JÖNKÖPING INTERNATIONAL BUSINESS SCHOOL
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# Low Cost Carriers effect of entry on airfare and passenger traffic within US Airline Industry

Master Thesis within Economics Trade and Policy, 30 credits

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Master's Thesis in Economics

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# Abstract

This study analyzes how the presence of a low cost carrier is going to affect the airfares and the passenger traffic. The present structure of the US carriers market is also overviewed, in order to determine the share of incumbent carrier market power. A number of factors such as distance, number of passengers, market concentration, income, low cost presence, type of travel (leisure or not) playing an essential role in analyzing ticket fares and helped in providing a reliable outcome. Most of the findings in previous research reveal that the entry effect of a low cost carrier decreases the airfares and leads to an increase in the passenger traffic. The regressions essentially determine if the fares strategy is different taking into account the presence of a low cost carrier on a specific route. Based on fixed effects and an instrumental variable approach over 2000 to 2014 it can be concluded that the entry of low cost aviation companies do indeed diminish the airfares though at a lower level and in the same time the passenger traffic will rise due to a cut down in ticket price. Precisely, the findings of this paper according to the panel instrumental variable method reveal a 6.3% drop in airfares concomitant with a 6.7% increase in the passengers' traffic once the entry is established.

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# 1. Introduction

The importance of entry in terms of competition and innovation is significantly indisputable within the field of airline industry. Further, entry has the ability to cut off the excess profits acting as a balance towards an equilibrium level. There are several ways in which this behavior occurs namely when the entrant has the ability to drag profits by closely resembling the established firms method of production or even the product itself. Another way would be through the innovation channel, moreover an innovative entry occurs when the new company discovers new techniques to respond to the customer need or by producing a certain product with lower input. As Geroski (Geroski, 1995) mentioned, this innovative entry can be viewed as a disequilibrium tool which drive the industry from a state of an equilibrium to another.

The US airline industry can be viewed as a certain example for the applicability of both types of entry. Starting with 1978 when the industry deregulation began, similar entries into numerous city-pairs increased considerably the competition pressure and drove full service carriers towards a boost in terms of product efficiency which in the end lead to a decrease in the airfares together with an increase in passenger traffic and better service for their routes. In the same time, due to deregulation, new business models were emerging and soon growing, namely low cost carriers who had the ability to challenge full service carriers with numerous ways of innovative entry. This unique combination of deregulation and regulation and taking into account the innovative and imitative entry, turns the US airline industry into a prime applicant for a depth examination of the market entry role. The interest upon this topic strikes further by the relative absence of research over the effect of entry that accounts for the turmoil within the market developments as: massive external disturbance, particularly the September 11th attacks in 2001 as well the 2008 economic recession, and massive internal disturbance specially the mergers of Delta Airlines with Northwest Airlines and also the merger of American Airlines and Trans World Airlines.

Since 1978 when the first low cost airline was established (Southwest Airline), this new business model had accumulated big success hits together with other airlines such as AirTran Airways, JetBlue Airways, Spirit Airlines, etc. which shows that these companies have grown and tend to be the new strength of development. In 1993, US Department of Transportation creates a concept called ‘Southwest effect’ which illustrates the great impact of the Southwest entry on incumbents within the same serving region. Moreover it extend the meaning of this term towards a more general understanding of the low cost carrier entry effect. The same authority, later on defines ‘the low cost carrier service revolution’ acknowledging for the massive increase of this type of carrier (Hüschelrath and Müller, 2011). Many of the previous research paper are in fact based on the Southwest effect, from which they extend it to investigate the impact of low cost revolution. The conclusions from such papers are best summarized by (Wang, 2005) which accounts for three main effects. First, the effect of entry of Southwest lead to an important boost in terms of passenger’s traffic. Moreover, this airline is responsible for the declining of number of passengers using other pairs within the same serving region. Additionally, incumbents try to absorb the market share for a specific city pair Southwest Airline entered by decreasing their prices (Riiter, 1993).

The present paper continue the research to analyze the effect of low cost carrier’s entry upon airfares and passengers traffic in the present circumstances.
A panel data would be used accounting for both time-series and cross-sectional effects. The case will cover factors such as low cost presence, market concentration, distance, number of passengers, route, income and average fare using quarterly data from 2000 to 2014. The data is acquired from the Department of Transportation 1B Dataset, which gives information related to the entry effect by network carrier and low cost airlines over the airfares in non-stop airline market for the U.S. Furthermore, a number of methods are used step by step to eliminate the systemic drawbacks of other research papers. Beginning with the regular Ordinary Least Square regression which can give inappropriate explanation regarding the variables relation due usually to heterogeneity bias. Continuing with the fixed effect model which provides a better result but does still not account sufficiently for the effect of low cost carriers upon airfares and number of passengers. And concluding with the instrumental variable method IV which is more applicable for this dataset according to the endogeneity test. As well, the panel IV method is also used to handle the omitted variable bias and the problem of causality between the airfares and ticket demand.

In accordance with several previous research papers, this thesis provides a more decisive interpretation for the entry effect of low cost carriers on airfares and number of passengers. Nevertheless, there is still a constraint for which an extra research is required. The variable accounting for low cost presence is a dummy which is only accounting for the exact moment of entry. Yet, the depressing effect can be already seen started as early as previous two quarters before the entry actually occurs. This rationalization is also showing the shift in number of passengers before and after the entry moment. The previous insights are according with the findings of (Goolsbee and Syverson, 2008) which states that incumbents have the tendency to impede the low cost carriers by lowering the airfares pre-emptively, though the fact that the passengers traffic is increasing gives enough incentive for the entry occurrence.

The reminder of this paper is structured as follows. The subsequent section 2 gives a review of the existing literature consistent with the aim of this paper and the research question. Section 3 gives more insights about the behavioral effect upon entry and the shift in airfares. This section is followed by the construction of the sample together with the description of the model (section 4). Afterwards, in section 5 the initial results are being reviled descriptively followed by the wide discussion in section 6. The paper concludes with section 7 which accounts for several comparisons together with some suggestions and further research approaches for low cost carriers.

## 2. Literature review

Starting with 1978 when deregulation of US airline industry occurred, together with a more straightening response from the legacy carriers (Full Service Carriers) and the available data of route specific traffic and airfares collected from the US Department of Transportation provides a successful support for empirical research in today's environment. In terms of market entry, the current literature can largely be subdivided into two main categories that refers to the 'entry determinants' papers and 'the entry effect' literature. The first category refers mostly to a set of articles that analyzes the most important drivers of carriers decision to enter specific routes by either accounting for structural models such as (Berry, 1992), (Dunn, 2008), (Tamer and Ciliberto, 2009) or by using a reduced form approach which uses market and firm characteristics approximating the likelihood of entry such as (Sinclair, 1995) (Lederman and Januszewski, 2003) and (Boguslaski *et al.*, 2004). The papers accounting for the entry effect can further be subdivided into analyzes of general effects and researches seeking to concentrate over the specific incumbents reactions of entry. Following the target of this research, the reminder of the present section focuses on the articles review associated to the 'entry effects' literature.

The previous research papers targeting the general entry effects mostly study the effect of entry on a route for a certain low cost airline on airfares and passenger traffic. Namely, researchers as (Winston and Collins, 1992) overview the entry on a particular route of People Express (low cost carrier) and conclude that entry caused on average a fall in airfare by 34% between years 1984 and 1985 in 15 origin and destination airports. (Dresner and Windle, 1995) in their paper '*The Short and Long Run effects of Entry on US Domestic Air Routes*' uses a similar research question but with particular insights from the entry effect of a route by Southwest Airline on airfares and passenger traffic. They used both econometric models and descriptive analysis from which the present paper is inspired in terms of methodological and theoretical basis. Relying on a data sheet within the 1991 to 1994 period from the Origin and Destination Survey published by U.S Department of Transportation, they notice a mean ticket fare decline by 48%, together with a mean rise in passenger traffic of more than 200%. First, they were using time series regressions in terms of market concentration expressed by Herfindahl Index, ticket fare and passenger number. Moreover, authors have been using two empirical methods to depict the relationship between the variables and airfares. Also when they account for the airline dummy variable, they notice that the presence of a low cost carrier have lowered significantly the airfares on routes, nevertheless the route density and market concentration did not affect the price as the researchers expected to.

Expanding the contribution that examines the route level effects of entry for single airlines, some papers provide a wider perspective. Within a more eloquent paper, (Joskow *et al.*, 1994) analyzes quarterly data for 27 important route pairs for the US from 1985 to 1987 and generally conclude that entry diminishes airfares and rise output. Moreover the researchers notice that entry lowered the yield by around 9% and show a corresponding rise in the air traffic passengers of around 57%. They also conclude that the entry pattern is not induced by airfares levels that overpasses the norm.

Another interesting research paper that uses a time series analysis for price premiums for the US airline industry is '*Price premiums and low cost carrier competition*' by (Hofer *et al.*, 2008). They use the years of 1992, 1997 and 2002 and conclude that airport concentration accounts for the biggest share of price premiums rather than route concentration. Moreover, somewhat surprising, they found that full service carriers price premiums are usually decreasing with the presence of low cost airline and also that the later airlines charge no price premiums.

In a more recent study investigating the general entry effects by (Brueckner *et al.*, 2011), the authors included a differentiation of the airfare reaction between full service carriers and low cost airlines. Using quarterly data statistics accounting from 2007 to 2008, the researchers agreed that "the presence of in-market, nonstop LCC (Low Cost Carriers) competition reduces fares by as much as 34% in the nonstop markets, and adjacent LCC competition in these markets reduces fares by as much as 20%" (Brueckner *et al.*, 2011:4p). So the impact of a second network airline in the non-leisure market is significantly smaller, lowering the airfares by approx. 5.3%. Also adding a third airline on a route will lead to no significant impact over the airfare. Interestingly, researchers additionally notice that the brief competitive entry effect from full service carrier is somewhat a new phenomenon and could be due to the expansion of price range from the low cost airlines and their rapid growth, due to internet service which contributes to a more fare transparency search and due to a shift in companies acquisition patterns and travel policies.

Adding to the literature of the 'general entry effects', several articles primarily investigates the incumbents response to low cost carriers entry. Most relevant, a relatively new research by (Goolsbee and Syverson, 2008) looked at how incumbents react to the entry intention from the competitors (different from how they react when an actual entry occurs). They used statistical data from the US Department of Transportation Database 1A for the period between 1993 and 2004 with focus on passenger carriers and using the growth of Southwest Airlines route chain to determine pairs where the entry probability increases. One of their findings was that the incumbents significantly cut prices with the Southwest entry threatened, moreover one half of the total effect of Southwest airline over the incumbents price will occur even before Southwest starts flying. Another interesting paper is the one of (Daraban and Fournier, 2008) '*Incumbent response to low-cost airline entry and exit*' reached a comparable outcome. They found that the incumbents significantly lower their fares after and before entry of a low cost airline. Furthermore, the reduction in price were less strong for other low cost airlines comparing with Southwest Airlines. Also the researchers notice that the post entry ticket fare adjustment took place somewhat fast towards a new equilibrium within one or two quarters after entry.

In the previous years the growth of the new business model was considered the main power tool for the air transport industry. Nevertheless, the industry environment knew a lot of changes due to external or internal shocks. A reasonable question is if in the present situation such model is still going to fit? How about the impact of ticket fares of low cost carriers and their sustainability over the initial promotional period? An article by (Abda *et al.*, 2011) summarizes a new trend for the effect of these carriers over the passenger traffic using the biggest 200 US airports data. Their conclusion was that even though these carriers account for a growth in market share this is steady cutting off. Moreover, the airfare on routes with low cost presence depress less from those routes with no entry. Nevertheless, passengers on pairs with low cost presence are more elastic from those with no entries, meaning that passenger traffic rise and decline significantly in good years and respectively in bad years.

Last but not least, a study conducted by (Bamberger and Carlton, 2006) about the airfare from the full service perspective as reaction of a low cost entry, failed to reach empirical evidence for a predator reaction of full service carriers (FSC) within the aftermath of entry from the low cost carriers. Though the researchers find that most of the new business model carriers entry were successful together with the fact that full service carriers did not lower their prices substantially after the entry of a low cost and also that the prices did not rise significantly after the exit either.

In order to summarize these previous research articles, the main literatures considered above are presented in a table below.

Table 1 Literature review summary

| Research | Dataset | Method | The entry effect by low cost carriers | |
|---|---|---|---|---|
| | | | Airfares | Number of passengers |
| Windle & Dresner (1995) | Panel data | Descriptive | Decreases by 19% on average<br>Decreases by 47% (Southwest effect) | Increases by 182% on average<br>Increases by 297% (Southwest effect) |
| Windle & Dresner (1998) | Panel data | 3SLS | Decreases by 53% (Southwest only)<br>Decreases by 39% (multiple carriers) | |
| Goolsbee& Syverson (2008) | Time series | OLS | Decrease 18.6% at the entry year and keep lowering afterwards | The significance of the quantity response is roughly double of the airfare shifts |
| Daraban (2008) | Time series | OLS | WN's entry decrease average fare by 22% while depressing legacy carriers' price by 17.6% | |
| Brueckner(2011) | Cross section | OLS | Nonstop LCC competition reduces fares by as much as 34% in the nonstop markets, and adjacent LCC competition in these markets reduces fares by as much as 20% | |
| Abda *et al.* (2011) | Panel | Descriptive | Significantly decrease of 5% more on routes with low-cost airlines entrance in 2005 | Passengers are more elastic on routes with low-cost airlines presence, implying increase and decrease more in good years and bad years, respectively |

With the foray through the previous research paper literature, this paper aims to contribute to the 'general entry effect' category of research. Therefore empirical methods will be used for the latest available data to analyze the impact of low cost airlines entry over the air tickets and passenger traffic for the current US airline industry environment.

## 3. Entry and Airfare Dynamics

Once deregulation took place in 1978, the US competitive airline industry passed through various changes. Since then, airline carriers faced with a lot more flexibility within their network route and air tickets pricing strategies. Nowadays it is much easier for carriers to enter routes which once were heavily regulated by the board of Civil Aeronautics. Therefore, over the past thirty years an important inflow by the low cost carriers took advantage of the implementation of a point to point route and the movement towards the usage of the same type of airplane[1]. This is broadly in contrast with full service carriers, which carry out a hub and spoke structure and run with a variety of different airplanes. Nevertheless, one of the conclusions of (Smyth and Pearce, 2006) from their paper '*Airline Cost Performance*' mentioned that the biggest difference between low cost and legacy carriers is due to the lower cost per seat kilometer, which allows low cost airlines to charge relatively lower airfares.

Mostly, low cost airlines have increased their market share in the U.S airline industry, in the past ten years. In 1999, the new business model carried more than 62 million passengers which count for 23.2% of the total market share of passengers flying within the borders. Moreover, in 2007, low cost airlines faced another increase in the total number of passengers to over 119 million, accounting for 38.6% of market share for all domestic flights[2]. Such a growth can be due to the development of the low cost airlines route network. Between the first 150 most busiest airports, there were around 3000 instances of entry starting with 2000:Q3 ending with 2014:Q3 by the low cost airlines, with Southwest accounting for approx. 1300 routes, Jet Blue Airways approx. 350 routes, AirTran Airways 1250 routes and Spirit Airlines around 60 routes. Every route represents a particular one way airport match. Example, when Southwest Airlines begins to fly in the second quarter of 2004 from Orlando Airport to Philadelphia Airport and forth, there were considered as being two routes. The present paper investigates most of the currently operating airlines (table 3) who have developed significantly over the past twenty years and who are important actors within the US airline industry scene nowadays[3].

[1] Here I refer for example to Southwest Airlines which uses exclusively Boeing 737 aircrafts.
[2] Outcomes calculated using data from USA Department of Transportation 1B Dataset (DB1B).
[3] This present research doesn't study the effect of entry for full service carriers because statistics reveal that these airlines did not enter an important number of airport pairs during this time period.

Previous papers had analyzed the brand loyalty effect on the flying demand. Starting with (Borenstein, 1989) and (Gilbert, 1996) explanations about how carriers employ marketing tricks taking the form of frequent flier program with the purpose of building and strengthen customers brand loyalty for the specific company. Thus customers enroll in this airline flier frequent program and gather credit every time they use the same particular company. Therefore, members can exchange their credit for cheaper or even free flights, upgrades, or any recompenses from the airline. Brand loyalty customers adequately experience a swap cost upon enrollment in a frequent flier program for a particular airline. In 2001 (Kim *et al.*, 2001) examine the possibility of creating two market segments from these marketing programs, namely brand loyal passengers and price sensitive passengers.[4] Usually the first type of passengers tend to be members of the airline's frequent flier program and also tend to purchase more flights using that particular airline. While the latest category it's just driven by the flight which accounts for the lowest price giving a particular route. (Borenstein, 1992) provides insightful information about how passengers are more willing to participate into a frequency flier program for a particular airline when they live within the airline's hub city. The home for Delta Air Lines, Hartsfield-Jackson Atlanta International Airport hub, consists of consumers that are not just likely to fly with Delta but also be members of Delta's frequent flier program noticing the benefits from the spread selection of markets out of Atlanta. In the end this will lead to a more tight relationship between passengers and a particular airline, furthermore companies that account for such strategies can also increase their airfares without the risk of losing an important amount of their market base. This mean that members of such programs will continue to purchase air tickets from their member carrier even though they were charged more, these passengers will like to benefit from an award after acquiring a number of trips from the particular airline. Concluding, brand loyalty drives a switching cost for passengers.

[4] Here researchers named the brand loyal passengers as heavy-user segment and the price sensitive passengers as light-user segment.

It is well known that legacy airlines incumbent carriers similarly divide the market when a low cost airline enters a route.[5] Full service carriers can target the brand loyal segment within the market and allow newcomers to serve the price sensitive segment, which would led to a wider dispersion of airfares. Therefore, the displacement effect is significant if incumbent carrier focuses entirely on brand loyal passengers, producing a rise of the incumbent average fare and fare dispersion. Nevertheless, the rivalry effect prevail if entry by the low cost airline enhance a stronger competition for passengers that are price sensitive, culminating with lowering incumbents average fare. Furthermore, lowering fares at the left tail of the fare distribution could lead incumbents to also lower fares at the right tail in order to avoid the segment of brand loyal consumers in becoming more price sensitive. If there was a massive difference from full airfares and discount airfares, then brand loyal passengers would swap between competing airlines.

The previous literature on low cost airlines gives enough evidence that the dominance of the rivalry effect is possible (Morrison, 2001) and (Vowles, 2001) they both gained evidence that incumbents lower their airfares when Southwest Airlines get in a new route pair, also called Southwest Effect. Nevertheless, taking into account the particularities of the US airline industry, it is probable that the displacement effect is more significant. Therefore, it's plausible to argue that the incumbents would rise their airfares in response to an entry from the low cost carrier into a particular route. This paper serves to empirically analyze the impact of such entrance in terms of airfares and passenger traffic in response to low cost carriers for the U.S airline industry.

[5] The present research overviews the response from the full service carrier incumbents because there were no evidence that low cost carrier incumbents facing a potential entry by a rival company would indicate a drop in the price as a response. Furthermore, the main results are qualitatively the same when gathering all incumbent airlines.

# 4. Methodology

The present topic analyzes the impact of entry which was previously well documented. This paper aim to extend the research using panel data, taking into account both cross-sectional and time series variables, in order to evaluate whether the impact of the presence of a low cost carrier upon airfares and traffic suffered any changes.

## 4.1 Sample Construction

The main dataset used in the present analysis is collected from the Domestic Airline Consumer Airfare Report which was initially based on the Origin and Destination Traffic Survey directed under the US Department of Transportation Bureau of Transportation Statistics. This report has been made public for first time in June, 1997 by the Department's Office of Aviation Analysis. The data accounts for the 1000 largest domestic city-pair routes which covers 75% of all the 48 states number of passengers and 70% of total domestic passengers (Domestic Airline Consumer Airfare Report). This research paper refine the first 100 city-pairs from the domestic US airline market ordered by the number of passengers in the third quarter of 2014 and linked to the other quarters. Moreover, some other data were collected from the Bureau of Economic Analysis together with some previous research papers.

The panel data is constructed by repeated observations on particular factors for a number of Origin and Destination pairs (N) at a number of different points in time (T). For the present paper 57 points in time are selected starting with the third quarter of 2000 and ending with the third quarter of 2014[6]. This factors (variables) are composed by price, number of passengers, length, income, market share, tourism and the presence of low cost carriers.

[6] The data for the first two quarters of 2000 are missing completely. As for the data accounting last quarter of 2014, would be made publicly in May 2015.

## 4.2 Variables Description

A detailed description of the construction of variables is provided below. In order to avoid the bias which is caused by the heteroskedasticity together with the big volume variance between some variables but taking the sufficient coefficients, all independent variables which accounts for large positive amounts have been converted into natural log pattern, which can easily be noticed having the prefix “ln”, example ln_income, ln_passenger, ln_price, ln_mkshare large, ln_distance.

Price (LN_PRICE) represents the one-way average airfares which in fact are average ticket prices in dollars paid by all passengers that acquired a ticket. This variable also covers the airfares for first class tickets but it does not cover the free tickets which are usually awarded by the airlines which offers frequent flyer programs (Domestic Airline Consumer Airfare Report, 2014).

Distance (LN_DISTANCE) stands for market distance and measures the non-stop distance from an endpoint of a route in miles to another. Now, taking into account that the longer the flight the higher the ticket price, nevertheless the time spent in the air by cruising is directly proportional within the longer routes which will indeed suggest that flights on longer distances encounter a lower per mile cost. Now a striking and decisive information stands among the fact that if a plane flies on a shorter route the cost per mile will be higher due to the large amount of fuel that the plane consumes especially during takeoff and landing. In this case the cost will increase more slowly as the distance of the route extends. In average low cost carriers flight distance is larger than that of a major carrier (865 miles for FSC and 878 miles for LCC). Even though there is a difference, it is not strong enough that would create an advantage of flying on much bigger routes. In this case low cost carriers could choose to increase the flights on short haul routes together with a lower price in the market.

Giving all these and assuming they will stay constant, flights on longer distances should account for a higher price than those of shorter distances. Therefore, just by looking at the fuel, flights on longer distances use more and therefore are costly to handle. Nevertheless, as stated before most of the aircrafts fuel is used during takeoff and landing. While the aircraft is in the air the efficiency of the fuel is very high. Using this intuition leads to the understanding that flights on a longer routes encounter a lower cost per mile then those on routes less the 500 miles. Therefore a longer route it’s not necessarily keen to drag along a higher price. JetBlue Airways one of the best players in this league operates mostly on short haul routes and interestingly is still able to practice lower fares then the rivals. Distance accounts for a big share on the percentage level of a ticket price, but there is no evidence that could explain the difference in fares between carriers. To show this I have compared a flight between JetBlue Airlines a LCC who is able to undercut prices by up to 70% from those of the competitors and here I choose American Airlines. So as it stands, a no restriction coach ticket from New York (JFK) to Los Angeles (LAX) will cost with American Airlines approximately $2550 and around $750 with JetBlue Airlines. As observed in some previous analysis the impact of distance is excessive and I no longer think nowadays this is the case. As we saw the LCC's are today able to operate this long haul flights at a diminishing cost so there is no more market power on the side of FSC's that could explain those higher fares.

Passengers (LN_PASSENGERS) stands for number of passengers and represents the average load factor of all the flights on an observed route giving any airline. This has a negative coefficient from the fact that if the load factor increases the cost per passenger will decline. Again there is no surprise that LCC's register a higher load factor then the rivalry. This could imply that routes with high load factor account for a fall in prices. Nevertheless, these flights usually take place during mornings or evenings and giving that this periods are most used in aviation the agglomeration occurs. Moreover, congestion increase the cost both by increasing the personal required to handle the flights that land and takeoff within a short period and due to delays. This, together with the fact that the bigger the loading factor the higher the chance of the origin or destination of that flight to be a hub which again accounts for large levels of agglomeration during peak hours. The least affected of this fact are LCC's because they tend to operate on the second airports of big cities which are far less crowded.

Income (LN_INCOME) accounts for personal income for the every state, quarterly, which has been collected from the Bureau of Economic Analysis. For the purpose of this variable to match the passenger variable, personal income level in both origin and destination city-airport have been summarized. Moreover, all the dataset is adjusted by the inflation rates quarterly. The general framework assumes that passengers with higher income are less influenced by the air ticket fare. Therefore, the relationship between these two variables is expected to be positive.

Market share largest carrier (LN_MKSHARE_LRG) this variable stands for the largest market share which represents the largest carrier market share that operates on a specific route. The market share can be found within the Domestic Airline Consumer Airfare Report which also covers the name of the largest carrier. To some extent the bigger the market share the more concentrated the particular market is. When the biggest carrier takes an important proportion of the market share, it means that the particular market is intensive, leaving the other rather small carriers sharing the remaining of the market. Overall, full service carriers compensate their loss from the highly concentrated markets by rising the prices, namely the monopolist strategy will imply that due to the lack of competition the airfare naturally increases. Therefore, the present variable is expected to have a positive relationship with the price variable.

TOURIST this variable is fairly simple referring to the observed route and if it's or not a tourist[7]. So this would be a dummy variable with value 1 if the endpoint is tourist location and 0 otherwise. From the study of (Dresner and Windle, 1995) the cities with the tourist feature are mostly centralized in four regions Hawaii, Nevada, Florida and Puerto Rico. Taking into account this variable would eliminate the risk of obscuring the influence of other variables, simply taking, tourists on average have a more flexible demand curve so many tourists on a plane would lower the prices on that particular route. And therefore this variable would account for a negative coefficient.

Table 2 Tourist destination cities within the model

| Region | Cities |
|---|---|
| Hawaii | Hilo, Honolulu, Kahylui, Kona |
| Nevada | Las Vegas, Reno |
| Florida | Fort Lauderdale, Fort Myer, Miami, Orlando, Tampa, West Palm Beach |
| Puerto Rico | San Juan |

[7] As accounting for touristic city destination.

LCC's_presence accounts for the presence of a low cost airline on a particular route. This dummy variable consists of 1 at the moment of entry from a LCC and holds the 1 index as long as this carrier flies on that specific route. When/if the LCC will leave that specific market the 0 index will be stated. Why 0 because we started with FSC being the dominated carriers and we can think at these LCC's as being the carriers which comes and 'steal' the market share from these FSC yet the dominator's are still these legacy carriers.

Table 3 Comprehensive Carrier List

| Latest available 2014 data is September | | | |
|---|---|---|---|
| REPORTING_CARRIER | Description | Share (PASSENGERS) | Type of Carrier |
| WN | Southwest Airlines Co. | 20.86 | 1 |
| DL | Delta Air Lines Inc. | 15.06 | 0 |
| UA | United Air Lines Inc. | 9.24 | 0 |
| AA | American Airlines Inc. | 9.05 | 0 |
| US | US Airways Inc. | 8.16 | 0 |
| EV | ExpressJet Airlines Inc. | 4.38 | 0 |
| B6 | JetBlue Airways | 4.13 | 1 |
| OO | SkyWest Airlines Inc. | 4.04 | 0 |
| AS | Alaska Airlines Inc. | 2.79 | 0 |
| MQ | Envoy Air | 2.40 | 0 |
| YX | Republic Airlines | 1.98 | 0 |
| NK | Spirit Air Lines | 1.93 | 1 |
| 9E | Endeavor Air Inc. | 1.87 | 0 |
| F9 | Frontier Airlines Inc. | 1.81 | 1 |
| YV | Mesa Airlines Inc. | 1.43 | 0 |
| FL | AirTran Airways Corporation | 1.35 | 1 |
| HA | Hawaiian Airlines Inc. | 1.34 | 0 |
| G4 | Allegiant Air | 1.33 | 1 |
| QX | Horizon Air | 1.07 | 0 |
| VX | Virgin America | 1.02 | 1 |

| | | | |
|---|---|---|---|
| ZW | Air Wisconsin Airlines Corp | 1.01 | 0 |
| 16 | PSA Airlines Inc. | 0.92 | 0 |
| S5 | Shuttle America Corp. | 0.85 | 0 |
| G7 | GoJet Airlines LLC d/b/a United Express | 0.64 | 0 |
| CP | Compass Airlines | 0.56 | 0 |
| RP | Chautauqua Airlines Inc. | 0.53 | 0 |
| SY | Sun Country Airlines d/b/a MN Airlines | 0.26 | 1 |
| All Rows | All Rows (including those not displayed) | 100% | |

SOURCE: International Civil Aviation Organization (ICAO)
Note: In the present table the value 1 is assigned to the low cost carrier while value 0 is assigned to carriers that are not low cost.

Table 3 gathers a comprehensive list of all the airlines covered in the dataset established for this analysis. Due to the fact that Databank 1B dataset represents a 10% random sample of all tickets sold, the carriers that I included in Table 3 are selected randomly, with their weight proportional to the number of passengers for each carrier during the third quarter of 2014. Furthermore because there is no clear definition that can describe a low cost carrier there are two ways to solve this issue. First from each and every company website and second from The International Civil Aviation Organization (ICAO) and their list of LCC's as of October 24th, 2014 (List included in the bibliography).

## 4.3 The estimating equation

In the present research paper, the panel data has been used to regress a number of four models progressively: Pooled Ordinary Least Squares model, Fixed effects model, Instrumental Variable (IV) estimation and a Panel Instrumental Variable estimation. For the first two models, two regressions are being run with the dependent variable *price* and *passengers* respectively. Therefore, variables such as, distance, income, market share largest carrier, tourism and LCC's presence accounting for data for every quarter of every year of 2000-2014 period. These variables have been meticulously picked from diversifying but related aspects accounting for a mix of demand, market concentration, cost which influence airlines airfares. The last two models, the regressions are being run by the two stages least squares or 2SLS. Further details upon the construction of every model will be provided in the next section.

### *4.3.1* Pooled Ordinary Least Squares model

In general, the takeoff point for a panel data analysis is the Pooled ordinary least squares mode, same as in the present research. This OLS model estimator consider all the entity for all time points as one single sample therefore these sample will gain a considerable bigger size comparing to the simple cross-sectional data model. When a particular sample is big enough, the coefficients of multiple variables will be reaching infinitely close to the real value. A commonly used equation of the present model is given by (Podesta, 2002):

$$y_{jt} = \beta_1 + x_{jt.}$$

Where $y_{jt}$ accounts for the dependent variable and $x_{it}$ accounts for the independent variable with j=1,2,3… ,N which designate the number of cross-sections and in the same time t=1,…,T represents the different points in time. Moreover x=1,…,X stands for the particular explanatory variable. Therefore, when there can be found dissimilarities within the cross-sectional sample observations, the OLS model becomes inappropriate due to the heterogeneity bias driven by the coefficient variance (Hakkala *et al.*, 2009).

### *4.3.2* Fixed Effect model

Taking into consideration the disadvantage of the pool OLS model, further models for the analysis of a panel data type is carried out. There are three regular tackles namely the fixed effect model, the random effect model and the mixed model. These models are being used naturally on different circumstances. The first model applies time independent effects for every entity that could be correlated with the dependent variable. Briefly, the main discrepancy between the fixed effect and the random effect consist of the fact that the intercept is constant or not to the intercepts of the independent variables. A commonly used test to determine which effect model is most suited to be use is the post-estimation Hausman test. For the present research paper, the outcome from the Hausman test suggest that the data that has been collected correspond to the fixed effect model. The Hausman test hypothesis states that the estimates for the random effect and for the fixed effect models account for no significant difference. Therefore, this hypothesis is rejected meaning that these regression models are very distinctive proving that the use of fixed effect model would be appropriate. Richard Paap in 2011 provides a generic equation namely:

$$y_{jt} = \alpha + x'_{jt}\beta + \varepsilon_{jt}$$

Here, same as before, $y_{jt}$ accounts for the dependent variable while the other $x_{jt}$ accounts for the independent variable, moreover j=1,2,3…,N designates the number of cross-sections and t=1,2,3…,T represents the different points in time.

*4.3.3* Instrumental Variable estimation

Even though the fixed effect model approach overcomes the bias due to heterogeneity from the ordinary least squares model, however it cannot solve the problem of endogeneity, where the independent variable is correlated with the error therm. Moreover, the fixed effect model can lead to bias by omitting variables when it automatically neglect the time-invariant variables. Both of the previous two regressions investigates the link between price and passenger variable in solely one way, when in fact the relation is reciprocal. To reveal a more insightful information and extending the model, the Instrumental Variable estimation is performed using two stages least squares regression as third step.

Before making use of instrumental variable estimation, (Stone and Shepherd, 2011) suggests in his paper related to this estimation method that a test for endogeneity needs to be run to make sure there is correlation among variables. Therefore, if the hypothesis from the endogeneity test is rejected which means that there in fact exist a problem of endogeneity, the instrumental variable estimation earns its credit, adversely the results can be even worse than those using ordinary least square models.

The basic equation for the instrumental variable method is the one provided by (Cameron and Trivedi, 2009) namely:

$$y_{1j} = y'_{2j}\beta_1 + x'_{1j}\beta_2 + u_j, \; j=1, \ldots, N$$

Within the present equation, $y_{1j}$ stands as the dependent variable and in the same time the independent variable accounts for both endogenous variables $y'_{2j}$ and exogenous variables $x'_{1j}$. This in fact entails that the errors $u_j$ are namely uncorrelated with variables that are being exogenous ($x'_{1j}$)

but correlated with variables that are being endogenous ($y'_{2j}$) which would serve to the inconsistence of $\beta$. In order to solve the endogenous problem, a better way would be to make use of the instrumental variable ($z_j$). This would imply that the term $z_j$ match the restraint of the $E(u_j \mid z_j)=0$.

### *4.3.4* Panel Instrumental Variable estimation

Namely because I make use of the panel framework, and also the dataset consists of a panel pattern, there will be a forth step accounting for the Panel Instrumental Variable approach. As before for the previous steps, a generic equation is provided but now in the form of two stages least square regression, namely:

$$y_{jt} = x'_{jt}\beta + \alpha_j + \varepsilon_{jt}.$$

$$\ln(\text{price})_{jt} = \beta_0 + \beta_1 (\text{LCC's presence})_{jt} + \beta_2 \ln(\text{distance})_{jt} + \beta_3 \ln(\text{income})_{jt} + \beta_4 \ln(\text{mkshare\_large})_{jt} + \beta_5 (\text{tourism})_{jt} + \varepsilon_{jt}$$

$$\ln(\text{passengers})_{jt} = \beta_0 + \beta_1 \ln(\text{price})_{jt} + \beta_2 \ln(\text{distance})_{jt} + \beta_3 \ln(\text{income})_{jt} + \beta_4 \ln(\text{mkshare\_large})_{jt} + \beta_5 (\text{tourism})_{jt} + \varepsilon_{jt}$$

As in the previous estimation, an instrumental variable in form of $z_{jt}$ is needed. The standard framework assumes that $z_{jt}$ acknowledge for two hypothesis. First, the exogeneity while the second is correlated with the error of the time-invariance ($\alpha_j$) though uncorrelated with the time-varying factor of errors defining $E(\varepsilon_{jt} \mid z_{jt})=0$. Therefore the present equation provides a persistent estimation regressed of $y_{jt}$ on $x_{jt}$ using $z_{jt}$ instruments (Cameron and Trivedi, 2009). The efficiency and strength of the methods have a decisive impact on the quality of the model as a whole. The correlation between the repressors and the instrumental variable, will lead to a decrease of the instrumental variable standard errors. Once the instruments are too loose, the model can suffer in terms of precisions but worst can drive to incorrect inference.

## 5. Descriptive statistics

So far the previous sections reveal economic evidences in terms of entry by the low cost carriers but from documentary and modelling perspectives.

Nevertheless, in the last several years, economic environment and also the aviation industry in particular suffered considerable changes. Moreover, a considerable portion of previous papers utilize cross-sectional technique, obstructing the time series effect. In the following stages, a formal model will be generated but previously an analysis of the variables in terms of descriptive statistics will be conducted.

Table 4 summarizes the mean of all the variable. Therefore, the average of a one way ticket on a route is 196.08 dollars. The first 100 city pairs mean distance is 1171.80 miles, which means that the yield per miles is 0.200 dollars. A remark needs to be made here, namely one can already observe that even if the distance and price averages increase, the yield is slightly higher than the one obtained by (Dresner and Windle, 1995) paper of 0.175. This can imply that due to the newly emerged business models and their high efficiency the distance-price ratio didn't increased much. Moreover, daily 2581 passengers travel between the top 100 city-pairs in both origin and destination directions. Furthermore, the personal income level from both origin and destination states in average has increased considerably at the level of 768269.23 dollars. In terms of dummy variables, 23 out of 100 city pair routes account as a vacation city while 21 percent of routes, on average, have a low cost airline as a main carrier with the largest market share, while more than 70 percent of in average have a low cost carrier involved.

Table 4 Descriptive statistics

| | mean | sd | min | max |
|---|---|---|---|---|
| price | 196.08 | 67.87 | 60.0 | 518.0 |
| passenger | 2580.87 | 1961.689 | 213.00 | 21187.47 |
| distance | 1171.80 | 670.39 | 209 | 2704 |
| income | 76826.92 | 12090.52 | 29756.55 | 123874.64 |

| | | | | |
|---|---|---|---|---|
| mkshare large | 50.06 | 15.40 | 39.89 | 99.21 |
| tourism | 0.23 | 0.42 | 0.0 | 1 |
| LCC's presence | 0.20 | 0.40 | 0.0 | 1 |
| *N* | 5700 | | | |

The present table can already give a broad perspective upon the airline industry field. By looking at variables such as number of passengers per day, largest market share, personal income, they vary significantly and certainly more than it did back in 1995. This may insinuate that the US airline market is getting more and more competitive and also differentiated implying an offset in terms of yields. Further other factors such as the steep increase in oil prices, the economic crises are suited to explain this counteraction.

In order to analyze the specific effect of the presence of a low cost carrier, several graphs are created, reveling the historical changes of the low cost carriers and their link with other decisive variables.

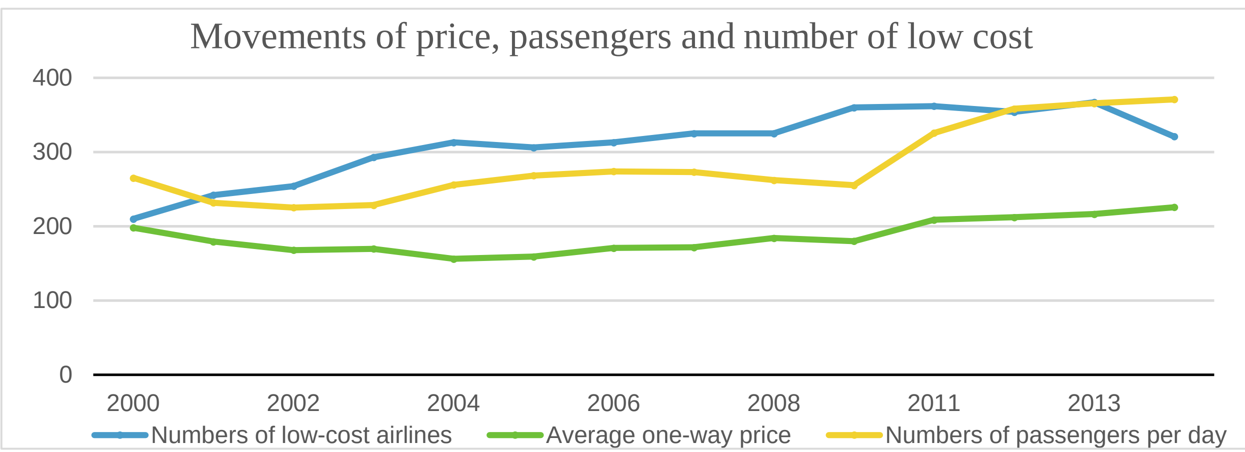


Figure 1 The path of price, number of passengers and number of low cost carriers

The present figure shows the movements of three important variables, the one-way ticket price on average, the number of passengers travel per day[8] and also the presence of low cost carriers on the

[8] The number of passenger per day revealed in the figure have been adapted by 10 times less in order to fit the volume level of the other two indicators.

first 100 routes between year 2000 and 2014. The graph does not account for year 2009 and also year 2014 does not include the last quarter[9]. Therefore this two values cannot be comparable with those of other points in time. The graph line accounting for the presence of low cost carriers reveal a smooth increase over 13 years which gives more reasoning for the framework discussed in the second chapter. Overall, in 2013 there were 367 low cost carriers that were flying within the domestic US market. On one side, the green line indicating the one way average of airfare ticket didn't actually fluctuate too much between 150 dollars and 225 dollars, with a more straightforward increase during the past last years. Unusually, the airfare ticket line does not move against the increase in the presence of low cost carriers. On the other side, the line indicating the number of passengers travel per day is in fact not revealing an increase with the path of low cost presence. As a matter of fact, it mildly fluctuates between 2252 and 2740 passengers per day, but with a more steep increase during the last few years. It can be interpreted that the airfare ticket and the passengers travel of low cost carriers effects have sustained after the initial promotional time. Moreover it seems that this relationship during the last years followed more or less the same path. Nevertheless, it cannot be assumed as totally certain, taking into account that several other factors might have hurt such as the economic crises or the steep increase of the oil price.

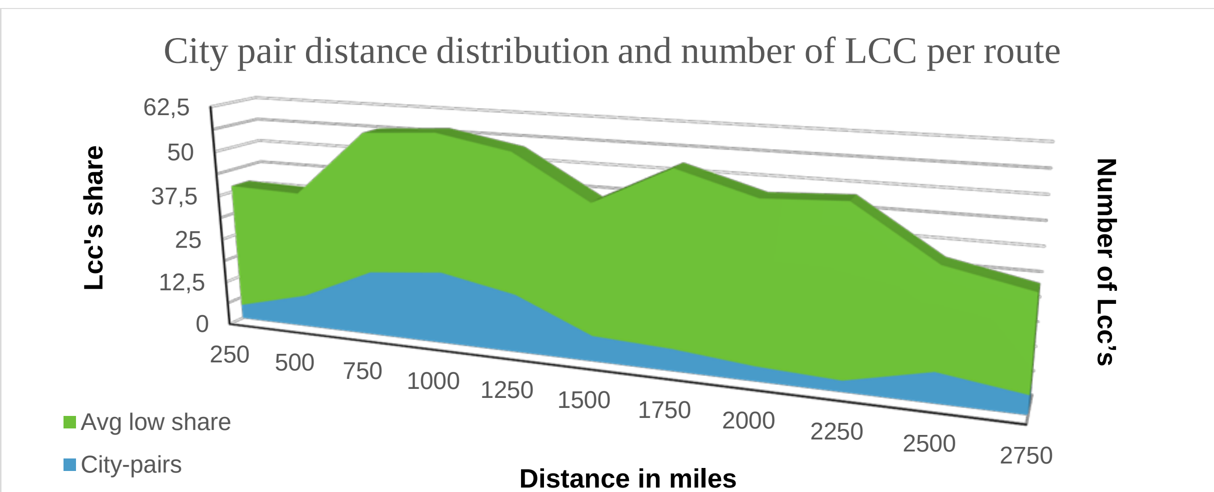


Figure 2 City pair distribution on first 100 routes together with the number of LCC per route

After performing a vertical time series investigation, the graph above reveal two variables horizontally on the distance. First the blue bars accounts for the number of city pairs at the level of

[9] The data for year 2009 are entirely missing due to report issues and also the data for year 2014 quarter 4 would be made publicly available after this paper has to be submitted.

miles situated between that specific ranges shown by the distribution of the first 100 air-routes. For example, there are 3 out of 100 top routes on the range between 2000 and 2250 miles, namely Las Vegas – Washington DC, Atlanta – San Francisco and New York – Phoenix. From the graph, it can easily be seen that the most concentrated routes are the ones between somewhat short distances, mostly between 750 to 1250 miles. The most concentrated route would be the one between 750 and 1000, accounting for 20 city-pairs. Second, the mean number of low cost carriers that is present on a route for multiple distances are illustrated by the green bar. Remote, graph 2 does not enhance the negative link between the entry from the low cost airline and the distance variable, relation that was concluded in the early paper of (Dresner and Windle, 1995). Seems like low cost airlines don't solely focus on the short route distance, but extend towards a more distant and popular city-pairs. The route which accounts for the largest presence of the low cost carriers is distributed around 1750 miles distance and accounts for 47 low cost carriers flying on that distance range. Nevertheless, the points in time when these low cost carriers enter on the long distance route its overall later than the one for the short distance city-pairs.

Unfortunately, the previous two graphs do not provide a very insightful indications of the entry impact a low cost carrier might have had as a whole. In order to examine the influence provided by the entry of such carriers, the variable accounting for the presence of low cost carrier is being analyzed. First, all 100 top routes account for the presence of low cost carriers during all the sample period from 2000 Q3 to 2014 Q3. Therefore a two line representation taking into account the change of airfare and number of passengers after a LCC enters on a route are being executed.

Primarily, according to the Appendix 1, 16 routes out of 100 provide a straightforward proof what when a low cost carriers enters on a particular route, the airfare on that specific route declines and manage to sustain a low level. Furthermore, between all 16 routes, city-pairs with average to long distance (750 – 1250 miles) account for the most insightful impact comparing with the city pairs on short distances.

The figure in Appendix 1 accounts for the shift in airfare for 4 quarters pre and post entry for all 16 most easily spotted influence[10]. In the present figure, it is only shown the route between New

[10] In the paper of Windle and Dresner it has been demonstrated that 4 quarters before and after entry occurs are indeed enough to account for the entrance impact.

York and San Diego just for the example purpose. As it can be easily seen in the graph, the airfare suffered a drop by around 50% of the highest point before entry from 370 dollars to 185 dollars. Afterwards, the airfare manage to stay stable even accounting for a slight decline and some small fluctuations until today. Moreover the present result accounts for the exact percentage in airfare drop that (Dresner and Windle, 1995) found in their paper from 1995 when analyzing the impact of low cost carriers. The present city pair accounts though for one of the biggest drop in airfare among all 100 routes.

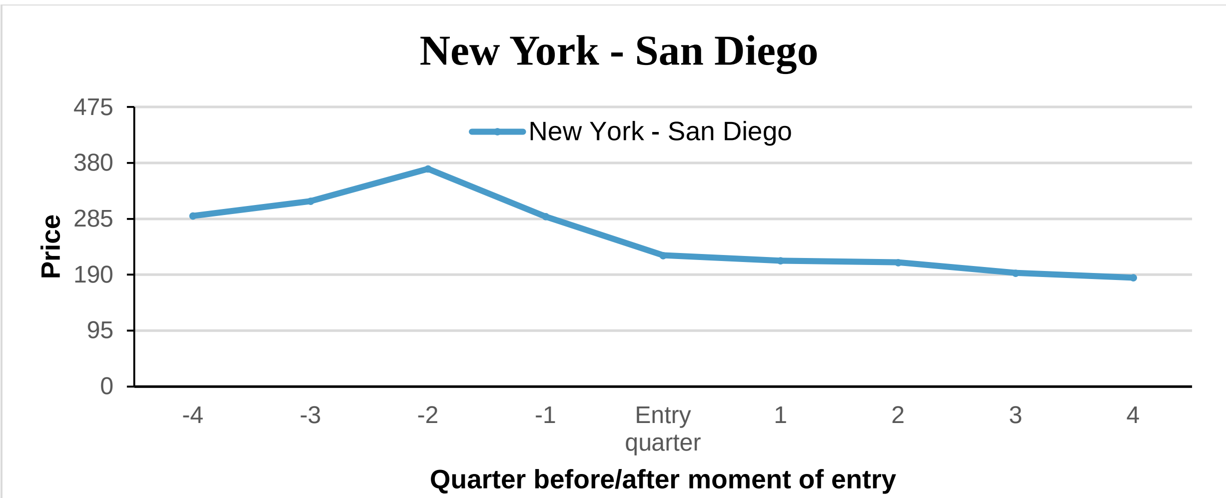


Figure 3 One-way ticket fare before and after the entrance

Secondly, the change in number of passengers is revealed in Appendix 2 which accounts for the most easily spotted rises. For the passengers variable in 17 out of 100 routes the change after an entry from a low cost carrier had considerably increased the number of travelers. Nevertheless, for this variable there is no proof that the entry of a low cost airline is depending on the distance. Yet, 11 out of 17 routes account for the same city-pair that are adequately measured for the entry change in the airfares. Therefore it appears that the influence of the entry of a low cost carrier has simultaneous repercussion for both airfares and number of passengers. Furthermore, using the same example as for the previous graph and taking the route between New York and San Diego, figure that will show the change in number of passenger before and after the entry. This particular route account for the most striking effect over the influence of low cost airline entry. The number of passengers flying on this route suffered a significant increase 60.48% after the entry, from 920 to 2328 travelers per day. Moreover looking backwards at the (Dresner and Windle, 1995) paper, the result of the Southwest Airline entry lead to an increase up to 200% of the traffic on a specific city pair route, and in the same time all other airlines increase by around 74% on average the number of passengers.

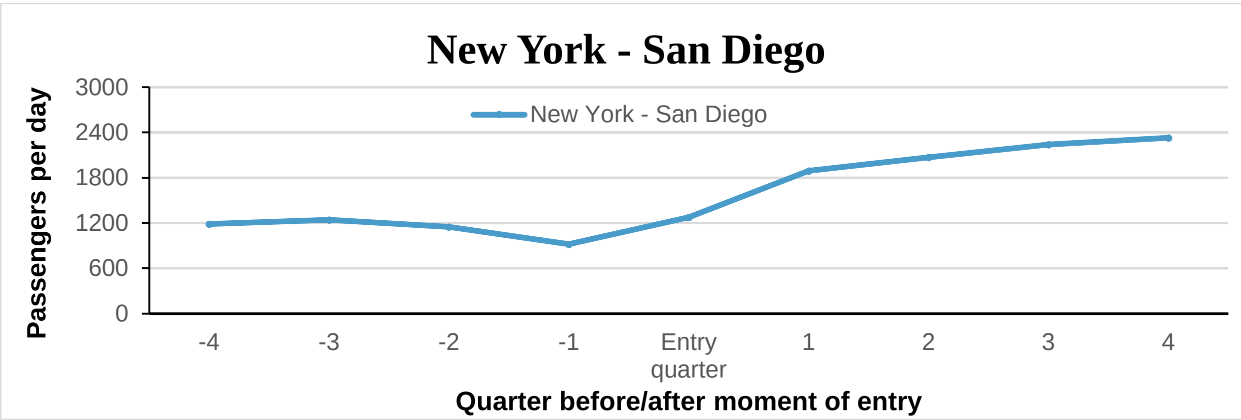


Figure 4 Shift in number of passengers before and after entry occurred

From the descriptive analysis section, several basic conclusions can be stated. Primarily, the low cost carriers are still growing over the sample period. Withal, the increase is though yet not clearly associated with a decrease in airfare nor with a rise in passenger traffic for top 100 routes on the average level. Yet, the graphs suggest that low cost airlines do not only fly on short distances but their presence on medium to large distances is still strengthening, result in contradiction with some previous papers that suggest these type of carriers only fly on short distances. Certainly, it should be accepted that the presence and also the entry of such carriers does impact the airfares and passengers traffic on a specific route they entered, though such influence is settling. Nevertheless, an in depth explanation will be conducted in the following section with the help of some formal statistical methods.

Moreover a number of tests have been applied in order to check the reliability of data. Starting with ADF for unit root patterns and by accepting the null under 10% (p-value) the variables are stationary. Another test in the name of BPG regarding heteroskedasticity has been performed which revealed that there is no bias for non-normality.

# 6. Model results

From the evidences on the section above about the descriptive statistics, the entry effect of the presence of low cost airlines does indeed exist. In depth, the most striking effect accounts for 16 routes that give the best evidence in terms of air fare drop once an entry from a low cost carrier has occurred. Additionally, the longer the route distance the steeper the drop in airfare, therefore there is a positive influence coming from the distance when accounting for airfare drop. Making use of quarterly data starting with third quarter of year 2000 and ending with third quarter of 2014, in the present section the statistical meaning of such data and the analysis of the panel data models will be interpreted. As mentioned in the methodology section, the panel data regressions would be made in four steps.

## 6.1 Pooled Ordinary Least Squares model

The first step of a comprehensive analysis is the Pool OLS regression model. In the table 5 the result of the OLS regression model is shown. The first column is referring to the regression dependent variable price while the second column is referring to the regression second dependent variable passengers. The standard deviation error term has been adapted for both regressions by the collection of group number. Here the $R^2$ accounts for how much of the variation in the true values explained by the model are 58.93% for the price dependent variable and 27.85 for the passenger's variable.

Specifically for the first regression, a number of four out of six cross sectional independent variables are statistically significant at 1% level, including passengers, distance, tourism and LCC's presence. First it seems logical that the airfare ticket would increase with the distance. Interestingly, the influence that this variable has over the price has decreased during the last years and comparing with the paper of (Dresner and Windle, 1995) this influence was around 20% higher than today. The airfare seems to decrease when the city-pair involves a tourism origin or destination while the amount of passengers overall seems to positively influence the airfare on a specific route. Besides, the presence of low cost carriers somewhat depresses the airfare on the route of entry. In terms of income several previous papers pointed out that there is a positive influence as explained by the fact that wealthy people are more elastic in terms of airfares, meaning higher prices in high income states. Yet, this sort of fare discrimination seems not existent given by the fact that income variable is not statistically significant over price. In terms of market share there is somewhat evidence of monopoly power provided by the significant relationship between this variable and airfare. Also this is in line with the current theory, stating that usually the carrier with the largest market share within a specific route tend to set a higher price for their tickets.

Table 5 Regression Results (OLS)

| | (1)<br>price | (2)<br>passenger |
|---|---|---|
| passenger | 0.0215*** | |
| | (3.93) | |
| distance | 0.3839*** | -0.2711*** |
| | (76.27) | (-15.98) |
| income | -0.0036 | 0.2318*** |
| | (-0.8318) | (23.02) |
| mkshare large | 0.0268* | -0.7656*** |
| | (2.63) | (-33.96) |
| tourism | -0.2397*** | 0.1893*** |
| | (-34.39) | (10.30) |
| LCC's presence | -0.1083*** | 0.2245*** |
| | (-16.30) | (13.86) |
| price | | -0.1261*** |
| | | (-3.93) |
| C | 2.5139*** | 6.9652*** |

| | | |
|---|---|---|
| | (24.30) | (28.25) |
| *N* | 5699 | 5699 |
| *G* | 100 | 100 |

Note: *t* values are given in parentheses
***significant at 1%, **significant at 5% and, *significant at 10% level

As for the second column, passenger accounts as dependent variable, all six cross sectional variables are significant. Seems reasonable that a lower price tend to attract more travelers, from here the negative relationship with passengers. Wealthy people can be assumed to travel more since income has also a positive influence over the number of passengers variable due to their higher personal income availability. Moreover, travelers prefer to use routes that are less concentrated which can give them a number of more choices, routes that are also somewhat cheaper due mostly to the lack of monopoly power from the largest airlines. As expected, the influence that distance pays upon the number of passengers is negative. This is in line with the common theory that travelers prefer short distances considering the comfort criteria, time and cost. Generally it is well known that tourist places tend to attract more passengers therefore the positive link between this and passengers. Further, as noticed in the descriptive analysis section, the presence of a low cost carrier is indeed affecting positively the number of passengers. Overall within the present regression, the passenger variable can more easily be influenced by the number of explanatory variables and has a more insightful outcome that leads to a well-known conclusion that the number of passengers is nowadays increasing.

Before moving any further into the next model as is stated in the methodology which is Fixed Effect model Hausman Test has been conducted in order to have the statistical proof that the Fixed Effect model is the right model to use. This will provide insights of who out of Random Effect or Fixed Effect is the right model for a specific set of data. Moreover Hausman null hypothesis states that Random Effect model is the right model to use while the alternative, by rejecting the null hypothesis implies that Fixed Effect model is the right model to use.

Table 6 Hausman test outcome

| Test Summary | Chi-Square Statistic | Chi-Square d.f. | Probability |
|---|---|---|---|
| Cross-section random | 127.24 | 4 | 0 |

By looking at the probability index which is 0%, less than 5% meaning that we reject the null hypothesis. Therefore by rejecting the null hypothesis we are left with Fixed Effect model which, in this case is the right model to use and will be performed in the following section.

## 6.2 Fixed Effect Model

Even though the OLS model is pretty much in line with the current theory and trend within the US airline industry, still the regression can be biased due to the inherent drawbacks that the model has which were discussed within the methodology section. In order to give more proof to the results, a further and in depth step is undertaken with the help of the fixed effect model. In line with the previous regression, same for the fixed effect model two regressions are being performed with price and passengers as dependent variables with robust standard errors. These standard errors are being adjusted in order to prevent the defective individual variances which can misleading the outcome by weighting them less. After this step, all coefficients kept the same sign, yet the *t* estimation is somewhat lower. A number of (two) variables have been skipped, distance and tourism, leaving the other independent variables with a significant influence. This is because of the drawbacks of this type of model. The fixed effect model support in taking into account for unobserved heterogeneity and when heterogeneity is constant over time and is correlated with the independent variables. Therefore, variables such as distance and tourism are one of these constants which don't change over time period. Hence, the model automatically neglect these two variables.

The outcome of the fixed effect model can be seen in the table 7. On one side, for the price variable a major part of the expectations are satisfied. All the explanatory variables are statistically significant excepting mkshare_large. As predicted and somewhat logical the passengers variable has a negative influence over the airfares implying that if there is an increase in the number of passengers on a certain route, the price is expected to drop. It also can be sort of strategy for companies so they can lower their tariffs followed by an increase in passengers traffic, bringing smaller profits but on a quick pace in order to compensate for low traffic routes. Secondly, income variable is positively influencing the ticket fares in line with the common thinking of wealthy people living usually in higher income states, are willing to pay a higher fare for a ticket. Subsequently, the variable accounting for the presence of low cost carrier has a negative relationship with the dependent variable price. Same as in the descriptive statistics section, the influence that the entry of a low cost airline exercises over the price variable, is fading off. Therefore, there is yet more proof provided by the statistical evidence saying that the entry of such carrier on a specific city-pair sufficiently lower the airfare. The variable accounting for the market share has no statistical significance over the price when accounting for date variables.

On the other side, the dependent variable passenger estimation still provides statistically more significant outcomes than the OLS mode. Same as before all statistical results are significant. Beginning from the income which clearly shows an important influence over the number of passengers can also be associated with: the wealthy you are the higher the traveling frequency resulting into an increase of passenger traffic. The market share and the price variable are negatively influencing the number of passengers. Market share can be viewed in terms of concentration therefore the higher the concentration the likely the monopoly power can be which can lead to higher fares for the monopolist air tickets. While in terms of price this has a more straightforward approach, namely the lower the ticket the higher the number of passengers flying on that specific route.
Nevertheless, the core of this thesis represented by the low cost carrier presence is still fading off showing less influence in terms of passenger traffic then in the previous model. However this is consistent with the current theory.

Table 7 Fixed effect model outcomes

| | (1) | (2) |
|---|---|---|
| | price | passenger |
| passenger | -0.1099*** | |
| | (-15.698) | |

| | | |
|---|---|---|
| income | 0.4879*** | 1.143*** |
| | (32.608) | (43.363) |
| mkshare_large | 0.0203** | -0.3690*** |
| | (1.807) | (-18.082) |
| LCC's presence | -0.0612*** | 0.1200*** |
| | (-10.370) | (10.899) |
| price | | -0.3836*** |
| | | (-15.698) |
| C | -3.7647*** | -11.961*** |
| | (-13.135) | (-23.027) |
| *N* | 5699 | 5699 |
| *G* | 100 | 100 |

Note: *t* values are given in parentheses
***significant at 1%, **significant at 5% and, *significant at 10% level

## 6.3 Instrumental Variable estimation

The previous two regressions are still not sufficient in order to provide solid outcomes. As illustrated on the methodology section, an Instrumental Variable with Two-Stage Least Squares (2SLS) would be performed. At the very first step is the instrument selection. There has also been created a correlation matrix see table 7 in the appendix. Under the assumption that price is correlated with the error time_varying component, in which case the fixed effect model becomes inappropriate therefore the price variable needs to be instrumented. In the present case, the variable that needs to be instrumental has to be highly correlated with the pricing variable but does not need to determine the amount of passengers. Hence, there are only two variables that can be choose when looking at the correlation matrix. First is the distance variable and the second one is LCC's presence. Nonetheless when using the fixed effect model above such variables have been removed due to the time-invariance. Now in our case, the LCC's presence variable is correlated with the independent variables price by -0.29 while for passengers by 0.08. It's obvious that they differ a lot, though both of these are statistically significant under 99% confidence interval. Nevertheless, the LCC's presence which accounts for the presence of low cost carriers on a specific route seems to be the most appropriate one in taking the instrumental variable form. It can be translated as that the low cost carrier influences the number of passengers by having an influence over the price variable.

After the instrumental variable identification, a standard instrumental variable estimation can be performed. Taking into account that the main reason for which this section is being applied is for making sure of which method is more suited for this specific database between OLS and 2SLS. Moreover, a test accounting for the endogeneity is carried out after running a 2SLS regression. Hence the exogenous variables hypothesis has been rejected meaning that instrumental variable estimation is much trustier than the ordinary least square method.

## 6.4 Panel Instrumental Variable estimation

The previous regression stages are examining the best suited approach for the present data set. Lastly, the panel instrumental variable is assumes to be the most appropriate choice which can contribute at fixing the problem of endogeneity or help explaining the two way causality between airfares and demand. Moreover, after the Hausman test is performed the p value equal 0.9807 meaning that we will accept the null hypothesis. Therefore the instrumental variable estimation should be regressed under the model of random effect. Also, it eliminates the omitted variable bias from the fixed effect model. The outcomes are presented in the following table.

Table 8 2SLS regression outcomes

| | 1st Stage | 2nd Stage |
|---|---|---|
| | price | passenger |
| price | | $-0.378^{***}$ |
| | | (-14.42) |

| | | |
|---|---|---|
| LCC's presence | -0.063*** | |
| | (-10.44) | |
| distance | 0.354*** | -0.155 |
| | (14.07) | (-1.860) |
| income | 0.248*** | 1.088*** |
| | (21.72) | (46.00) |
| mkshare large | 0.037*** | -0.450*** |
| | (3.15) | (-19.61) |
| tourism | -0.172*** | 0.300 |
| | (-5.66) | (2.93) |
| C | -2.267*** | -9.475 |
| | (-7.63) | (-13.30) |
| *N* | 5699 | 5699 |
| *G* | 100 | 100 |

Note: *t* values are given in parentheses
***significant at 1%, **significant at 5% and, *significant at 10% level

Thus, first column gathers the outcomes from the first stage while the second column reveals the output for the second stage. Further, the $R^2$ is equal to 32% being reasonable when it comes to panel instrumental variable estimation. For the first stage, all the variables are statistically significant with also the expected sign. It is pleasant to notice that the variable accounting for the largest market share gives a positive significant effect on airfares, more than it did on the OLS model. Even though the coefficient (0.037) is less than other variables, the effect of market concentration still influence the airfare sufficiently. Logically, the more concentrated and intensive a market is, the greater the airfare. This is also in line with the theoretical evidence, saying that when an airline company is accounting for monopolist power and has enough strength it can set up higher prices for their tickets, compensating in this way from other down slopping markets (Wang, 2005).

Looking at the influence that the presence of a low cost carrier exercises over the price and acknowledging that LCC's presence is a dummy variable it can be stated that, if a low cost carrier will enter on a specific city-pair, the airfare will decrease on average by 6.3%.

Continuing with the second stage, the price variable which is instrumented by LCC's presence negatively affects the number of passengers. It can be understood that passenger variable is somewhat elastic so the travelers will switch to cheaper flights. The relationship will imply that for $1 loss in airfare will account for 0.378 increase in passengers. The tourism variable has still a significant role in influencing the price at a more accurate level. In case that the time varying errors are independent, this would not be suited for accounting as a valid instrument (Cameron and Trivedi, 2009). On the other side, the tourism feature has changed a lot. Traveling does not necessarily imply that people go on holidays, together with a sharp increase in business travel. But if the purpose of travel accounts as a business type then the freedom of choosing the destination falls.

Four different econometric models have been used in the present section. Starting with the standard ordinary least squares model, the outcomes from that model are somewhat questionable due to the genetic drawback of the method. Next, the fixed effect model solves the heterogeneity problem though it leaves the issue of omitted variables bias. In order to solve the endogenous bias and the reciprocal causality, the use of instrumental variable comes in hand. The panel instrumental variable approach deals with all the biases and problems providing the final and most reliable outcome for this paper. The influence of the entry of a low cost carrier on airfares is significantly negative. However, the entry and presence of such airline seems that it has been fading off so the effect is less and less noticeable. Nevertheless is still showing additive influence between the presence of low cost, ticket fare and number of passenger through the reoccurrence association. Mathematically speaking, one extra entry from the low cost carrier on a specific city pair cuts 6.3% of airfare while $1 drop in price brings 0.378% more passengers on that specific route. Therefore, it deduce that an extra presence of low cost carrier will rise the number of passengers on that specific route by 6.7%.

# 7. Conclusion

As one of the most interesting and exiting topics within the airline industry, the impact of low cost airline over the airfares and number of passengers has a wide background in other research papers and has been well documented. This paper enlarge the previous researches in order to overview such influence within the current environment. The descriptive analysis, together with the modeling regressions, this section will structure the findings by comparing them with other research papers and evidences from the LCC. Future research analysis proposals are provided in the closing stages of the paper.

## 7.1 Concluding by comparing

In the category containing the literature review, the presence of a summary graph illustrates briefly several outcomes from previous research analysis. In order to define the comparison, that graph is refreshed including the outcomes from this paper.

Undoubtedly, the conclusion overall is backing the previous outcomes. Firstly, the entrance of a low cost airline does indeed reduce the airfares together with increasing the number of passengers that travel on that specific route. Nevertheless, some effects can be seen within two main aspects. The first one that can be certain of is the influence that the low cost carrier use to exercise is nowadays fading off. In terms of airfares, can be concluded: the negative influence that the entry plays is shrinking from 38% in 1995 to 6.3% in 2014. While in terms of passenger traffic, the impact that the entry has does not affect directly this variable anymore, but indirectly through price.

Relying on table 5 and accounting for the same methodology (Ordinary Least Square), the influence on airfares had more than 50% drop in the period from 1998 – 2007. Moreover, taking into account the time effect, the methodology used for composing these regression is another reason for differences in outcomes. Even though some research papers use panel data model, they only regress using OLS methodology which comes with some generic drawbacks when using a panel data collection. For this research paper, the drawback that came with different methodologies had been resolved step by step using some advance approaches such as the model of fixed effects and instrumental variable estimator. Depending on the instrumental variable outcomes, the influence that the low cost carriers exercises has been dropping from 10.8% to 6.3%. As stated before, the outcomes from this research are more solid than the other papers presented in the review.

Table 9 Comparable outcomes

| Research paper | Database | Methodology | The entry effect by low cost carriers | |
|---|---|---|---|---|
| | | | Airfares | Number of passengers |
| Windle&Dresner (1995) | Panel data | Descriptive | Decreases by 19% on average<br>Decreases by 47% (Southwest effect) | Increases by 182% on average<br>Increases by 208% (Southwest effect) |
| Windle&Dresner (1998) | Panel data | 3SLS | Decreases by 53% (Southwest only)<br>Decreases by 39% (multiple carriers) | |
| Vowles (2000) | Panel data | OLS | Decreases by 45.50% on average<br>Decreases by 77% (Southwest effect) | |
| Alderighi et al. (2004) | Cross section data | OLS | Decreases by 42.50% | |
| Wang (2005) | Cross section data | OLS | Decreases by 18.25% (WN effect) | |
| Bogdan Daraban (2008) | Time series data | OLS | Southwest's entry decreases the average airfares by 22% and in the same time depresses FSC carriers' airfares by 17% | |
| Goolsbee&Syverson (2008) | Time series data | OLS | Decreases by 19% in the year of entry and keep depressing afterwards | The impact of the quantity response is around twice the changes in airfare |
| Abda et al. (2011) | Panel data | Descriptive | Significantly depresses by 5% on routes with entry by low-cost carriers in 2005 | Passengers are more flexible on routes with low-cost carriers entrance, meaning that increases and decreases more in good years and bad years, respectively |
| Present paper | Panel data | OLS | An extra entry decreases 10.8% of airfare on average | An extra entry increases # of passengers by 22.45% |
| Present paper | Panel data | FE | An extra entry decreases 6.12% of airfare on average | An extra entry increases # of passengers by 12% |

| | | | | |
|---|---|---|---|---|
| Present paper | Panel data | 2SLS | An extra entry decreases 6.3% of airfare | 1% airfare drop leads to 0.378% increase in # of passengers<br>An additional entry increases # of passengers by 6.7% |

## 7.2 Conclusion meanings for Low cost carriers

As reported in the conclusions, low cost carriers are fading off the impact effect upon airfares and number of passengers. It can be therefore stated that the well-known strategy in terms of growth for the airlines might not continue favorably in the near future. Therefore, a new task will account for the importance of how to manage the cost advantage and how to apprehend new opportunities (Bundgaard *et al.*, 2006).

In order to restrain some of the cost advantages the low cost airline should work on increasing the fuel efficiency. The US low cost carrier's fleet is relatively old therefore this might be something that these carriers can improve. The steep increase in kerosene[11] has without no doubt affected the low cost carriers cost efficiency. Therefore due to the impossibility of controlling the fuel price the only way in achieving a cost reduction will be by using the fuel in a more efficient way. In terms of future growth opportunities these new carriers have already got into the most profitable routes within the US borders. The rivalry within these city pair routes is vehement and costs money. Another thing to look at would be either to search for new methods that the carriers could use in order to gain some points at the hub destination from the FSC. Either, a totally new perspective would be to push the low cost airline companies' efficiency to a whole new level in terms of flying distance and aiming for transatlantic flights.

## 7.3 Further research

In accordance with the constraint mentioned in the introduction regarding the entry moment, the lagged LCC presence dummy variable turn out to impact the result of the model. Therefore, for the upcoming research papers, a good advice would be that this entry should be considered at some previous moment, for example account for the dummy somewhere as two periods before the actual entry.

[11] Jet engines fuel. More than 50% of aircraft fuel is consumed during takeoff and landing.

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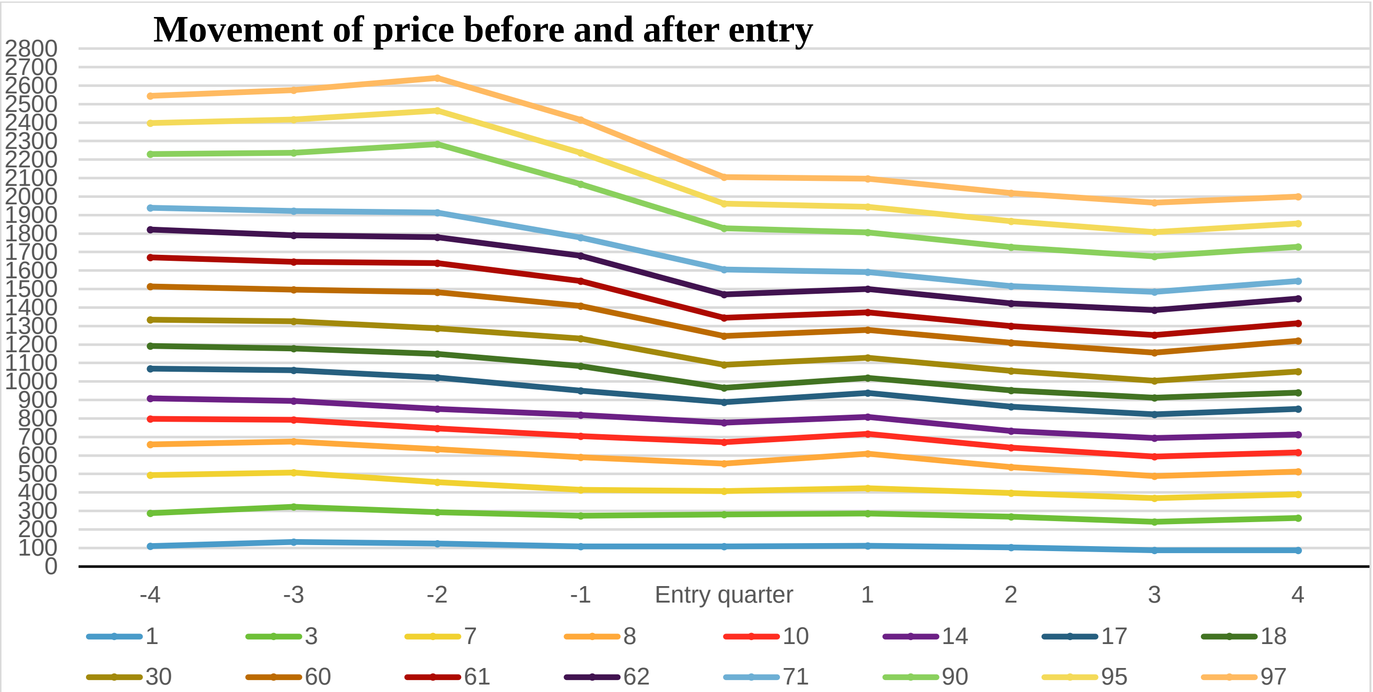
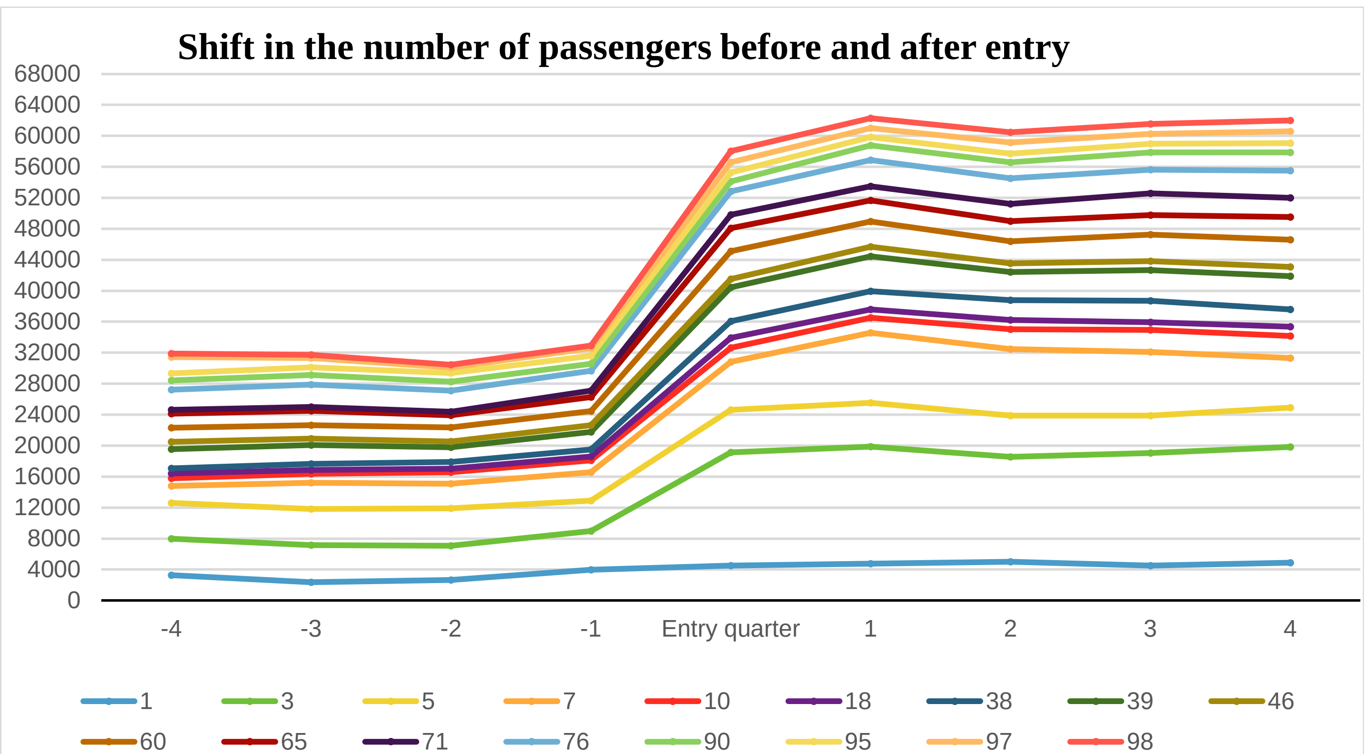
# Appendix

Appendix 1. Price movement before and after the entry for most noticeable shifts




Appendix 2. Change in the number of passengers before and after entry



Appendix 3. List of top 100 city pairs

| **Route ID** | **City Name 1** | **City Name 2** |
|---|---|---|
| 1 | Los Angeles, CA (Metropolitan Area) | San Francisco, CA (Metropolitan Area) |
| 2 | Los Angeles, CA (Metropolitan Area) | New York City, NY (Metropolitan Area) |
| 3 | Miami, FL (Metropolitan Area) | New York City, NY (Metropolitan Area) |
| 4 | Chicago, IL | New York City, NY (Metropolitan Area) |
| 5 | New York City, NY (Metropolitan Area) | San Francisco, CA (Metropolitan Area) |
| 6 | New York City, NY (Metropolitan Area) | Orlando, FL |
| 7 | Boston, MA (Metropolitan Area) | Washington, DC (Metropolitan Area) |
| 8 | Los Angeles, CA (Metropolitan Area) | Seattle, WA |
| 9 | San Francisco, CA (Metropolitan Area) | Seattle, WA |
| 10 | San Diego, CA | San Francisco, CA (Metropolitan Area) |
| 11 | Chicago, IL | Los Angeles, CA (Metropolitan Area) |
| 12 | Atlanta, GA (Metropolitan Area) | New York City, NY (Metropolitan Area) |
| 13 | Las Vegas, NV | Los Angeles, CA (Metropolitan Area) |
| 14 | Las Vegas, NV | San Francisco, CA (Metropolitan Area) |
| 15 | Chicago, IL | San Francisco, CA (Metropolitan Area) |
| 16 | Denver, CO | Los Angeles, CA (Metropolitan Area) |
| 17 | Chicago, IL | Washington, DC (Metropolitan Area) |
| 18 | Los Angeles, CA (Metropolitan Area) | Sacramento, CA |
| 19 | Boston, MA (Metropolitan Area) | Chicago, IL |
| 20 | Los Angeles, CA (Metropolitan Area) | Washington, DC (Metropolitan Area) |
| 21 | Miami, FL (Metropolitan Area) | Washington, DC (Metropolitan Area) |
| 22 | Dallas/Fort Worth, TX | Los Angeles, CA (Metropolitan Area) |
| 23 | Boston, MA (Metropolitan Area) | San Francisco, CA (Metropolitan Area) |
| 24 | San Francisco, CA (Metropolitan Area) | Washington, DC (Metropolitan Area) |
| 25 | Atlanta, GA (Metropolitan Area) | Washington, DC (Metropolitan Area) |
| 26 | Las Vegas, NV | New York City, NY (Metropolitan Area) |

| | | |
|---|---|---|
| 27 | Los Angeles, CA (Metropolitan Area) | Phoenix, AZ |
| 28 | New York City, NY (Metropolitan Area) | Tampa, FL (Metropolitan Area) |
| 29 | New York City, NY (Metropolitan Area) | West Palm Beach/Palm Beach, FL |
| 30 | Orlando, FL | Washington, DC (Metropolitan Area) |
| 31 | Denver, CO | San Francisco, CA (Metropolitan Area) |
| 32 | Boston, MA (Metropolitan Area) | Los Angeles, CA (Metropolitan Area) |
| 33 | Denver, CO | New York City, NY (Metropolitan Area) |
| 34 | Houston, TX | New York City, NY (Metropolitan Area) |
| 35 | Los Angeles, CA (Metropolitan Area) | Portland, OR |
| 36 | Dallas/Fort Worth, TX | New York City, NY (Metropolitan Area) |
| 37 | Boston, MA (Metropolitan Area) | New York City, NY (Metropolitan Area) |
| 38 | Portland, OR | San Francisco, CA (Metropolitan Area) |
| 39 | Boston, MA (Metropolitan Area) | Orlando, FL |
| 40 | Chicago, IL | Dallas/Fort Worth, TX |
| 41 | Chicago, IL | Denver, CO |
| 42 | Charlotte, NC | New York City, NY (Metropolitan Area) |
| 43 | Chicago, IL | Las Vegas, NV |
| 44 | Atlanta, GA (Metropolitan Area) | Chicago, IL |
| 45 | Chicago, IL | Orlando, FL |
| 46 | Phoenix, AZ | San Francisco, CA (Metropolitan Area) |
| 47 | Denver, CO | Washington, DC (Metropolitan Area) |
| 48 | Atlanta, GA (Metropolitan Area) | Miami, FL (Metropolitan Area) |
| 49 | Los Angeles, CA (Metropolitan Area) | Salt Lake City, UT |
| 50 | Chicago, IL | Minneapolis/St. Paul, MN |
| 51 | Dallas/Fort Worth, TX | Houston, TX |
| 52 | Boston, MA (Metropolitan Area) | Miami, FL (Metropolitan Area) |
| 53 | Atlanta, GA (Metropolitan Area) | Los Angeles, CA (Metropolitan Area) |
| 54 | Houston, TX | Los Angeles, CA (Metropolitan Area) |

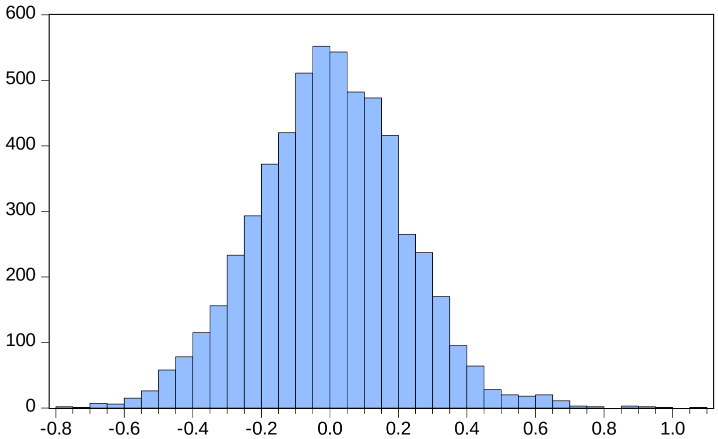
| | | |
|---|---|---|
| 55 | Dallas/Fort Worth, TX | Washington, DC (Metropolitan Area) |
| 56 | Dallas/Fort Worth, TX | San Francisco, CA (Metropolitan Area) |
| 57 | New York City, NY (Metropolitan Area) | Seattle, WA |
| 58 | Los Angeles, CA (Metropolitan Area) | Miami, FL (Metropolitan Area) |
| 59 | San Diego, CA | Seattle, WA |
| 60 | Dallas/Fort Worth, TX | Denver, CO |
| 61 | Denver, CO | Phoenix, AZ |
| 62 | New York City, NY (Metropolitan Area) | Washington, DC (Metropolitan Area) |
| 63 | Detroit, MI | New York City, NY (Metropolitan Area) |
| 64 | Chicago, IL | Miami, FL (Metropolitan Area) |
| 65 | Denver, CO | Las Vegas, NV |
| 66 | Tampa, FL (Metropolitan Area) | Washington, DC (Metropolitan Area) |
| 67 | Atlanta, GA (Metropolitan Area) | Dallas/Fort Worth, TX |
| 68 | Las Vegas, NV | Washington, DC (Metropolitan Area) |
| 69 | Denver, CO | Minneapolis/St. Paul, MN |
| 70 | Orlando, FL | Philadelphia, PA |
| 71 | Boston, MA (Metropolitan Area) | Philadelphia, PA |
| 72 | Chicago, IL | Houston, TX |
| 73 | Atlanta, GA (Metropolitan Area) | Boston, MA (Metropolitan Area) |
| 74 | Las Vegas, NV | Seattle, WA |
| 75 | Minneapolis/St. Paul, MN | New York City, NY (Metropolitan Area) |
| 76 | Chicago, IL | Phoenix, AZ |
| 77 | New York City, NY (Metropolitan Area) | Phoenix, AZ |
| 78 | Denver, CO | Seattle, WA |
| 79 | Chicago, IL | Philadelphia, PA |
| 80 | Denver, CO | Houston, TX |
| 81 | Houston, TX | Washington, DC (Metropolitan Area) |
| 82 | Dallas/Fort Worth, TX | Las Vegas, NV |

| | | |
|---|---|---|
| 83 | New York City, NY (Metropolitan Area) | Raleigh/Durham, NC |
| 84 | Boston, MA (Metropolitan Area) | Denver, CO |
| 85 | Chicago, IL | Seattle, WA |
| 86 | Los Angeles, CA (Metropolitan Area) | Philadelphia, PA |
| 87 | Los Angeles, CA (Metropolitan Area) | Minneapolis/St. Paul, MN |
| 88 | Boston, MA (Metropolitan Area) | Dallas/Fort Worth, TX |
| 89 | Seattle, WA | Washington, DC (Metropolitan Area) |
| 90 | New York City, NY (Metropolitan Area) | San Diego, CA |
| 91 | Atlanta, GA (Metropolitan Area) | San Francisco, CA (Metropolitan Area) |
| 92 | Minneapolis/St. Paul, MN | Washington, DC (Metropolitan Area) |
| 93 | Detroit, MI | Los Angeles, CA (Metropolitan Area) |
| 94 | Miami, FL (Metropolitan Area) | Philadelphia, PA |
| 95 | Denver, CO | San Diego, CA |
| 96 | Boston, MA (Metropolitan Area) | Charlotte, NC |
| 97 | New Orleans, LA | New York City, NY (Metropolitan Area) |
| 98 | Salt Lake City, UT | San Francisco, CA (Metropolitan Area) |
| 99 | Boston, MA (Metropolitan Area) | Tampa, FL (Metropolitan Area) |
| 100 | Philadelphia, PA | San Francisco, CA (Metropolitan Area) |

Table 1. Unit root test ADF

| Method | Statistic | Prob.** | Cross - sections | Observations |
|---|---|---|---|---|
| ADF - Fisher Chi-square | 375.784 | 0.0000 | 100 | 5515 |

Table 2. OLS - Normality test




Series: Standardized Residuals
Sample 2000Q3 2014Q3
Observations 5699

| | |
|---|---|
| Mean | -1.34e-15 |
| Median | 0.000394 |
| Maximum | 1.070212 |
| Minimum | -0.769986 |
| Std. Dev. | 0.216858 |
| Skewness | 0.100669 |
| Kurtosis | 3.494769 |
| Jarque-Bera | 67.75479 |
| Probability | 0.000000 |

Table 3. OLS regression results

Dependent Variable: LN_PRICE

| Variable | Coefficient | Std. Error | Prob. |
|---|---|---|---|
| C | 2.513902 | 0.103446 | 0.0000 |
| LN_PASSENGERS | 0.021514 | 0.005465 | 0.0001 |
| LN_DISTANCE | 0.383959 | 0.005034 | 0.0000 |
| LN_INCOME | -0.003617 | 0.004348 | 0.4055 |
| LN_MKSHARE_LRG | 0.026888 | 0.010201 | 0.0084 |
| TOURISM | -0.239745 | 0.006970 | 0.0000 |
| LCC’s_PRESENCE | -0.108370 | 0.006645 | 0.0000 |
| R-squared | 0.589337 | | |

Dependent Variable: LN_PASSENGERS

| Variable | Coefficient | Std. Error | Prob. |
|---|---|---|---|
| C | 6.965203 | 0.246489 | 0.0000 |
| LN_PRICE | -0.126194 | 0.032058 | 0.0001 |
| LN_DISTANCE | -0.271180 | 0.016960 | 0.0000 |
| LN_INCOME | 0.231886 | 0.010072 | 0.0000 |
| LN_MKSHARE_LRG | -0.765642 | 0.022541 | 0.0000 |
| TOURISM | 0.189354 | 0.018383 | 0.0000 |
| LCC’s_PRESENCE | 0.224589 | 0.016195 | 0.0000 |

| | | | |
|---|---|---|---|
| R-squared | 0.278515 | | |

Table 4. Hausman Test

| Test Summary | Chi-Square Statistic | Chi-Square d.f. | Probability |
|---|---|---|---|
| Cross-section random | 127.24 | 4 | 0 |

Table 5. Fixed effect model outcome

Dependent Variable: LN_PRICE

| Variable | Coefficient | Std. Error | Prob. |
|---|---|---|---|
| C | -3.764743 | 0.286610 | 0.0000 |
| LN_PASSENGERS | -0.109970 | 0.007005 | 0.0000 |
| LN_INCOME | 0.487953 | 0.014964 | 0.0000 |
| LN_MKSHARE_LRG | 0.020310 | 0.011239 | 0.0708 |
| LCC’s_PRESENCE | -0.061235 | 0.005905 | 0.0000 |
| R-squared | 0.796042 | | |

Dependent Variable: LN_PASSENGERS

| Variable | Coefficient | Std. Error | Prob. |
|---|---|---|---|
| C | -11.96188 | 0.519462 | 0.0000 |
| LN_INCOME | 1.143838 | 0.026378 | 0.0000 |
| LN_MKSHARE_LRG | -0.369056 | 0.020410 | 0.0000 |
| LCC’s_PRESENCE | 0.120091 | 0.011018 | 0.0000 |
| LN_PRICE | -0.383647 | 0.024438 | 0.0000 |
| R-squared | 0.786877 | | |

Table 6. Correlation Matrix Outcome

| | ln_price | ln_passen-gers | ln_distance | ln_income | ln_mkshare_lrg | tourism | LCC's_presence |
|---|---|---|---|---|---|---|---|
| ln_price | 1 | | | | | | |
| ln_passenger | -0.11*** | 1 | | | | | |
| ln_distance | 0.69*** | -0.11*** | 1 | | | | |
| ln_income | 0.11*** | 0.21*** | 0.10*** | 1 | | | |
| ln_mkshare_lrg | -0.11*** | -0.37*** | -0.23*** | 0.03*** | 1 | | |
| tourism | -0.19*** | 0.24*** | -0.07*** | 0.01 | -0.16*** | 1 | |
| LCC's_presence | -0.29*** | 0.08*** | 0.005 | -0.15*** | -0.04*** | 0.007 | 1 |

***significant at 1%, **significant at 5% and, *significant at 10% level

Table 7. Instrumental Variable

Dependent Variable: LN_PRICE

| Variable | Coefficient | Std. Error | Prob. |
|---|---|---|---|
| C | -2.267833 | 0.297065 | 0.0000 |
| LN_DISTANCE | 0.354592 | 0.025194 | 0.0000 |
| LN_INCOME | 0.248370 | 0.011435 | 0.0000 |
| LN_MKSHARE_LRG | 0.037917 | 0.012005 | 0.0016 |
| TOURISM | -0.172841 | 0.030485 | 0.0000 |
| LCC's_PRESENCE | -0.063657 | 0.006096 | 0.0000 |
| R-squared Weighted Statistics | | | 0.133134 |
| R-squared Unweighted Statistics | | | 0.326824 |

Dependent Variable: LN_PASSENGERS

| Variable | Coefficient | Std. Error | Prob. |
|---|---|---|---|
| C | -9.475895 | 0.712417 | 0.0000 |
| LN_PRICE | -0.378529 | 0.026241 | 0.0000 |
| LN_DISTANCE | -0.155029 | 0.083319 | 0.0628 |
| LN_INCOME | 1.088353 | 0.023657 | 0.0000 |
| LN_MKSHARE_LRG | -0.450020 | 0.022944 | 0.0000 |
| TOURISM | 0.300189 | 0.102431 | 0.0034 |
| R-squared Weighted Statistics | | | 0.368256 |
| R-squared Unweighted Statistics | | | -0.731308 |