ERASMUS UNIVERSITY ROTTERDAM

Erasmus School of Economics

Bachelor Thesis - Strategy Economics

International Bachelor of Economics and Business Economics

Firm Entry and Saturation in Multi Markets

The impact of market competition on the route entry of carriers

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Date final version: 09/08/2021

Abstract

The paper studies the US aviation industry during the period 2005 until 2019. The research aims to comprehend the impact of route saturation on the entry of budget carriers in the presence of traditional airlines. With data from the US Bureau of Statistics, I construct a market saturation model for low-cost carriers, fully serviced network carriers, and the total of both airlines. Subsequently, I analyze firms' behaviour under socioeconomic factors since the location's environment impacts the decision of entry. The results indicate a significant negative effect of route saturation of the previous year on a carrier's choice to serve a new route in the current period. Budget carriers do not consider the presence of incumbents in a route while traditional airlines feel threatened by low-cost firms. Budget airlines are risk-takers and seek to join new markets to generate demand, contrary to traditional ones. Nonetheless, both carriers must have a negative saturation of the matching firm type in the prior year for a route to signify potential entry.

Keywords Route saturation, Low-cost carriers, fully serviced network carriers, market entry

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1 Introduction

The airline industry is one of the most volatile, precarious, and least profitable sectors in business. The demand for air travel is highly dependent on the surrounding population, and on changes in the political and economic environment. Hence, a carrier's performance suffers from severe cyclical fluctuations over time (Button, 2012). For instance, the 9/11/2001 event in the United States of America (US) and the COVID outbreak in 2020 are two cases that drastically led the industry to a commercial and financial downfall. Yet remarkably, numerous airlines still attempt to enter the business with hopes of success. This emergence of traditional and budget airlines began after the 1978 liberalization of the US airline industry.

The paper differentiates between the entry of two main firms, namely low-cost carriers (LCCs) and fully serviced network carriers (FSNCs). Other firms, such as private jets and helicopters are excluded from the analysis. Consequently, the entry of an airline depends on socioeconomic factors and active market operations (Budd et al., 2014). Gil-Moltó and Piga (2008) find that entry is more likely in larger markets, which have more incumbents, and existing flight routes. This suggests that most airlines are market-takers rather than creators, implying that they join markets which have existing demand. Hence, the presence of incumbents in the market of interest is vital for potential entrants. Incumbents increase the competition and risk of success, due to contradictory or similar strategies and uncertainty on the consumer segment in that route (Graf, 2005). Aside from the strategic approach, the entry decision depends on airport expenses, distance, and travel time costs (Kawasaki & Lin, 2013).

Concurrently, when the count of entrants increases, route competition rises and eventually profits per airline declines (Berry, 1992). Each route refers to a market, thus the paper defines the US airline industry under all the routes domestic airlines operate in. A route refers to the distance (in miles) between the departure and the arrival airport. Hence, this market allows for an airline to exit or enter. Each airline flies a unique set of routes to various destinations and can decide to operate in a diverse set of markets. Due to this, competition is present whenever airlines compete for a similar segment of passengers in a specific route.

Ciliberto and Tamer (2009) indicate that firms serve a market only if they do not generate negative profits. Appropriately, the entry decision depends on fixed expenses, post-entry saturation, and strategic model of other firms (Cohen & Mazzeo, 2007). With focus on the US banking industry, Cohen and Mazzeo (2007) discover that incumbents and new entrants can both be profitable in a certain market. Yet, the condition for multiple firms to coexist in a market is to differ in strategy, target audiences, and differentiate amongst one another. This can refer to the distinct approaches of LCCs and FSNCs, and how they can survive in one route.

Nevertheless, because of low barriers to entry and deregulation of the industry, airline failures are common, and the majority are from LCCs who opt for an inaccurate business model. For example, out of the 43 LCCs in the European aviation market during the period 1992 until 2012, 33 failed and exited the market (Budd et al., 2014). For a carrier to succeed, it must have a competitive advantage. Therefore, this paper explores the influence of route saturation on low-cost carriers in the presence of FSNCs. This effect examines whether higher route saturation positively or negatively impacts the strategic decision of an airline to join a certain market. Hence, the following question studies carriers' decision to operate within the US during 2005 until 2019:

How does competition influence the route entry of low-cost carriers in the American aviation industry?

Carriers operate flexibly towards their optimal advantage in an open market. These strategies are a combination of air fares, aircraft type and size, passenger capacity, services, and additions (Graham et al., 1983). The research question examines how the carriers determine to enter in a market based on route competition and saturation. Competition is the rivalry among firms for market power, revenue, demand, and growth. Market competition among airlines exists within and between LCCs and FSNCs. The competitive effects of FSNCs differs from LCCs and depends on the consumer market in a certain route (Ciliberto & Tamer, 2009). Nevertheless, each carrier strives to obtain the highest passenger yield and increase across the industry, through operations in multiple routes. As for market saturation, this considers the maximum level of services the consumers can afford and utilize. In my paper, saturation represents the potential capacity for firm entry in a specific route.

This research contributes to the academic literature as it captures market saturation in a new light. A limited number of papers study the firm's strategy to enter a route in the aviation market. Dobruszkes (2006) and Dobruszkes (2009) examine the frequent, exclusive, and recent routes budget airlines enter. Whereas Dresner et al. (1996) study the impact of carriers' entry on route competition based on data prior to 2005. Most papers use statistical fixed effects or event studies in attempt to retort the role of the carrier's strategy, the airport presence and competition on entry, exit and firm survival. Nevertheless, some papers build on Brensahan & Reiss (1991) ordered probit model to construct entry and exit, such as Ilo and Lee (2003), yet none create the saturation variable and base the analysis solely on socioeconomic factors and rival firms. Hence, this market saturation model adds value to academia as it provides perspective on firm entry with respect to not only competition, but also market capacity, which is applicable beyond the aviation industry.

On the other hand, the growth of airlines is a result of deregulation and creation of new networks. The high entry reduces prices, increases competition, and raises demand (Bailey, 2019). In turn, high failure is due to multiple factors that include fuel prices, economic shocks, fluctuating demand, and exchange rates (Hotten, 2019). The paper is socially relevant for institutions and economists who decide whether to regulate the industry or not. For instance, Borenstein (1992) discusses that the long-run equilibrium of airlines is unclear with the frequent entry and exit. He predicts that with time, the number of carriers will amount to only a few. This might provoke a new price regulation to control the market dynamics, competition and increase basic expenses for airlines. Therefore, this paper provides context on the market interaction and allows institutions to determine whether firm behavior requires regulation.

The paper begins with an introduction about the research topic of route competition and firm entry in the aviation industry. This follows with literature review (section 2), which discusses past academic paper findings. Next, the theoretical framework (section 3) introduces the hypotheses and supporting theory. Afterwards, the paper delves deeper into the methodology (section 4) and data (section 5). This leads to the results of the market saturation model and entry regressions (section 6). The conclusion thoroughly evaluates the results through the hypotheses and literature in attempt to answer the research question. The paper ends with a discussion on recommendations, and future implications (section 7).

2 Literature Review

Following the 1978 deregulation, the airline industry became a competitive market, with less political and economic control on entry, exit, mergers, and ticket pricing. This paper separates between two firm strategies: LCCs and FSNCs. There is no universal definition for LCCs. These carriers tend to travel short haul, around 3000km, for less luggage compartment and on-board services (Ahmad et al., 2018). This single aircraft type, usually new for less maintenance costs and fuel efficiency, reduces training cost for both crew and pilots (Fan, 2009). The cheap flights then compensate for less comfort and limited customer service. Alternatively, FSNCs operate similar aircrafts, but with divisions of economy and business class, and differentiate in service bundles.

Nevertheless, the mutual fixed expenses, committed to months in advance, are borne regardless of a zero-load or 100 percent load factor.

Porter (1980) explores in-depth the alternative strategic positions in the airline market. The three are cost-leadership, differentiation, and focus. In the first case, firms compete with their rivals through significantly lowering operating expenses and thus, their airfares. The revenue-model depends on cost reduction rather than profits from services. Contrarily, differentiation synergizes multiple activities to offer the premium service for the highest yielding passengers. These carriers of expensive strive to achieve profits through revenue ticket flights. They do not require a high market share as cost leaders, but rather a small one to appear unique and specific. Lastly, the focused position targets one discrete market segment, and not multiple audiences across the market.

Due to high entry of LCCs in markets, carriers frequently opt for discount package offers. Therefore, the cost-minimization strategy currently dominates the markets (Ahmad et al., 2018). One of the outcomes is high risk and uncertainty for airline management (Button, 2012). There is high competition among these airlines to differentiate and gain competitive advantage. The result is a trade-off between cost-minimization and differentiation strategies. Gillen and Lall (2004) explain that a strategy in between, 'lost-in-the-middle', is not feasible. Firms which attempt to operate a hybrid position fail to entice a high volume of customers to rivals with either lower rates or superior services (Porter, 1980). The optimal position, according to Porter (1996), is a manifold of capabilities that complement one another. This stance is difficult to imitate and places the carrier at the forefront of the market.

Gil-Moltó and Piga (2008) elucidate that the existence of flights in a route provokes entry and exit, as there is existent demand, whereas the high seasonality periods discourage entry. An airline which ensures profitable operations joins routes with no prior airline activity. An airline that expects to incur high expenses enters a route with another existing airline, to share the demand (Kawasaki & Lin, 2013). However, Graf (2005) finds that passengers in richer populations exhibit a preference towards FSNCs as they are more reliable and reputable in terms of flight schedules and services. Nevertheless, any type of airline can face issues with scheduling. Mazzeo (2003) uncovers those carriers which dominate a route do not face the competitive pressure of delivering high quality and on-time services. Hence, flights are less frequently on time in routes that are served by only one airline.

To understand the market dynamics of entry and exit, Budd et al. (2014) demonstrates the European industry life cycle (Figure 1). The first stage, pioneers (1992 – 1998) involves the supply of a new service with high uncertainty and low volume. There are several airlines experimenting the cost-minimizations with no definite approach. Following this, the second interval is the take-off. In this, the early adopters (1999 – 2002) refine the service and define the market. The outcome is rapid growth, less uncertainty, and exit of inefficient airlines. This is observed when the average operating duration declines by 3 years. In 2003, the market approaches maturity, with a dominant strategy and standard approach, where entry and exit slow down. The market is saturated and high competition is present. The shakeout period begins. Consequently, the late adopters who join between 2007 and 2012 have the shortest average operating duration, only 2 years. It is more difficult for the airlines to attract consumers and create new demand.

Figure 1 *Average operating durations (years) of unsuccessful carriers during 1992 - 2012*

Adapted source: Budd et al. (2014)

The initial rapid growth in the second stage hides the inefficiencies and errors of businesses, which allows many firms to survive and gain profit. However, when the industry matures, the market uncovers the weaknesses and pressures firms to either improve or exit. The high competition during the mainstream and late adopters stage insinuates that firm survival depends on the operational efficiency, business strategy and market's demand.

In support of Figure 1, CAPA (2019) describes the North American LCC market maturity. The growth rate drastically declined and for the past few years, there is minimal LCC start-up activity. Porter (1996) confirms this stage as industry maturity through declining growth rates and increasing market exits. Nevertheless, LCCs still account for 32% of passenger seat capacity in the US aviation market. As the market matures, de Wit and Zuidberg (2012) find that multiple routes entries suffer from high density, whereby the average frequencies are decreasing, and average route distance is increasing. Thus, LCCs presently attempt to expand and operate in niche markets and new routes, to maintain profits and consistent demand.

My research focuses on the effects of firm entry in saturated markets. This is possible through the construction of an ordered probit model and prediction variables. Bresnehan and Reiss (1991) assemble a benchmark framework with the number of firms in a market, the market size, and drivers to determine the influence of entry on market competition. This application is present in various industries such as dentistry and retail markets. The outcome depicts that the second or third entrant in the market stimulate a shift towards greater competition, while beyond that threshold, a new firm has little effect on the market dynamics. Overall, their findings show that with control on firms' prices and costs, market size and demand drivers can determine entry in an industry. The main condition is that all firms are homogenous. However, the market does not grow, but rather the firms fight for the resources and consumers. Thus, the inefficient firms exit.

Nonetheless, entry can also result with market expansion and less competition. Schaumans and Verboven (2015) build on Bresnahan & Reiss (1991) method to expose that firms also sell differentiated product attributes in distinct environments. Yet, both papers agree that additional entry boosts demand while prices are constant. This paper finds that entry leads to significant market expansion. Whereby, the third or higher entrant have small effects on firms' markups. Meanwhile, in some industries such as bakeries, there is one dominant firms and other entrants are insignificant in terms of competition. Therefore, these insights solely indicate the interaction of firms with other factors and firm competition, rather than market capacity and saturation of both supply and demand in a certain area.

Chevalier (1995) learns that firms are also more likely to enter and expand in a local market if there is an existing high share of incumbent firms. This is a similar finding to the behavior of LCCs with present FSNCs in a certain route (Gil-Moltó & Piga, 2008). Furthermore, Cleeren et al. (2010) examine German supermarket chains and distinguish between discounters and traditional firms. Contrary to Schaumans and Verboven (2015) finding, discounters affect the profitability of traditional supermarkets solely after the third entry as supermarkets are no longer successful with promotional discounts on their product. Entry of a discount store does not have an immediate significant negative impact on supermarkets' performance. In this case, traditional firms focus on the more profitable price insensitive segment. The higher the discounters, the greater the impact is on price sensitivity. Incumbents decrease prices which reduces their profit margins. This is when discounters try to differentiate themselves and acquire features from normal supermarkets.

In the airline industry, Goolsbee and Syverson (2008) find that FSNCs significantly decrease airfares in threatened routes prior to potential entry. The drop in prices accompanies an upsurge of passengers and higher competition, which is not optimal for a new firm entrant. Concurrently, Fan (2009) finds that new entrants to the French or Irish market are less likely to survive due to intense competition. Entry to an existing market prompts a change in ticket prices, and therefore LCCs' struggle to easily promote demand (Graham et al., 1983).

Another perspective on competition is that incumbents determine the competition level and improve their strategy towards the target audience against other potential firms. For instance, Zhu et al. (2011) assess the effect of entry on incumbent store prices in different locations. With focus on multi-product retailers, the findings suggest that following entry, the prices of products not offered by discounters are higher. And the incumbents near discounters perform better. This is because the discounter acts as a filter for the nearby retailer and screens out the highly price sensitive customers. In turn, the incumbent improves its strategy towards the more profitable and less price centered customers.

3 Theoretical Framework

Seim (2006) explains the importance of location in terms of specific market demand characteristics. This suggests that income and population can determine whether a firm has potential in a market or not. Meanwhile, factors such as unemployment rate and other demographic features indicate the pricing strategy of the firm and the consumers' behavior. With focus on video rental industry, Seim (2006) finds that firms differentiate differently, depending on the location of the market. Moreover, a firm's local market power has a significant positive relation with market size, and consumers preferences alter correspondingly to the firm's products. Therefore, my paper tests whether socioeconomic factors, such as population and income, play a significant role on the firm entry and strategic approach in a specific route, under the following hypothesis:

H1: Socioeconomic factors influence the participation of a distinct firm type in a market

The first hypothesis links to the research question as market competition may not be the only factor which determines entry of a firm. But rather, a carrier may serve a market if it contributes to the population's needs and preferences (Graf, 2005). The ordered probit model determines the relation of the factors with the firm.

Regarding other factors for entry, Mazzeo (2002) constructs an empirical ordered probit model to measure the effect of competition depending on the firm's type. It refers to the Hotelling's concept that competition among firms decreases if they differentiate in less substitutable products. This equilibrium model predicts the number of firms to operate in a market and determine their product type. With focus on the motel industry in the US, the results indicate that firms earn more if they substantially differentiate their services. Hence, high competition results with differentiation among market participants to succeed. This is in line with Bresnahan and Reiss (1991) and Berry (1992) where entry has a negative effect on the firm and the competitor in terms of payoffs if the firms are homogenous. Therefore, additional competition reduces profit of new entrants and increases competition, as firms share demand and not expand the market (Schaumans & Verboven, 2015).

As the LCC market is oversaturated and mature, a new one is evolving. The ultra-low-cost carrier (ULCC) is a distinct business model which further undercuts airfares, in comparison to LCCs. However, Bachwich and Wittman (2017) discover that ULCCS average operational duration is two years. This suggests that recent carriers opt for new strategies to appeal new customers and stir demand in distinct locations. De Poret et al. (2015) clarify that LCCs suffer from high route density problems and face difficulties with rivals. The passengers are dispersed over many transport modes, particularly with FSNCs that offer lower fares but then discretely add extra charges (Dresner et al., 1996). The large players dominate the markets, in this case, FSNCS or LCCs, and increase entry barriers through operating in more routes and at greater frequencies (Fan, 2009). Hence, start-ups divert to other options and experiment with strategies, in hopes of success.

Bresnahan and Reiss (1991) find that competition intensifies as firms in the market increases. This indicates that when there is greater competition, the firms approach the market capacity and entry is no longer profitable. In their paper, this threshold is from the third entrant onwards. The implication is that the saturation is at its peak and firm exit takes place as there are inefficient and not productive ones. Following this, the paper investigates the market entry of carriers depending on the route saturation from the years 2005 until 2019:

H2: Route saturation negatively influences the entry of a carrier in a market

The second hypothesis attempts to answer the research question where the route saturation defines the competitive effect amongst firms. Therefore, several regressions illustrate the impact of route saturation per firm and other factors on a carrier's entry. The significance of the results determines firms' behaviour under competition.

4 Methodology

4.1 Market Saturation Model

An ordinal variable has a discrete and ordered value. In this case, the model identifies the current count of carriers (starting from 0) in the route per year. Subsequently, based on other socio-economic variables in the regression, it predicts the equilibrium number of carriers per route in the specific year. The count of carriers is limited to the minimum and maximum outcome of the actual count of carriers in that year.

$$Y = f(M, D, C) + \varepsilon \tag{1}$$

The model of equation (1) explains the presence of carriers per route based on market size, demand drivers, and cost drivers. The paper repeats the model every year, depending on the possible outcomes of route capacity. Specifically, the total count of carriers differs per year and the number of possible outcomes is dependent on the actual presence of carriers per year. These probabilities are based on the market size, demand drivers, and cost drivers.

Table 1 Drivers of the Ordered Probit Regression Model

Function	Variables
M – market size	Log population (in people) of the departure and arrival MSA.
D – demand drivers	Log per capita personal income (US dollars) of the departure and arrival MSA. Unemployment rate (in %) of the departure and arrival MSA. Count of other carriers (either LCC or traditional) per route.
C – cost drivers	Log distance (in miles) from departure to arrival airport location (route distance).
ε – error term	Independent and normal distribution of other unobserved drivers.

To construct the US aviation market, the paper divides the American geographical area per 381 MSAs. The model accounts for crucial variables such as population, per capita personal income (in US dollars), and unemployment rates per area. Consequently, the ordered probit regression falls under equation (1) with its variables in Table 2.

Table 1 illustrates the components of the model, which vary each year from 2005 until 2019. Following the approach of Bresnahan and Reiss (1991), the model centers on the market size, and the demand and cost drivers. Each measurement represents the departure MSA or arrival MSA separately, except for log distance (in miles), which is the difference between both airports.

The model includes population as it displays whether population density influences the location of airlines, either FSNCs or LCCs, operations. Ahmad et al. (2018) find that larger airlines, contrary to LCCs, are active in larger cities. As for the demand drivers, the consumer with an average per capita personal income in US dollars and steady employment is more apt to afford a plane fare. In areas with high unemployment rate and low per capita personal income (US dollars), customers are incentivized to partake with LCCs cheap airfares. As for competitors, the greater the competition, the vaster are the options for consumers. The result is a selective choice on either service or price. Subsequently, distance is a cost driver for the airline, as Button (2012) explains the burden of fuel expenses and customer services rise for long distance routes.

The error term, which potentially summarizes the other drivers that influence market entry and exit of carriers, is unobserved (Bresnahan & Reiss, 1991). The paper assumes that the error term is normally and independently distributed across the various routes over the years. The variable has a constant variance and zero mean. Hence, the use of an ordered probit model can predict outcomes across the routes and forecast market saturation. This assumption results with the conclusion that the excluded drivers affect each carrier in the market equally.

There are three models, one for each carrier type, namely LCC, competitors and total market. One model covers a period from 2005 until 2019. Each carrier category has its own ordered probit model with the same variables in Table 2, except for the demand driver of competitors. Model one represents the low-cost carriers' market, where the competitors are the traditional *competitors* airlines. The second model focuses on the traditional carriers' market with *LCC*s as the competitors for consumer demand. As for the third model, it is an overview of the entire market, with the sum of both LCC and traditional carriers per route. There are no competitors in this model.

There are two types of firms, i = 1,2. The first type of firm are LCCs, and the latter are FSNCs. Other than their classification, the firms are homogenous (Mazzeo, 2002). Each firm decides when to enter the market, with the assumption of no external stimulus. Entry of either firm takes place as a strategic decision. It is possible that the entry or exit of one firm strongly affects the decision of the other firm. Regardless, entry takes place when the market saturation of the previous period is low, while firms exit the route when market saturation of the previous period is high.

Consequently, the ordered probit predicts the number of firms per route. The notation is N_i, to indicate the number of firms 'x' per year. Accordingly, the paper calculates the predict variable for each type of firm 'i' as follows:

$$Predict_i = 0 * N_0 + 1 * N_1 + 2 * N_3 + \cdots + x * N_x \quad (2)$$

Accordingly, this is done for each year depending on the possible outcomes of the actual count of carriers, of model 1, 2 or 3, per route. Following this, the saturation variable is the difference between the carrier, for example LCC, and the predict variable of LCC. If the saturation is positive, this indicates that the route is oversaturated, and conversely, negative saturation signifies room for entry.

4.2 Regressions for market entry

Using the prediction variables of the ordered probit model, we conduct a robust regression analysis. To test the first hypothesis on route entry, equations (3) and (4) estimate the effect of market saturation on entry. Entry of a variable is the difference of the count of firms per route in the current period *"t"* and the previous (lag) period *"t - 1"*.

$$Y_{Ni} = \alpha + \beta_1 * X_{it-1} + \beta_2 * Y_t + \beta_3 * Z_{Dt} + \beta_4 * Z_{At} + \beta_5 * W_{Dt} + \beta_6 * W_{At} + \beta_7 * S_{Dt} + \beta_8 * S_{At} \quad (3)$$

The above regression represents the dependent variable entry of carrier *N* for each of the firms *i* - LCC, FSNC or the total of both firms. The independent variable is lag market saturation X and represents the carrier *i*. For instance, if *Y* is LCC entry, then the independent variable is LCC saturation of the previous year. Regarding the control variables, Y is log distance in miles of the route, Z is log population in people, W is per capita personal income in US dollars, and S is the unemployment rate. Finally, the constant is α, while *D* represents the departure location and *A* the arrival MSA.

$$Y_{Ni} = \alpha + \beta_1 * X_{it-1} + \beta_2 * X_{It-1} + \beta_3 * Y_t + \beta_4 * Z_{Dt} + \beta_5 * Z_{At} + \beta_6 * W_{Dt} + \beta_7 * W_{At} + \beta_8 * S_{Dt} + \beta_9 * S_{At} \quad (4)$$

Akin to equation (3), equation (4) includes additional control variables which influence entry. This includes the lag market saturation of the firm's competitor X_I. This regression accounts for both firm types and illustrates a more accurate model of firm behavior and market dynamics.

5 Data

5.1 Data

The research paper focusses on the United States domestic aviation market. This data is available on the Bureau of Transportation Statistics (BTS), a division of the United States Department of Transportations (DOT). The platform provides context, statistics, and historical data on the commercial, financial, and strategic activity of airlines in the US market (BTS, 2020). Accordingly, BTS (2020) publishes monthly and yearly aviation datasets that are freely accessible. The institute thus presents credible analyses and services for decision makers, market specialists, and interested parties to comprehend the transportation sector.

This paper implements the “Air Carriers: T-100 Domestic Market U.S. Carriers” dataset (BTS, 2020) to analyze the route saturation and competition of low-cost carriers in the US. Suitably, the dataset includes the distance in miles between the departure airport to the arrival airport. The statistics are categorized per year, whereby the start is 2005 and the end is 2019. Therefore, this includes each domestic airline flight from the departure to the arrival location and the frequency of this route per carrier per year. The reference of the departure and arrival is per city and state in the United States.

As the dataset simply names the airlines, I categorize each carrier as low-cost carrier, a traditional airline (competitor), and exclude others, such as helicopters and private jets. Therefore, this identification takes place by studying the airline’s ticket fares, services and strategic model through their personal website. Following this, the paper labels each domestic carrier by its’ characteristic in the market, either as an LCC or FSNC.

To construct the market saturation model, each city from the dataset is part of a metropolitan statistical area (MSA) in the United States. Hence, the MSAs connect to each city with a departure or arrival airport. To achieve this, BEA (2020) lists the 384 MSAs, with the corresponding states. Thus, in total, there is a list of cities not matched to an MSA. Therefore, the matching takes place by accessing the statistical areas in a certain state, extracting the list of counties per state, pairing the list of cities with a specific county, and then allocating the counties with an MSA. Following this, I ensure that the thousands of cities correspond to the identical MSA, in terms of state and name, from the BEA (2020) dataset. Moreover, solely airports in a cities within an MSA are part of the analysis.

5.2 Variables

Carriers

Per each route during a specific year, there is a certain number of airlines operating. Therefore, the variable *LCC* represents the actual number of low-cost carriers travelling in a route per year. There is a minimum of 0 and a maximum of 10 LCCs in one route over the 15 years. A route represents a market. Hence, with the ordered probit model, the variable *predict LCC* indicates the predicted count of carriers per route as an outcome of the demand and cost drivers. Furthermore, the *LCC entry* is the difference between *LCC* and the count of *lag LCC* from the previous year. While *LCC exit* denotes the difference between the count of *lag LCC* and *LCC*. This is done for each year during the period 2005 until 2019.

Similarly, traditional airlines, namely the competitors, operate in various routes over the years. The variable *competitors* represents the sum of traditional carriers in a route. The minimum number is 0 and the maximum is 16 competitors per route in one year. To calculate route saturation, the ordered probit model estimates the *predict competitor*. This variable is the equilibria count of carriers per route under the assembled model. As for market entry and exit, the *competitor entry* is the difference between *competitor* and the *lag competitor*. While *competitor exit* is the change from the *lag competitor* count and the present *competitor*. This is done for each of the 15 years.

Additionally, the paper looks at the total number of players in the market. The variable *total market* implies the sum of *LCC* and *competitors*. The minimum number is 1 and the maximum is 23 airlines per route per year. Akin to other carrier variables, the model generates the *predict total* to estimate the equilibria sum of carriers per route. As for the market entry and exit of each period, *total entry* is the difference of *total market* and *lag total market*. While *total exit* refers to the difference between *lag total market* of the previous year and *total market.*

Market saturation

Market saturation refers to the activity per route. In this case, there are three saturation variables. *Saturation* represents the difference between the actual *LCC* and the *predict LCC*. *Saturation_O* is the difference of competitors and predict competitor. While *saturation_B* is *total market* minus *predict total*. Accordingly, if the saturation is negative, then the market is undersaturated, and there is room for entry. While if the saturation variable is positive, that means the market is oversaturated, and exit is plausible.

Distance

Distance represents difference in miles between the departure airport and the arrival airport. Subsequently, *x_distance* is specific to a route. This variable is a log transformation and time-invariant; hence it is constant over the years. All the activities are within the United States, and between or within MSAs. The minimum flight distance (not in logarithm form) is 26 miles, which is within MSAs, while the maximum is 5,158 miles.

MSA specific data

For further supporting information on the MSAs, BLS (2021) reports the unemployment rate (%) per year for each of the required years. The variables *unemployment_D* and *unemployment_A* represent the unemployment rates of the departure MSA and the arrival MSA, respectively.

Meanwhile, BEA (2020) publishes yearly datasets per MSA division. The datasets of interest are on the per capita personal income in US dollars and total population in millions of people. The total population is transformed to a natural logarithm on Stata. Accordingly, the variables are *logpopulation_D* and *logpopulation_A* for the departure and arrival location, respectively. Similarly, the per capita personal income in US dollars variable is a natural logarithm function. The variables are *log_PCI_D* and *log_PCI_A*, where they represent the departure and arrival location, correspondingly. The reported data are from the years 2005 until 2019.

5.3 Descriptive Statistics

Table 2 demonstrates the descriptive statistics of the variables. The log of population, per capita income (US dollars) and distance (in miles) adjusts for skewness. In total, there are 824,860 observations in the panel dataset. This data represents the airline activity over fifteen years in the 55,324 different domestic US routes. If there are no carriers in the route at a certain period, then the count of firms is 0.

Table 2 Descriptive Statistics of the variables from 2005 until 2019

	Observations	Mean	Std. Dev.	Min	Max
LCC	824,860	0.252	0.665	0	10
FSNC	824,860	0.475	1.155	0	16
Total market	824,860	0.728	1.605	0	23
Distance (miles) $^{\alpha}$	824,860	6.483	0.859	3.258	8.548
Population (D) $^{\alpha}$	824,860	13.863	1.401	10.943	16.777
Population (A) $^{\alpha}$	824,860	13.835	1.401	10.943	16.777
Per capita inc. (D) $^{\alpha}$	824,860	10.683	0.243	9.792	11.707
Per capita inc. (A) $^{\alpha}$	824,860	10.681	0.242	9.792	11.707
Unemployment% (D)	824,860	5.624	2.520	1.500	29.200
Unemployment% (A)	824,860	5.609	2.507	1.500	29.200
Year	824,860	2012	4.321	2005	2019

Notes *"$^{\alpha}$" refers to natural log transformation.*

6 Results

6.1 Market Saturation Model

Following the three models of the ordered probit regressions, I generate the prediction, saturation, and entry variables. Table 3 summarizes the values of the predicted outcomes for each carrier for 15 years and every routes. The minimum number for all is zero and the average for each carrier type is less than 1. This indicates that one firm suffices in most markets for the entire demand. The unusual prediction of 33 carriers in the total market is much higher than the actual count. This can signify a few large markets size with limited current activity and a large capacity.

Table 3 The Ordered Probit Model Variables

	Observations	Mean	Std. Dev.	Min	Max
Predict LCC	824,860	0.251	0.412	0	9.201
Predict FSNC	824,860	0.477	0.742	0	14.271
Predict Market	824,860	0.737	0.785	0	33.203
LCC saturation	824,860	0.001	0.569	-7.512	8.611
FSNC saturation	824,860	-0.001	0.963	-11.734	14.799
Market Saturation	824,860	-0.009	1.524	-32.203	20.851
LCC entry	824,860	0.000	0.461	-7	7
FSNC entry	824,860	-0.006	0.681	-11	9
Market entry	824,860	-0.006	0.837	-14	12

The saturation indicators in Table 3 is an overview of all the routes per year in the US industry. For LCCs, the mean is positive, which implies that markets are oversaturated and predicts exit. The minimum is around -8 and reveals a great market capacity for entry. In contrast, the maximum is around 9 and resembles intense competition. As for FSNCs and the total market, the mean is negative, and implies room for entry in a route. The minimum and maximum for the latter firms is greater than the one for LCCs. This elucidates that majority of the market prefers incumbents for its higher certainty of success, comfort, services and sometimes, adequate airfares. Lastly, LCC entry has a predicted mean of 0, and that means that the number of budget airlines per route does not drastically fluctuate over the years. For FSNCs and total market, the mean is -0.006 and this refers to expected route exit. As for the minimum and maximum values, LCCs greatest shift in the market is a total of 7 carriers. As for FSNCS, the largest predicted exit is 11 carriers. In total, the market faces no greater than 12 predicted entries and 14 forecasted exits.

6.2 Role of socioeconomic factors

The first column of Table 4 illustrates the relation of LCCs with the market size, demand drivers and cost drivers. In alignment with Bresnahan and Reiss (1991), population for the departure and arrival is a significant and valuable variable in the ordered probit model. The relationship is positive and is slightly higher for the arrival airport. This indicates that budget airlines depart from smaller locations to larger ones (Dobruszkes, 2006). Accordingly, the per capita personal income in US dollars has a negative coefficient, that insinuates the departure from a poorer and less developed area to a wealthier one. As for the unemployment rate (%), the negative and significant relationship suggests that the number of budget airlines increases when the unemployment rate decreases (Budd et al., 2014). The rival, FSNCs, is positively and significantly related to LCCs. This demonstrates that airlines operate where there is existing consumer demand, as it is a safer option that entering a new market to create demand. The positive and significant coefficient of distance (in miles) signifies that LCCs attempt to expand in niche market and operate in longer distances. This is contrary to their approach of minimal fuel expenses, cabin costs and avoid transfers, yet suggests their risk-seeking approach towards creating demand and generate new profits.

FSNCs, akin to their competitor, are more likely to operate in a route with a larger departure and arrival MSA location. The population coefficient is greater than the one for LCC. This corresponds with Budd et al. (2014) explanation that LCCs operate is markets with smaller airports, which tend to be in cities with lower populations. The significant and positive relation is evident as well with per capita personal income in US dollars. Traditional airlines tend to be more expensive than budget carriers (Ahmad et al., 2018), therefore the coefficient size implies that these carriers operate in routes where individuals can afford the flight and travel fees. Moreover, there is a negative and significant relation with unemployment rate (%), where the lower coefficient in comparison to LCC's 0.006 parallels the intuition that FSNCs operate in richer and more economically developed cities.

Table 4 Market Saturation Model for Carriers in US industry during 2005 - 2019

	(1) LCC	(2) FSNC	(3) Total
Population (D) $^{\alpha}$	0.090***	0.139***	0.180***
	(0.002)	(0.001)	(0.001)
Population (A) $^{\alpha}$	0.096***	0.130***	0.178***
	(0.002)	(0.001)	(0.001)
Per capita inc. (D) $^{\alpha}$	-0.140***	0.296***	-0.332***
	(0.010)	(0.009)	(0.008)
Per capita inc. (A) $^{\alpha}$	-0.130***	0.286***	-0.314***
	(0.010)	(0.009)	(0.008)
Unemployment (D)	-0.006***	-0.012***	-0.014***
	(0.001)	(0.001)	(0.001)
Unemployment (A)	-0.004***	-0.010***	-0.011***
	(0.001)	(0.001)	(0.001)
LCC		0.660***	
		(0.002)	
FSNC	0.386***		
	(0.002)		
Distance $^{\alpha}$	0.064***	-0.095***	-0.054***
	(0.002)	(0.002)	(0.002)
Observations	824,860	824,860	824,860

Notes *The standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Moreover, the "$^{\alpha}$" refers to natural log transformation.*

Concurrently, FSNCs are active in routes with existing carrier operations (Gil-Moltó & Piga, 2008). The LCC coefficient, 0.660, is greater than FSNC in model one, 0.386. This signals that traditional airlines are risk averse and ensure profitable demand before joining a route. Also, traditional carriers operate in routes with shorter distance in miles due to more success, affordability, and less uncertainty. Regarding column three, the results reveal similar relations of the variables with the total market as for the FSNCs. The total market is mostly comprised of FSNCs, with only a third as LCCs (CAPA, 2019). Thus, this suggests that traditional airlines mask the influence of the budget one. Lastly, all the results are highly significant with a p-value below 0.01.

6.3 Market Entry Regressions

Table 5 displays the effect of route saturation on the carrier's entry. Column (1a) and (1b) are a regression on LCCs. Entry takes place when the route saturation of LCCs in the previous year is low. This means that there is room for entry according to the ordered probit model, and the competition is low. The *LCC entry* decreases by 0.336 units when the *LCC saturation* of the previous period decreases by one unit in column (1) and (1b). This is significant and reveals that the p-value is below 0.01. In column (1b), the *lag FSNC saturation* has an insignificant and zero coefficient. This aligns with LCCs strategy as market-creators, regardless of existing demand, and attempt to expand the market with their cost-minimization strategy (Schaumans & Verboven, 2008). Moreover, the insignificant relation with rivals supports Mazzeo (2002) finding that high competition cause firms to differentiate and fully target their own consumer market to succeed and avoid disparate rivals (Porter, 1996). As for the significant and positive constant, this endorses the finding that LCCs risk and effort to join multiple routes for new demand generation.

Table 5 Regressions for the influence of market saturation of firm entry

	(1a) LCC entry	(1b) LCC entry	(2a) FSNC entry	(2b) FSNC entry	(3) Market entry
Lag LCC saturation	-0.336***	-0.336***		-0.019***	
	(0.002)	(0.002)		(0.003)	
Lag FSNC saturation		0.000	-0.258***	-0.263***	
		(0.001)	(0.002)	(0.002)	
Lag market saturation					-0.159***
					(0.002)
Distance $^{\alpha}$	0.004***	0.004***	-0.004***	-0.004***	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Population (D) $^{\alpha}$	0.001***	0.001***	0.005***	0.005***	0.009***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Population (A) $^{\alpha}$	0.001***	0.001***	0.006***	0.006***	0.010***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Per capita inc. (D) $^{\alpha}$	-0.017***	-0.017***	0.003	0.004	-0.022***
	(0.003)	(0.003)	(0.004)	(0.004)	(0.005)
Per capita inc. (A) $^{\alpha}$	-0.018***	-0.018***	0.003	0.004	-0.024***
	(0.003)	(0.003)	(0.004)	(0.004)	(0.005)
Unemployment (D)	-0.001***	-0.001***	-0.003***	-0.003***	-0.005***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Unemployment (A)	-0.001***	-0.001***	-0.003***	-0.003***	-0.005***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.329***	0.330***	-0.169***	-0.197***	0.262***
	(0.028)	(0.028)	(0.046)	(0.046)	(0.056)
Observations	824,860	824,860	824,860	824,860	824,860
R-squared	0.165	0.165	0.124	0.124	0.080

Notes *The robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Moreover, the "$^{\alpha}$" refers to natural log transformation.*

FSNCs approach entry similarly to LCCs. In Table 5, the coefficient of *lag FSNC saturation*, -0.258, denotes the importance of lower route traffic density for entry. The negative and significant coefficient is larger than the *LCC saturation* in column (1b). Traditional airlines have a consistent demand of business passengers and average income travelers who prefer airlines with frills and services (Graf, 2005). This is dissimilar with LCCs which ought to find certain audiences are more sensitive about prices than comfort for air travel. As for the influence of the rival in column (2b), *FSNCs entry* decreases with 0.019 units when the *lag LCC saturation* increases by one unit. Ito and Lee (2003) and Gil-Moltó and Piga (2008) explain that traditional carriers join the market when there is existing demand and revenue in the market. Then, the airlines compete by offering their best travel packages (Gillen & Lall, 2004). Goolsbee and Syverson (2008) deduce that FSNCs feel threatened from entry of budget airlines, and hence, enter when LCCs saturation decreases, the carriers offer lower airfares and attempt to dominate the market (Zhu et al., 2011). Therefore, FSNCs burden more with competition than LCCs (Dobruszkes, 2009). As for the constant, the negative and significant illustrates that traditional airlines do not frequently enter new markets, but rather settle and expand in one.

As for the total market, the entry of a carrier increases by 0.159 units when the total saturation of the previous year decreases by one unit. Budd et al. (2014) clarifies that the negative and significant coefficient refers to the lower expenses shorter distances endure. Besides that, the paper stresses on the results of column (1b) and (2b) as the regressions include the saturation of the competitor which further explains the dynamics of the carrier in the market. The model best fits the LCC entry, as it has the highest R^2 value of 16.5%. Overall, the paper does not have sufficient evidence to reject hypothesis two, and therefore accepts that entry of carriers takes place in markets with lower saturation. The results are almost all highly significant with a p-value under 1%, except for per capita income (in US dollars) for FSNC entry.

7 Conclusion and Discussion

7.1 Conclusion

Over the past decade, the aviation market underwent bankruptcy, economic and financial shocks, a pandemic, and for some airlines, business booms. The volatile industry incurs high entry and exit every year, in multiple segments of the market (Button, 2012). Yet, the firm survival is shortening as the industry matures. Thus, this paper concludes that competition plays a role on the entry of

LCC carriers in the presence of traditional airlines, in the American aviation industry, through the research question:

How does competition influence the route entry of low-cost carriers in the American aviation industry?

Many previous studies investigated the topic of entry, exit and performance of carriers in the American aviation industry. Nonetheless, despite the great attention the airline topic receives, the topic of market saturation and entry, excluding price fares and operating expenses, is overlooked. Therefore, this study presents an analysis of the firm's entry and behavior through market saturation and changes in firm count per route each year under specific socioeconomic factors. The paper uses a large period of 15 years, from 2005 until 2019, and rich data on the number of carriers per each route in the US. Hence, the research adds value to the scientific area with more recent trends in a latter industry stage and, most importantly, a new indicator of saturation through the commonly used ordered probit model. These insights can apply to other industries and firms in multi-market sectors. Moreover, through this model, economists and institutions can determine whether the industry requires regulation on entry and exit, to enhance the market's conditions.

Comparable to Schaumans and Verboven (2008), the method is an ordered probit model with market size, and demand and cost drivers. In agreement with Bresnahan and Reiss (1991), the logarithms of population, per capita income in US dollars, and unemployment rate (%) support with predicting the market's entry and saturation variables. Each factor is significantly related to the carrier with a p-value below 0.01. LCCs operate in smaller markets, while FSNCS are active in larger populations with potentially expensive airports (Dobruszkes, 2006). Further, LCC has a negative relation with per capita personal income (US dollars) and unemployment rate, which suggest operations in less economically developed and adequate living expenses in (Budd et al., 2014). Meanwhile, FSNCs operate in areas with a higher per capita income (in US dollars) that corresponds with their higher air fares (Ito & Lee, 2003). Additionally, LCCs seek greater distances (miles) in attempt to expand in new markets, contrary to FSNCs remarked shorter distances. Therefore, there is not sufficient statistical evidence to reject the first hypothesis that socioeconomic factors influence firm entry.

Furthermore, the paper finds a significant effect of route saturation on the entry of LCCs, FSNCs and both carriers in the market. Entry takes place when the route saturation of the carrier of the same category in the previous year is low. Meanwhile, LCCs do not weigh on incumbents' existence in a route whereas FSNCs consider markets where exit of the rivals occurs. Following entry, FSNCs imitate LCCs cost-minimization strategy to dominate the market (Goolsbee & Syverson, 2008) to threaten LCCs potential entry. Moreover, in agreement with Gil-Moltó and Piga (2008), FSNCs join a market with existing incumbents to avoid uncertainty of success and lower saturation in the previous year (Seim, 2006), while LCCs simply consider lower saturation and failure of their own firm type in the prior period for market entry (Mazzeo, 2002). Therefore, the second hypothesis that airline route saturation negatively affects market entry of low-cost carriers per year is not rejected, due to sufficient statistical evidence to support it.

In summary, route competition influences the entry of carriers in the US airline industry. Entry has a negative relation with lag route saturation of the firm. Market saturation looks at market capacity and the way firms behave to work at their fullest potential in a certain market. When competition is severe, consumers choose the carrier with the most focused strategy towards their preference, either cheap airfares or great service. Therefore, firms tend to work at their fullest potential in a not oversaturated market. Accordingly, firms can access all the necessary resources and provide sufficient consumers their services in less competitive environments.

7.2 Discussion

7.2.1 Limitations

The paper creates a market saturation model that predicts the real-life situation as accurately as possible. Nevertheless, the ordered probit model does not consider the timing of entry and exit decisions. The paper thus does not account for all unobservable behaviors of firms, only the time-invariant effects of the model. To address this, Bresnahan and Reiss (1991) advice to develop a richer empirical model to portray competition and all the influential variables. This limitation can provide bias results and associations, as prices or weather conditions can change the behaviour of the firms in the regression. However, this data is not available per MSA for the entire period. Another drawback is the lack of data to include the average operating duration of an airline in the specific route. This time-consuming matter is not simple and feasible with the data obtained. The outcome prevents from tracking whether carriers enter or exit at the predicted time, which is when the carrier's count per route per year shifts.

7.2.2 Recommendations and Theoretical Implications

To improve the research, the paper can look at the differences of carriers' behaviour in markets at separate industry stages. For instance, the US and European market is in industry maturity (Budd et al., 2014), while Africa is still approaching rapid growth. It is interesting to understand the dynamics and firm entry in various life cycles. In addition, it is crucial to distinguish the divisions of airlines under LCCs and FSNCs. Hence, there are the ultra-low-cost carriers, there are the ones with mixed strategies, and FSNCs which sometimes follow the cost leader approach. By including this in the analysis, the model precisely represents the firm's performance under competition and market capacity. Another theoretical practice is the foreign entry of firms in routes out of the US. There is not enough literature on the change of behavior of airlines in foreign routes, in terms of strategy. Following the improvement of the model, papers can implement the saturation variable under the context of different professional and retailing industries. Academics can apply this to study the firm's entry, exit and operation duration choices.

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