest absolute increases in consumer welfare are realized by JetBlue's entries into the most competitive markets - Boston-Los Angeles and New York JFK-Los Angeles - in which not only network carriers but also another low-cost carrier was already present at the time of entry of JetBlue Airways.

Although our estimation approach follows an accepted procedure successfully applied in other studies, several specificities should be mentioned to put the findings into perspective. First, our estimates only refer to existing long-haul markets and therefore only cover half of the 42 long-haul entries of JetBlue Airways. Although it is reasonable to assume that the 21 new markets entered by JetBlue Airways are of smaller size, it is obvious that an additional consumer surplus is realized by these entries. Second, one has to remember that we concentrated on long-haul entries by JetBlue Airways only. Thus, our estimates do not include obvious consumer welfare gains of entries in short- and medium-haul markets. Although it can generally be expected that (price) competition is already tougher in these markets, our estimation results from above revealed that potential market size rather than the number of competitors seems to be the key driver of the absolute consumer welfare effects of entry. As a consequence, it can be expected that especially entry by JetBlue Airways into several dense medium-haul markets from New York JFK to Florida created substantial additional consumer welfare effects. Third, by analyzing the effects of entry on an airport-pair basis, we ignore possible effects of entries by JetBlue Airways on adjacent routes. Although it is rather difficult to estimate such effects, the results by Morrison (2001) for Southwest Airlines suggest that it is very likely that the inclusion of such spill-over effects would increase the consumer surplus estimate quite substantially.

# 6 CONCLUSION

Many low-cost carriers have entered and – to a large fraction – exited the U.S. airline industry since its deregulation in 1978. Although the birth, growth, decline and death of firms is a common and somehow desired occurrence in market economies, any case study has to provide convincing arguments for the significance and the sustainability of the business strategy of the airline under investigation.

Since its first market appearance in February 2000, the business strategy of JetBlue Airways shows clear signs of both significance and sustainability. Despite rather turbulent economic times, JetBlue Airways managed to build up a route network with 60 destinations in 21 U.S. states and transported about 20.4 million passengers (in 2009) making it the 9th largest airline in the United States. Furthermore, despite its rapid growth, JetBlue Airways still managed to realize an overall net income of USD 201 million and therefore belongs to the small group of profitable airlines.

The market success of JetBlue Airways can be explained by its innovative business strategy that diverges from typical low-cost carriers in several important dimensions. For example, JetBlue Airways developed hub operations at New York's biggest airport (JFK), offers high quality services including in-flight entertainment or pre-assigned leather seats with more legroom, and has signed code-sharing agreements with international carriers such as Lufthansa, Aer Lingus or Icelandair. Furthermore, JetBlue Airways introduced long-haul services on a large scale and therefore brought 'low-cost' competition to a type of routes formerly dominated by 'high cost' network carriers.

Against this background, the paper estimates the effects of entry by the low-cost carrier JetBlue Airways in long-haul domestic U.S. airline markets. For the period from 2000 to 2009, we find that non-stop fares were on average about 21 percent lower post-entry; however, the magnitude of the price effect depends on the pre-entry market structure. While entry into monopoly markets triggered an average price decrease of about 25 percent, the respective average price drop for entries into oligopoly markets lied at about 15 percent. Based on additional estimates of the price and income elasticities for long-haul domestic U.S. flights, we are able to calculate that JetBlue's long-haul entries alone led to an increase in consumer welfare of about USD 661 million, only referring to the effects in the first year after the respective entry events. Our empirical analysis reveals further that although the largest percentage price decreases are observed for entries in monopoly markets, the largest absolute increases in consumer welfare are realized by entries in oligopoly markets.

Turning from the quantitative results of the paper to a discussion of their implications for the evolution of the U.S. airline industry, it can be expected that the low-cost-high-quality strategy of JetBlue Airways will put additional pressure on the revenue and net income situation of the network carriers particularly in long-haul markets. In the medium and long-run, these developments might trigger a further shakeout among the network carriers. Such a scenario becomes even more likely if the recent market entry of Virgin America is taken into account. This new entrant not only follows a similar low-cost-high-quality strategy but also focuses on long-haul coast-to-coast markets. Although Virgin will put additional pressure on network carriers it will also have to directly compete against JetBlue in many long-haul markets and will therefore put the sustainability of the entire low-cost-high-quality business strategy to the test.

From a policy perspective, the appearance and growth of JetBlue Airways is a clear sign that competition in the U.S. 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 existence and further growth of low-cost carriers such as Southwest Airlines or JetBlue Airways alone will constrain the market power of these mega-airlines and will secure at least a significant fraction of the benefits of deregulation and competition in the 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 by network carriers to apply instruments out of the tool box of anticompetitive behavior.

Coming back to the recent concentration trend among network carriers, the case of JetBlue Airways can also be seen as an example of how mega-mergers can facilitate the growth of low-cost carriers. The merger between American Airlines and Trans World Airlines in 2001 freed-up a significant amount of slots at New York's JFK airport. The slots provided the nucleus for the growth and success of JetBlue Airways in the U.S. airline industry in general and the Greater New York region in particular. Most recently, JetBlue Airways moved into the famous Terminal 5 at New York's JFK airport. The terminal was build in the zenith of airline regulation in the 1960s and accommodated the Flight Center of Trans World Airlines until the bankrupt airline was acquired by American Airlines in December 2001.

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# APPENDIX

**Table 7: Description of variables**

| Variable | Description | Source |
|---|---|---|
| *Dependent variables* | | |
| ln(passengers) | Logarithm of passengers in the markets (<= two stops) | DB1B |
| Non-stop fare | Average non-stop fare in constant (1995) USD | DB1B |
| ln(non-stop fare) | Logarithm of avg. non-stop fare | DB1B |
| | | |
| *Route characteristics* | | |
| ln(fare) | Logarithm of avg. fare in constant (1995) USD | DB1B |
| B6 serves | Indicator variable if JetBlue directly serves the market | T-100 |
| Short-haul | Non-stop distance <= 750 miles | T-100/DB1B |
| Medium-haul | Non-stop distance 750-1500 miles | T-100/DB1B |
| Long-haul | Non-stop distance > 1500 miles | T-100/DB1B |
| Monopoly | Market structure w/o JetBlue: Monopoly | T-100 |
| Oligopoly w/o LCC | Market structure w/o JetBlue: Oligopoly of network carriers | T-100 |
| Oligopoly with LCC | Market structure w/o JetBlue: Oligopoly including at least one low-cost carrier | T-100 |
| Avg. plane size | Average plane size as measured by available seats divided by number of departures | T-100 |
| Avg. load factor | Average load factor (passengers/available seats) | T-100 |
| Chapter 11 Route | At least one Chapter11-airline serves the route | ATA |
| | | |
| *MSA characteristics* | | |
| ln(population) | Population estimate in Mio (Mean) | Census |
| ln(income) | Average weekly wage in constant (1995) USD (mean) | BLS |
| Unemployment rate | Unemployment rate (Mean) | BLS |
| | | |
| *Airport characteristics* | | |
| Avg. airport HHI | Airport HHI (Mean) | T-100 |
| | | |
| *Time characteristics* | | |
| Quarter 1 | January-March | T100/DB1B |
| Quarter 2 | April-June | T100/DB1B |
| Quarter 3 | July-September | T100/DB1B |
| Quarter 4 | October-December | T100/DB1B |
| Trend | Year 1995-2009 | T100/DB1B |

*Source: U.S. DOT T-100 Market Segment Data and DB1B Origin and Destination Survey,U.S. Census Bureau, Bureau of Labor Statistics (BLS), authors' calculations.*

## Table 8: Summary statistics

| | Price effect by haul | | Price effect long-haul markets | | Long-haul demand | |
|---|---|---|---|---|---|---|
| **Variable** | mean | s.d. | mean | s.d. | mean | s.d. |
| *Dependent variables* | | | | | | |
| ln(passengers) | | | | | 6.446 | 1.663 |
| Non-stop fare | 162.38 | 67.710 | | | | |
| ln(non-stop fare) | 4.999 | 0.449 | 5.387 | 0.326 | | |
| *Route characteristics* | | | | | | |
| ln(fare) | | | | | 5.348 | 0.319 |
| B6 serves | 0.015 | 0.123 | 0.029 | 0.167 | | |
| Short-haul | 0.499 | 0.500 | | | | |
| Medium-haul | 0.334 | 0.472 | | | | |
| Long-haul | 0.167 | 0.373 | | | | |
| Monopoly | 0.624 | 0.484 | 0.657 | 0.475 | | |
| Oligopoly w/o LCC | 0.222 | 0.416 | 0.226 | 0.418 | | |
| Oligopoly with LCC | 0.154 | 0.361 | 0.117 | 0.322 | | |
| Avg. plane size | 120.87 | 43.365 | 163.79 | 38.377 | | |
| Avg. load factor | 69.864 | 12.610 | 77.599 | 10.617 | | |
| Chapter 11 Route | 0.088 | 0.283 | 0.134 | 0.340 | | |
| *MSA characteristics* | | | | | | |
| ln(population) | | | | | 3.441 | 0.743 |
| ln(income) | | | | | 23.191 | 0.839 |
| Unemployment rate | | | | | 5.305 | 1.655 |
| *Airport characteristics* | | | | | | |
| Avg. airport HHI | | | | | 31.370 | 12.000 |
| *Time characteristics* | | | | | | |
| Quarter 1 | 0.248 | 0.432 | 0.234 | 0.429 | 0.250 | 0.433 |
| Quarter 2 | 0.251 | 0.434 | 0.253 | 0.435 | 0.250 | 0.433 |
| Quarter 3 | 0.250 | 0.433 | 0.253 | 0.435 | 0.250 | 0.433 |
| Quarter 4 | 0.251 | 0.434 | 0.251 | 0.434 | 0.251 | 0.433 |
| Trend | 2002 | 4.289 | 2002 | 4.213 | 2002 | 4.325 |
| Observations | 76,831 | | 12,832 | | 56,128 | |
| Markets | 1,690 | | 298 | | 1,015 | |

*Source: U.S. DOT T100 Market Segment Data and DB1B Origin and Destination Survey,U.S. Census Bureau, Bureau of Labor Statistics, authors' calculations.*