Incumbent responses to a low-cost entry: empirical evidence from the German airline industry

MARIEKE FUNCK*

March 14, 2019

Abstract

In the context of a consolidation trend and route density problems on the European aviation market, access to congested airports and the market entry through slot allocation is important for effective competition. This paper uses a novel data set with all German domestic flights before and after a low-cost carrier (LCC) market entry (N=37,622) to identify the price reaction on direct competitive routes. Our difference-in-differences regression analysis shows that the full service network carrier reacts with significant decreasing fares and increasing frequencies. The results suggest that potential barriers due to the slot allocation for market entries should remain low.

*Paderborn University, marieke.funck@upb.de
I. Introduction

This study aims to identify the reaction of a high-quality firm on the market entry of a low-quality firm as a direct competitor. The aviation market as Bilotkach et al. (2018) mentioned is an excellent place for analysis entry of a firm offering a clearly lower quality as compared to what has been available from the incumbents. So the entry can be seen as vertical product differentiation. For this purpose, we collect data about flights for all airlines on domestic German flight market before and after the market entry of a low-quality airline. This data set contains fares for each flight. As a result, we can analyze the response of a high-quality firm with a monopoly position of the market entry. In a more general way, we also consider whether the slot allocation on congested airports as a market entry barrier has a significant effect on the competition in the European aviation market. The entry of a new airline into the market depends to a large extent on the availability of slots at airports and so the reallocation of vacant slots is focused on political and competitive authorities.

The emergency and the rapid development of the so-called low-cost carriers (LCCs) has undoubtedly been forcing traditional network full-service carriers (FSNCs) to respond progressively - a movement that is shaping the frontiers of competition in the industry (Oliveira, 2017). So the competition between LCCs and FSNCs has recently become one of the most significant issues. Many academic papers have examined the entry of LCCs as also the reaction of FSNCs on it (e.g. Berry (1992); Sinclair (1995); Windle and Dresner (1999); Boguslaski et al. (2004); Dunn (2008); Ciliberto and Tamer (2009)). However, most of these studies use data on the US domestic market. This may be due to the liberalization was first beginning in the U.S. but should also be related to the fact the availability of (route level) traffic and fare data collected by the U.S. Department of Transportation provides a fruitful environment for empirical research (Ito and Lee, 2003). However, the results of these studies cannot simply be passed on to the European aviation market.

In Europe on the one hand, we see through the continuing growth of LCCs increasing route density problems. The number of airlines for passengers is still comparatively high, with 146 compared to 53 in the U.S. (BDL, 2018). Especially for LCCs, which operate mainly on low-density routes between secondary airports, this is becoming an increasing obstacle. Increasingly there will be a shift to primary airports to find new routes that are more dense, less seasonal and more profitable. Hence, access to primary airports becoming more important. As a result, direct competition between the LCCs and FSNCs at their respective hubs will increase (de Wit and Zuidberg, 2012). Thereby, most of the literature about competition incorporate in the element that the LCCs operate out of secondary airports within large metropolitan areas, the strategy of Southwest and Ryanair (Morrison (2001); Goolsbee and Syverson (2008)). On the other hand, we also see a continuing consolidation trend toward a limited number of large LCCs in Europe. Small airlines are integrated into larger LCCs (e.g. Air Italy in Meridiana), some airlines left the market (Air Berlin, Monarch Airlines or Alitalia), in other case concentration took place through different business models, as in the case of Ryanair’s acquisition of KLM’s
subsidiary Buzz. This will cause a reallocation of vacant slots.

The allocation of slots at primary airports will affect this trend in the European aviation market. Especially against the background that the competition on the aviation market depends primarily on the availability and possibility of using airport infrastructure. The continuing growth of air traffic is putting the existing flight infrastructure under considerable pressure (Picard et al., 2017). Hence, the European Commission (EC) stated that slots can be seen as a rare resource and access to such resources is of crucial importance for the provision of air transport services and for the maintenance of effective competition. Also, the EC see that lack of available slots has become a prominent feature of the EU airline industry and is expected to become an even more critical issue for air carriers in the near future (European Commission, 2017a).

Political decision-makers and the competition authorities have focused on this development, abroad but also in Germany. This article empirically addresses this matter by examining the entry of the LCC easyJet in the German domestic market in 2018. In autumn 2017 the second-largest airline Air Berlin announced its insolvency and exited the market. Besides the national FSNC Lufthansa also the second biggest LCC in Europe easyJet proposed to acquire slots on primary airports to enter the German national flight market. The reallocation of the vacant slots and resulting competition on routes were under investigation by the EC (European Commission, 2017b) and the German Federal Cartel Office (Bundeskartellamt, 2018). As a result, easyJet does directly compete with established carriers and so with the Lufthansa on their hubs. To examine the effect of the entrant of easyJet for the national fares we use a difference-in-differences (DiD) method to deal with exogenous shocks, like the insolvency of Air Berlin or Christmas holidays. Our main finding is that Lufthansa reacts to the competition through an LCC like easyJet. On competitive routes, Lufthansa decreases fares on average 21% and increase the flight frequency on average 18% more than on similar routes without competition.

The article is structured as follow. In the next section, we outline determinants of the aviation market in Europe and in Germany as well as the related literature. The underlying modeling framework for our empirical approach will be explained in the following section. We then present the methodology and our empirical findings as well as descriptive statistics. The next session checks of the robustness of our results. The last section of the paper offers some concluding comments.

II. INDUSTRY BACKGROUND

The air transport industry is of crucial importance for the economy. More than any other means of transport civil aviation has experienced enormous growth in recent decades. Between 1997 and 2017, global demand for flights almost tripled (The world bank, 2018). Airlines around the world now transport more than 4 billion business and leisure travelers a year. By 2036, the International Air Transport Association expects to double again (IATA, 2017). However, airport capacity has not kept pace with the growth in airport traffic.
and demand for air travel (Czerny, 2010). A considerable number of airports have already problems with flight planning, especially during the peak traffic hours (Airbus, 2015). One option is investing in a new runway, this might be too costly, too slow and even unfeasible for space reasons (Aravena et al., 2018). Therefore the airport may require the practice of demand management to mitigation of air traffic delays. It includes administrative (e.g., slot control) or economic (e.g., congestion pricing, slot auctions) measures with the aim to reduce overall airport demand or modifying the temporal characteristics of such demand (Gillen et al., 2016). In Europe, in contrast to U.S. regulation, slot auction or trade is not intended. Rather congested airports in the EU are subject to a slot coordination process. They operate with slot limits that are strictly enforced by state-appointed schedule coordinators (Pertuiset and Santos, 2014). The allocation takes place according to the defined priorities of the EU Slot Regulation (European Commission, 1993). Once allocated slots are retained, but at least 80% of them must have been used in the previous period. This set of rules is usually known as ’grandfather rights’. It is also specified that slot can ’freely exchanged between air carriers or transferred by an air carrier from one route, or type of service, to another, by mutual agreement or as a result of a total or partial takeover (European Commission, 1993). This was the case in Germany after the insolvency of the second biggest German airline Air Berlin.

In autumn 2017 the German aviation market, in particular, attracted political and social attention and changed the competitive conditions in the domestic German flight market. After several years in which Air Berlin had to struggle with financial difficulties, it filed for bankruptcy in August 2017. A sharp rise in airfares and a lack of capacity on domestic flights were the results. As a consequence, Lufthansa, the biggest German airline with its 100% subsidiary Eurowings had a monopoly position for direct domestic flights. Shortly after the insolvency announcement Air Berlin published that it signed an agreement with Lufthansa for a large part of Air Berlin’s assets, i.e. the subsidiaries airline NIKI and the Luftfahrtgesellschaft Walter. This sale of assets especially the allocation of the vacated slots at congested airports was investigated by the EC (European Commission, 2017b) and the German Federal Cartel Office (Bundeskartellamt, 2018). In particular, the EC stated that the planned acquisition of slots from Lufthansa posed serious risks that European consumers would face a reduced choice and higher prices, long-term (European Commission, 2017c). The EC has already highlighted in prior decisions practice that the lack of access to slots constitutes a significant barrier to entry or expansion at Europe’s busiest airports. This can result in higher fares for passengers (European Commission, 2017a). A large slot portfolio from one airline on one airport can result in higher barriers to entry for airlines that want to operate to and from those airports. Therefore Lufthansa only received the approval for a part of the insolvent assets after it submitted an improved set of commitments. The acquisition of slot through the British LCC easyJet was

1Air Berlin was able to maintain flight operations until the end of October through credit from the German government.
approved by the EC (European Commission, 2017b). easyJet is beside Ryanair the two main dominate airline in Europe and is among the 10 largest airlines worldwide (Statista, 2016). 2017 easyJet transported over 80 million passengers and has a European market share of 18.

The phenomenon of LCCs and their market entry can be observed worldwide. While there is not clearly define what a low-cost airline is, and recently a kind of hybrid airline types occur, from an economic point of view, LCCs represent on an otherwise lower quality product as compared to what has been on offer in the industry prior (Bilotkach et al., 2018). Therefore the competition in the airline industry can not only assume horizontal product differentiation (Brueckner and Flores-Fillol, 2007) but also from the point of vertical product differentiation. Like Bilotkach et al. (2018) mentioned vertical product differentiation can arise from airlines offering either different frequency of service or different levels of in-flight amenities. Later like the availability of departure lounges, in-flight meals, seat comfort, etc. represent a conventional product quality measures. Besides this, the frequencies of service are related to the full cost of travel, consisting with monetary costs (e.g. fares) and the discrepancy between the passenger’s most preferred and scheduled departure or arrival time the so-called disutility of schedule delay (Bilotkach et al., 2018). This strategy has put the established FSNCs under considerable pressure. They react with long-term strategies such as network expansion, the formation of alliances or setting up their own low-cost subsidiaries. From an economic point of view, however, the reaction on fares and frequencies of FSNCs after the entry of an LCC seems to be the most relevant reaction. To the best of our knowledge, we are the first with a data set containing fares before and after the entry of an LCC outside the U.S. market. Moreover, the studies on the topic of the effects of entry on markets with vertical product differentiation are quite scarce.

The interest of the effect of airline competition on airfares was first spurred by deregulation of US airlines in 1978, which allowed airfares to be set by market forces and removed restrictions on entry. This led to a flurry of studies gauging the effects of competition on fares. Notable contributions include Bailey and Baumol (1983); Berry (1992, 1990); Borenstein (1989, 1990, 1991, 1992); Brueckner and Spiller (1992, 1994); Call and Keeler (1985); Evans et al. (1993); Graham et al. (1983); Hurdle et al. (1989); Morrison et al. (1989, 1995) and others. Using a number of different approaches these studies have unanimously shown that the most obvious effects of the liberalization of the aviation industry were the decline in airfares, the increase in frequencies and the increase in the efficiency of airlines while maintaining a good safety record (Goetz and Vowles, 2009). Another major revolution was the emerge of LCCs with the pioneer Southwest Airlines. The market entry of LCCs with aggressive pricing policies has changed the intensity of competition within the industry. With respect to market entries, the literature can be roughly divided into two strands: On the one hand there is the literature dealing with the determinants of market entry and on the other hand, there is literature on the effects of market entry. The first examines the key factors for airlines’ decision to enter certain
routes. This is often done by estimating structural models\textsuperscript{2} or estimating the likelihood of entry as a function of the firm and market characteristics\textsuperscript{3}.

For the latter Dresner et al. (1996) was the first who systematically measure that LCC competition exerted dramatic downward pressure on fares. The most know Southwest Effect i.e., a rapid increase in traffic volume and a simultaneous fall in route fares were, or close to were, Southwest Airlines operates has become widely known. Morrison (2001) takes a macroeconomic perspective that looks at the total extent of Southwest Airlines’ influence on the competition by investigating the impacts of its actual, adjacent and potential route presence. They reached the conclusion that the presence of the LCC permits saving to consumers that amounted to 20 % of the US airline industry’s domestic scheduled passenger revenue. Windle and Dresner (1999) investigate how established airlines react to the market entry of LCCs and refuted the US DOT’s claim that the incumbent increased fares on non-competitive routes to compensate for lost revenues on competitive routes. Their analysis shows that fares on routes with a competitor fall by 25 %. Goolsbee and Syverson (2008) showing that even such a threat of entry by Southwest substantially depresses fares. They find that incumbents significantly lower prices when threatened by an LCC, in this case, Southwest Airlines. More than half of the total price reaction occurs before Southwest Airlines enters the market. Alderighi et al. (2012) use the published fares of Lufthansa, British Airways, Alitalia and KLM for the most important city pairs from Italy to different European cities. In addition to the looking of different competition models between airlines, they find that competition with LCCs equally reduces the business and leisure fares of FSNCs, with a focus on medium segment fares. The most of these studies use data on the U.S. domestic market probably because the liberalization was first beginning in the U.S. together with the availability of (route level) traffic and fare data collected by the U.S. Department of Transportation provides a fruitful environment for empirical research (Ito and Lee, 2003). Therefore, there are only a few studies for the European aviation market, because extremely rich and detailed data are otherwise rarely accessible (Adler et al., 2014). Also, the literature about competition between LCCs and FSNCs incorporate in the element that the LCC operate out of secondary airports within large metropolitan areas.

III. MODELING FRAMEWORK

We interpret the entry from easyJet in the domestic German flight market as a change in the competitive situation. Between the exit of Air Berlin and the entry of easyJet Lufthansa was the only airline, besides its 100 % subsidiary Eurowings, offers direct domestic flights. Therefore we consider a monopoly position. Through the entry of the LCC easyJet, a further quality level was offered on the market. We see easyJet as low-quality firm and Lufthansa as a high-quality firm. Following Tirole (1988) consider $N$ consumer whose

\textsuperscript{2}For example Berry (1992), Ciliberto and Tamer (2009), Dunn (2008).
\textsuperscript{3}For example Boguslaski et al. (2004), Sinclair (1995).
preferences can be described by $U = \theta s_j - p_j$ if each consumes one unit of service quality $s_j$ and pays price $p_j$ and 0 otherwise. The parameter $\theta$, the taste of quality, is uniformly distributed across the population of the consumer between the interval $[0, 1]$. There are two firms, Lufthansa ($LH$) and easyJet ($EJ$). Both offer different, exogenous and observable qualities $s_j$ with $j \in \{LH, EJ\}$. We assume that the quality for Lufthansa is $s_{LH} = 2$ and for easyJet $s_{EJ} = 1$ and that higher quality is associated with higher costs: $c_{LH} > c_{EJ}$. That takes strong cost reduction. Finally, we assume that $c_{LH}$ and $c_{EJ}$ are such that both demand are positive when the two products are sold at unit cost (i.e. when $p_{LH} = c_{LH}$ and $p_{EJ} = c_{EJ}$.)

The parameter $\theta$, the taste of quality, is uniformly distributed across the population of the consumer between the interval $[0, 1]$. There are two firms, Lufthansa ($LH$) and easyJet ($EJ$). Both offer different, exogenous and observable qualities $s_j$ with $j \in \{LH, EJ\}$. We assume that the quality for Lufthansa is $s_{LH} = 2$ and for easyJet $s_{EJ} = 1$ and that higher quality is associated with higher costs: $c_{LH} > c_{EJ}$. That takes strong cost reduction. Finally, we assume that $c_{LH}$ and $c_{EJ}$ are such that both demand are positive when the two products are sold at unit cost (i.e. when $p_{LH} = c_{LH}$ and $p_{EJ} = c_{EJ}$.)

Let $\pi_j$ be the profit of airline $j$ and demand is $D_j$. First, we consider the monopoly case. A consumer with the parameter $\theta_i$ is indifferent between the flight with the incumbent or not to fly at all if and only if

$$\theta_i = \frac{p_{LH}}{2}. \quad (1)$$

With the demand function $D_{LH} = N(1 - \theta_i)$ and the profit margin per consumer of $p_{LH} - c_{LH}$ the profit of the incumbent can be written as a price function:

$$\pi_{LH}(p_{LH}) = N \left(1 - \frac{p_{LH}}{2}\right) (p_{LH} - c_{LH}). \quad (2)$$

From the first-order condition follows the monopoly price and quantity:

$$p_M^* = 1 + \frac{c_{LH}}{2} \quad (3)$$

$$q_M^* = N \left(\frac{2 - c_{LH}}{4}\right) . \quad (4)$$

Secondly for the period after entry we consider a case of vertical product differentiation. All consumers with $\theta > \bar{\theta}_i$ prefer $s_{LH}$. A consumer with parameter $\bar{\theta}_i$ is indifferent between both airlines if and only if $\bar{\theta}_i 2 - p_{LH} = \bar{\theta}_i 1 - p_{EJ}$. This results in the following equation:

$$\bar{\theta}_i = p_{LH} - p_{EJ}. \quad (5)$$

All consumers with $\bar{\theta}_i > \theta > \bar{\theta}_i$ choose $s_{EJ}$. Given that consumers is indifferent between the flight with the low quality and not to fly if and only if $\bar{\theta}_i 1 - p_{EJ} = 0$ the equation is following:

$$\bar{\theta}_i = p_{EJ}. \quad (6)$$

The demand functions are given by $D_{LH} = N(1 - \bar{\theta}_i)$ and $D_{EJ} = N(\bar{\theta}_i - \bar{\theta}_i)$ with $N = 500$. Then the profit functions follows

$$\pi_{LH}(p_{LH}, p_{EJ}) = N(1 - (p_{LH} - p_{EJ})) (p_{LH} - c_{LH}) \quad (7)$$

$$\pi_{EJ}(p_{LH}, p_{EJ}) = N(p_{LH} - 2p_{EJ}) (p_{EJ} - c_{EJ}).$$
The equilibrium prices and quantities follows

\[ p_{LH}^* = \frac{2}{7}(2 + c_{EJ} + 2c_{LH}), \quad p_{EJ}^* = \frac{1}{7}(1 + 4c_{EJ} + c_{LH}) \]  

\[ q_{LH}^* = \frac{1}{7}N(4 + 2c_{EJ} - 3c_{LH}), \quad q_{EJ}^* = \frac{2}{7}N(1 - 3c_{EJ} + c_{LH}). \]  

In the airline market the vertical product differentiation can arise from an airline offering either a different level of service, mostly offer only basic services to their customers and therefore sometimes called 'no-frill' carriers (Button and Ison, 2008) or different frequency of service. The latter is directly related to the full cost of travel. This contains on the one hand monetary costs and the disutility of schedule delay (Bilotkach et al., 2018). The monetary costs can be seen as the fares, the price for the flight ticket that the customers have to pay for a flight. To see how the fares change between the two market situation we consider both the monopoly price and the equilibrium prices with vertical product differentiation. For a better comparison, we consider \( c_{LH} = 1 \). Figure 1 shows the equilibrium prices dependent of the unit costs \( c_{EJ} \). The monopoly price is constant and above the prices under competition. It can easily see that, first, \( p_{EJ} \) is positively correlated with the unit costs however, they are below the prices of the high-cost incumbent. Second, with competition the high-cost incumbent sets prices below the monopoly prices and above \( p_{EJ} \). The disutility of schedule delay can be seen as the second distinction according to vertical product differentiation. A schedule delay is created from the discrepancy between the passenger’s most preferred and scheduled departure or arrival time. The expected schedule delay can be reduced through a higher frequency offered by the airline, under a normal distribution of the passengers’ preferred departure time. Also, a higher frequency is negatively related to the full cost of travel (Bilotkach et al., 2018). Especially in short-haul flights the flight frequency should be a major impact factor because driving is a travel option and a small amount of time is the main reason for the decision to fly rather drive. Hence, we also consider the reaction on the flight frequency offered by the high-quality firm as a reaction to the entry. The number of flights offered by an airline \( j \) is in our model \( q_j \). As to see in Figure 1 the number of flights offers by the high-quality
firm is constant with regard to $c_{EJ}$. Under vertical product differentiation, we distinguish between two areas. Is the low-cost entrant essentially more efficient than the high-cost incumbent the number of flights offers by the entrant is high due to low fares. Only passenger with high $\theta$ asks for flights from the incumbent. With a marginally more efficient low-cost entrant, the flight number of the incumbent is above the low-cost entrant. Also through the price competition, it is easy to see that $q_{LH} > q_M$.

IV. METHODOLOGY AND DATA

i. Empirical methodology

The estimation of the effect of the market entry of an LCC is complicated especially of the fares because as illustrated above, fares are affected by many economics factors others than the market entry from easyJet. The aviation market in Germany was after the exit of Air Berlin exposed to severe turbulence. Fares increased through a lower supply and a constant demand. Over the observed period, we then see an increasing frequency and decreasing fares. Also in the observed period were Christmas holidays, a time of increasing demand. Because of this, simple before-and-after examination of fares or frequencies on the routes affected by the risks that a possible entry effect may have other causes. In our analysis we therefore rely on the "difference-in-differences" (Diff-in-Diff or DiD) estimation technique (Ashenfelter and Card (1984); Card and Krueger (1993)). This is a standard econometric technique that compares a group is exposed to a causing variable of interest and others are not. The great appeal of DiD estimation comes from its simplicity as well as its potential to circumvent many of the endogeneity problems that typically arise when making comparisons between heterogeneous individuals. Also, there can arise endogeneity from self-selection due to LCCs’ entry decision (Bilotkach et al., 2018). In this case, the entry on specific routes should not be explicit determined by easyJet but much more due to the fact that the corresponding slots have become available after the exit of Air Berlin.

The DiD approach is well-suited to estimating the effect of sharp changes in the economic environment or changes in government policy (Bertrand et al., 2004). The basis is a natural experiment that is caused by an exogenous event, in this case, the market entry of easyJet. This divides the affected parties, in this case, the routes into two groups. On the one hand, routes that would not be affected by the entry act as a control group to capture the general trends. On the other hand, the treatment group assumed to be affected by the change. This approach allows us to account for the confounding effects of non-entry related changes in economic conditions, identifying the entry effects by relying on effects experienced only on treatment routes but not on control routes.

In order to be able to detect differences between the two groups, at least two periods are available. One period before the event and one after. With the DiD approach, the effect of market entry on fares can be identified by comparing the average change in fares between the two groups (Wooldridge, 2015). According to notation from Wooldridge (2015), we...
call the control group $C$ and the treatment group $T$, $d_t$ is a dummy variable which is 1 for the treatment group and 0 otherwise. Moreover, $d_2$ is a dummy variable for the second (post-change) period. This results in the following general formula:

$$y = \beta_0 + \delta_0 d_2 + \beta_1 d_T + \delta_1 d_2 d_T + \text{other factors.}$$  \hspace{1cm} (9)$$

where $y$ is the outcome variable of interest and $\delta_1$ measures the effect of market entry. Without other factors in the regression, $\hat{\delta}_1$ will be the difference-in-differences estimator:

$$\hat{\delta}_1 = (\bar{y}_{2,T} - \bar{y}_{2,C}) - (\bar{y}_{1,T} - \bar{y}_{1,C}),$$  \hspace{1cm} (10)$$

where the bar denotes average, the first subscript denotes the year, and the second subscript denotes the group. Then it is easy to see that we compute the differences in averages between the treatment and control groups in each time period and then difference the results over time Wooldridge (2015).

The DiD approach requires a control group that is not affected by market entry but has as similar as possible characteristics as the treatment group. It is sufficient that the price development of the two groups is as similar as possible. The basic assumption of the DiD approach is therefore that the group-specific trends would have been identical without the measure. Therefore an appropriate control group should also be treated by the same exogenous shocks then the treatment group. All routes are affected by Christmas holidays and by the resulting change in demand because we observe only domestic routes. Because Air Berlin was active on the treatment routes we consider only former routes from Air Berlin to control on price and frequency reactions. Also, we restrict the control group to routes where Lufthansa offers flights. Furthermore, we exclude the route MUC-DUS because Eurowings started to offer this route since 15 January 2018. Typically the first step by the DiD approach is the graphical way to check if the selected control routes have a similar pre-market entry price pattern than the treatment routes. Figure 2 shows the development of the control and treatment routes. The blue line is the development on the routes with former competition through Air Berlin and now easyJet. The red line shows the development of all other former Air Berlin routes operated by Lufthansa as a monopolist now. It is seen that the price trends of the two groups were almost identical until easyJet entered the market on 5 January 2018. Therefore, it can be assumed that no other exogenous shocks are known which apply only to the treatment routes. After the market entry, the prices on the treatment routes are below the prices of the control group. Also, the frequency indicates a similar development for both groups. The frequencies increase till 5 January 2018. Only on Christmas holidays, both series fall to a lower level, with more sharply for the control lines. After the market entry, there is a regular rhythm within both groups.

ii. Construction of the data set

To evaluate the reaction from Lufthansa to the market entry of easyJet on the domestic German flight market we use a novel panel data set. The data was crawled to collect flight
data including fares, the arrival and destination airport, the scheduled departure and arrival time, the duration and airlines. The time period for this study is from the 10 November 2017 until 10 March 2018. The time period starts after Air Berlin announced the insolvency. Thus we are not able to distinguish between the total flight market before and after the exit. However this paper mainly focusing the incumbent response to a low-cost entry, therefore our main results are not affected. All fares apply for the economy class and do not contain extra costs for payments or luggage. The data are all non-stop flights operated by domestic and international carriers. We use data collected five days prior to the respective day of departure. Fares are considered particularly volatile and may vary widely depending on the days remaining until departure, the booking period, the departure time, the airport and the day of departure (Aldighi et al., 2012). In order to address the dynamic pricing issue, we start collecting data always at midnight. Also, pricing adjustments through the airlines to cover different booking behavior of the target group (holiday, business etc.) does not constitute a problem. Unlike other low-cost airlines, easyJet focuses on business travelers as customers. This is clearly demonstrated by marketing campaign and loyalty programs. Lufthansa also focused business traveler for the domestic market, hence the target customer is similar we consider a similar dynamic pricing strategy.

In the literature, it is often discussed whether selecting rather a city-pair as the relevant market or an airport-pair. For the airport-pair approach, the main argument is that business travelers often have a strong preference for flying out of major airports. This is the view taken in Ciliberto and Tamer (2009). The results of Morrison (2001) and Goolsbee and Syverson (2008) show that the airport-pair approach should only be used when competition from adjacent airports is taken into account. Hence, especially when considering the competition between a major network and low-cost carriers the city-pair approach is often preferred. The important aspect is that LCCs like Southwest and Ryanair are operating mostly from secondary airports in the same city. Also, the EC use a city-pair approach in his prior decisions and characterize airport substitutability with a benchmark of 100km/
hour driving time. In their decision, they find for easyJet only possible substitutability of TXL and SXF (European Commission, 2017b). Though easyJet does not offer domestic flights from SXF. We use the airport-pair approach for the domestic market in Germany. We define a route as a route between two airports. Following the EC a substitution between an indirect flight and non-stops flights depends on the flight duration (European Commission (2009); European Commission (2005)). The national flights can be therefore seen as short-haul flights, with the longest flight between TXL-MUC with 90 minutes. Due to the short traveling time, customers are less likely to consider indirect flights when the additional stop increase the traveling time. Hence indirect flights appear do not normally provide a constraint to direct services on a short-haul flight we consider only direct flights. We choose the most relevant international German airports were 2017 cover 80% of all national flights (Destatis, 2017). This includes the following airports: Frankfurt am Main (FRA), Munich (MUC), Düsseldorf (DUS), Berlin-Tegel (TXL), Berlin-Schönefeld (SXF), Hamburg (HAM), Cologne/Bonn (CGN), Stuttgart (STR), Hannover-Langenhagen (HAJ), Leipzig/Halle (LEJ), Nürnberg (NUE), Bremen (BRE). On seven out of these twelve airports, the demand from the airlines exceeds the airport capacity. Therefore, the airport coordination for Germany (FLUKO) regulates coordinates the slot allocation and all incoming and outgoing on the airports: FRA, DUS, HAM, STR, TXL, SXF.

Between these twelve airports, 64 non-stops connections can be found. Before the insolvency Air Berlin operated on 26 routes and direct competition between Lufthansa and Air Berlin were found on eight routes. Immediately after the exit, Lufthansa has a monopoly position on these routes. Lufthansa also offers flights on further 26 routes as a monopoly. Only Eurowings was also active in this market. On 05 January 2018 easyJet entering the market with connections on eight former Air Berlin routes (TXL-DUS, TXL-FRA, TXL-STR, TXL-MUC). In direct competition with Lufthansa easyJet offers flights between TXL-FRA, TXL-MUC. Figure 3 shows the flight connections for Lufthansa, easyJet and also former routes from Air Berlin. Due to the market entry of easyJet compared with the situation before Air Berlin exit the market, Lufthansa’s share of all domestic flights within Germany fell from just under 68% to just under 60%.

iii. Descriptive analysis

Our data set contains 37,622 observations. The average fares for all national flight were 194 euro with a price range of 43 euro to 785 euro. On average, there are around 8 flights per day on each route, ranging from 1 to 29 flights, with an average of 311 national flights per day. The shortest connection is between HAM and HAJ with 151 km, the longest from HAM to MUC with 791 km. The average distance is 420 km, the average flight time is 66 minutes. An overview of the fares of Lufthansa and easyJet during the observed period is given by Figure 4. It becomes clear that Lufthansa’s ticket prices are the most expensive during the entire period. The average Lufthansa fare is just under 203 euro, with

4The dataset has been cleared of data errors.
Figure 3: Overview of the domestic German routes by airlines

a relatively large price range of 58 euro to 691 euro. A slight price decline can be seen in Lufthansa’s prices over Christmas and New Year’s Eve, where in the most federal states are holidays. easyJet offers fares far below from Lufthansa. The average price is 80 euro, with the most expensive ticket being offered for 785 euro and the cheapest for 43 euro. The development of the daily frequency for each airline is given on the right side of Figure 4. Lufthansa offers flights at least 115 times a day and a maximum 359 times a day, an average of 289 domestic flights a day. It is obvious that over the Christmas Holidays the frequencies decrease. easyJet, in contrast, offers an average of 42 domestic flights a day, with at least 2 times a day and a maximum of 46 flights.

It is visible that the fares from Lufthansa decrease over the observed period. Following the exit of the second biggest German airline, the supply was to low and an increase in
prices occurred. By comparing Lufthansa average fares before (November 2017) and after (February 2018) the market entry we see a decrease of just 13%. Furthermore, if we compare the routes affected by Air Berlin’s exit from the market with the remaining routes, this trend is even stronger. Figure 5 illustrates these developments. Before market entry, the average prices of Lufthansa on these routes were still 226 euro, after the entry these had fallen by 38 euro to 188 euro. By comparison, between November and February prices on routes not previously served by Air Berlin fell by only 13 euro from 213 euro to 200 euro. On the four routes where easyJet is an alternative to Lufthansa. The average prices of Lufthansa on these routes show a price reduction of 25%. The exit of Air Berlin also means that on the domestic market the supply for flights decrease and exceed the constant demand. Similar to the development of fares figure 5 shows that the number of flights offers by Lufthansa increased over time. By the comparison of the frequencies before and after the entry we see an increase of just 15%. Again these effect is with 33 % more powerful if we compare routes on which Air Berlin was formerly active. The German Federal Cartel Office find similar results. Fares were in November and December on average 25-30 % above the previous year’s level. Furthermore, they find that the prices in February 2018 fell by an average of around 25-30 % compared with autumn 2017. Thus roughly go back to the price level recorded before Air Berlin’s departure (Bundeskartellamt, 2018).

V. Estimation Results

To identify the effect of the established carrier Lufthansa on the fares and the frequencies through the market entry of easyJet and the change from a monopoly position to competition with a vertical product differentiation we use the DiD approach. In order to calculate the causal price effect on the market entry, a fixed-effects panel regression was estimated in the following form:

\[ \ln P_{i,j,t} = X'_{i} \beta_1 + \beta_2 D_{LH,j} + \beta_3 D_{ME,t} + \beta_4 D_{LH,j} D_{ME,t} D_{Treat,i} + \alpha_t + \epsilon_{i,j,t}. \]  

(11)
Figure 5: Comparison of the development of the Air Berlin and other routes

The dependent variable is the logarithm of the prices per flight. Prices are given for each route $i$ and airline $j$ at day $t$. The airline $j$ is either Lufthansa or easyJet. The matrix $X_t$ includes dummies for each day of the week. To consider for the national holiday between Christmas and New Year we include a dummy variable for a time period from 24 December 2017 till 01 January 2018 to control for corresponding price effects. Furthermore, we include a dummy variable for the daytime every two hours. $D_{LH,j}$ is a dummy variable that assumes the value 1 for a Lufthansa flight and 0 otherwise. We include the dummy variable $D_{ME,t}$ that take the value 0 before and 1 after the market entry on 5 January 2018. For the treatment routes, the dummy variable $D_{Treat,i}$ is 1. The interaction term $D_{LH,j}D_{ME,t}D_{Treat,i}$ determines the market entry on prices of Lufthansa. All time-invariant heterogeneity between different routes, e.g. sociodemographic characteristics of the cities, is absorbed by the route fixed effects $\alpha_i$. Table 1 presents the results of our regression.

The results show that especially in the middle of the week fares rise significantly. Fares on Wednesdays are on average 19% higher than Saturdays. In addition, the different departure times have an effect on the prices. In particular, flights between 8 am and 10 am are on average 13% higher than at lunchtime (2 pm and 4 pm). But there is also a
<table>
<thead>
<tr>
<th>Coefficient</th>
<th>(Standard error)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$D_{Monday}$</td>
<td>.1148*** (.0271)</td>
</tr>
<tr>
<td>$D_{Tuesday}$</td>
<td>.1450** (.0305)</td>
</tr>
<tr>
<td>$D_{Wednesday}$</td>
<td>.1840*** (.0266)</td>
</tr>
<tr>
<td>$D_{Thursday}$</td>
<td>.1823*** (.0164)</td>
</tr>
<tr>
<td>$D_{Friday}$</td>
<td>.1333** (.0295)</td>
</tr>
<tr>
<td>$D_{Sunday}$</td>
<td>.0718 (.0330)</td>
</tr>
<tr>
<td>$D_{6am-8am}$</td>
<td>.0784 (.0566)</td>
</tr>
<tr>
<td>$D_{8am-10am}$</td>
<td>.1340* (.0452)</td>
</tr>
<tr>
<td>$D_{10am-12am}$</td>
<td>.0466 (.0336)</td>
</tr>
<tr>
<td>$D_{12am-2pm}$</td>
<td>-.0078 (.0361)</td>
</tr>
<tr>
<td>$D_{4pm-6pm}$</td>
<td>.1223*** (.0220)</td>
</tr>
<tr>
<td>$D_{6pm-8pm}$</td>
<td>.1465*** (.0192)</td>
</tr>
<tr>
<td>$D_{8pm-10pm}$</td>
<td>.0139 (.0437)</td>
</tr>
<tr>
<td>$D_{Christmas holiday}$</td>
<td>-.2277** (.0453)</td>
</tr>
<tr>
<td>$D_{LH}$</td>
<td>.9260*** (.0405)</td>
</tr>
<tr>
<td>$D_{ME}$</td>
<td>-.0604*** (.0097)</td>
</tr>
<tr>
<td>$D_{LH, ME, Treat}$</td>
<td>-.2139*** (.0387)</td>
</tr>
<tr>
<td>Constant</td>
<td>4.1852*** (.0342)</td>
</tr>
<tr>
<td>Observations</td>
<td>14,138</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.4594</td>
</tr>
</tbody>
</table>

The estimation is performed by using a GMM. Dependent variable is daily prices and is expressed in logarithm. The regression include route fixed-effects. Cluster-robust standard errors (clustered on route level) are presented in parentheses. Statistics are significant for * $p < 0.5$, ** $p < 0.01$, *** $p < 0.001$.

Table 1: Price-Determination - Regression results with the difference-in-differences approach

significant increase in the afternoon and evening from 4 pm to 8 pm. The variable $D_{ME,i}$ shows that all prices on all routes fell on average by 6% after easyJet enter the market. Above all, the interaction term $D_{LH,j}D_{ME,i}D_{Treat,i}$ shows that Lufthansa has decrease its fares on routes on which it is in direct competition with easyJet much more than on the control routes. $\beta_4$ shows that this effect was 21%. The market entry from easyJet results, first, in a decrease of the average fares offers in the market and second, also Lufthansa responses with decreasing fares on the competitive routes. This pricing policy is consistent with the results of the formal model. Windle and Dresner (1999) also noted a similar price reaction. They analyses Delta Airlines’ reaction to ValuJet’s entry and found price reductions of 25%.

Also we estimate the causal effect on the frequencies through the market entry using a fixed-effects panel regression with the following equation:

$$\ln F_{i,j,t} = X_t^\prime \beta_1 + \beta_2 D_{LH,j} + \beta_3 D_{LH,j}D_{ME,i}D_{Treat,i} + \alpha_t + \varepsilon_{i,j,t}. \quad (12)$$

The dependent variable is the logarithm of the frequencies for each route $i$ and airline $j$ at day $t$. The matrix $X_t$ includes dummies for each day of the week and for the Christmas
holidays. It contains also dummy variables for the day times with a distinction between morning (6 am - 12 am), midday (12 am - 6 pm) and evening (6 pm - 12 am). $D_{LH,j}$ is the airline dummy variable for Lufthansa. The interaction term $D_{LH,j}D_{ME,i}D_{Treat,i}$ determines the market entry effect. All time-invariant heterogeneity between different routes, e.g. sociodemographic characteristics of the cities, is absorbed by the route fixed effects $\alpha_i$. Table 2 presents the results of our regression. The regression shows that significantly more flights are offered during the week than on Saturdays. The frequency on Thursday is on average 46 % higher than on a Saturday. Likewise, the frequency over the Christmas holidays has fallen sharply. From 24 December 2017 to 01 January 2018, 55 % fewer flights were offered on average. There is also an effect on the time of day. Compared to the morning, 38 % fewer flights are offered in the evening. However, following easyJet’s market entry the frequencies on the new competitive routes have increased by an average of 18 % compared to the non-competitive routes. According to the formal model this suggests that the marginal costs from easyJet are not that far below Lufthansa’s marginal costs. Lufthansa react with an increase of the frequency on the competitive routes. Hence, they expand the frequency compare to the monopoly position.

The fact that Lufthansa has temporally no competitor on the national German flight market should result in a monopoly position with higher prices and a lower frequency. Due to the already low level of competition on the national German aviation market, the EU complain against the acquisition from large parts of the insolvency Airline Air Berlin through Lufthansa. On the other side, they approve easyJet to take over assets and thus

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>(Standard error)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$D_{Monday}$</td>
<td>.4502***</td>
<td>(.0783)</td>
</tr>
<tr>
<td>$D_{Tuesday}$</td>
<td>.4574***</td>
<td>(.0645)</td>
</tr>
<tr>
<td>$D_{Wednesday}$</td>
<td>.4426***</td>
<td>(.0604)</td>
</tr>
<tr>
<td>$D_{Thursday}$</td>
<td>.4294***</td>
<td>(.0655)</td>
</tr>
<tr>
<td>$D_{Friday}$</td>
<td>.4291***</td>
<td>(.0733)</td>
</tr>
<tr>
<td>$D_{Sunday}$</td>
<td>.1927**</td>
<td>(.0488)</td>
</tr>
<tr>
<td>$D_{Midday}$</td>
<td>-.0226</td>
<td>(.0854)</td>
</tr>
<tr>
<td>$D_{Evening}$</td>
<td>-.3776***</td>
<td>(.0704)</td>
</tr>
<tr>
<td>$D_{Christmas}$</td>
<td>-.5520***</td>
<td>(.0593)</td>
</tr>
<tr>
<td>$D_{LH}$</td>
<td>.8195**</td>
<td>(.1629)</td>
</tr>
<tr>
<td>$D_{LH}D_{ME}D_{Treat}$</td>
<td>.1776**</td>
<td>(.0503)</td>
</tr>
<tr>
<td>Constant</td>
<td>.3454**</td>
<td>(.0974)</td>
</tr>
<tr>
<td>Observation</td>
<td>3,597</td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.5701</td>
<td></td>
</tr>
</tbody>
</table>

The estimation is performed by using a GMM. Dependent variable is daily number of flights and is expressed in logarithm. The regression include route fixed-effects. Cluster-robust standard errors (clustered on route level) are presented in parentheses. Statistics are significant for * p < 0.5, ** p < 0.01, *** p < 0.001.

Table 2: Frequency-Determinant - Regression results with the difference-in-differences approach
slots from Air Berlin and enter the market. This created a competitive situation in which consumers can choose between an airline with high and low quality. Our results show that through the entry of easyJet the monopolist Lufthansa reacts with a significant decrease in fares and an increase of the frequencies and e.p. increase the consumer welfare. In general, these results imply that access to markets affected by restrictions such as the availability of slots on congested airports is a crucial point for competition. Due to the growing consolidation trend in the European aviation market, we will observe an increase in takeovers, mergers, and insolvencies in the coming years. These will lead to free slots at some congested airports. Thereby the process of slot allocation in the EU allows the transfer from slots as a result of a total or partial takeover. This can result in further growth of the market position of some already big national flag airlines and so harm competition. Especially against the background that once slots are distributed, they are protected by the so-called grandfathering rights and are so hardly redistributed.

VI. ROBUSTNESS CHECKS

To confirm the robustness of our results, we have also run a variety of alternative specification of the regression. We will examine the possible reactions before the market entry from easyJet occurs and possible spillover effects that compensate for lower profit on competitive routes. The assumption of parallel trends of the treatment routes and the control routes before market entry is also checked with a placebo test. Besides the fact that there is naturally slight variation in results between various specifications, taken as a whole, these robustness check results strongly confirm our conclusion.

A major advantage of the DiD approach is the elimination of all factors that are identical for the treatment and control group. Such joint trend development occurs for example due to the insolvency of Air Berlin, economic influences as well as through general cost and price changes. Nevertheless, the approach is not completely immune to criticism. One problem is that a change in the situation can already become apparent in the period before the treatment takes place, this is known as Ashenfelter Dip (Ashenfelter, 1978). In this case, the situation would arise if Lufthansa had already changed its prices in anticipation of the market entry. In principle, such a reaction can not be excluded, but in this case, it is unlikely. An early price reduction could only make sense against the background of customer loyalty. From the customer’s point of view, airlines are highly interchangeable (Airliners, 2014). Similarly, against the background of dynamic pricing, a pricing policy should be implemented immediately. Also, experts do not expect that Lufthansa has waived its monopoly profit (manager magazin, 2017). Therefore, there is no indication that Lufthansa already changed its pricing policy before the entry occurred.

Another source of error can arise if the trend development of the control group is influenced by market entry. The incumbent airlines such as Lufthansa, in particular, often have a strong hub-and-spoke network. This may result in a positive effect of consumer welfare on competitive routes but however, FSNC can also increase fares on non-competitive route
to compensate for lost revenues (Windle and Dresner, 1999). Windle and Dresner (1999) examined the impact of competition by the LCC ValuJet on yields by the established carrier, Delta, at Delta’s hub in Atlanta and find no evidence that the FSNC increase fares on non-competitive routes. They argue that the airlines already maximizing profits on a route basis, and so unable to offset declines in revenue from increased competition on one route by raising prices on another route (Windle and Dresner, 1999). In order to address whether Lufthansa increased prices on routes without competition through easyJet, we run a further regression using the DiD approach. The treatment group is now the control group from the previous estimates, i.e. the routes on which Lufthansa has a monopoly position after the Air Berlin exit. Now the control group contains routes on which Lufthansa has over the entire period a monopoly position. A possible increase in fares on non-competitive routes to compensate for losses should be seen in differences between these fares. Figure 6 shows that the trend of both groups are similar until 5 January 2018. In addition, there seems to be a similar development after the market entry. In order to determine a possible effect a fixed-effects panel regression was also used to estimate the following form:

\[
\text{ln}P_{i,t} = X_t' \beta_1 + \beta_2 D_{ME,t} + \beta_3 D_{ME,t}D_{Control,i} + \alpha_i + \epsilon_{i,t}.
\] (13)

The dependent variable is the logarithm of fares per flight from Lufthansa for each route \(i\) and day \(t\). The Matrix \(X_t\) contains dummy variables for the each day of the week, the Christmas holidays as also for day times for every two hours. \(D_{ME,t}\) is the dummy variable that assumes the value 0 before and 1 after market entry. The interaction \(D_{ME,t}D_{Control,i}\) control for the price policy of Lufthansa after the market entry. All time-invariant heterogeneity between different routes, e.g. sociodemographic characteristics of the cities, is absorbed by the route fixed effects \(\alpha_i\). Table 3 presents the results of our regression. The regression shows no significant effect between the control and treatment group. Therefore we find no evidence that Lufthansa react with higher fares on non-competitive routes to compensate for losses.

To verify the assumption of parallel trends in the treatment and control group we perform placebo tests. Therefore we simulate fictitious market entries at different time points

---

**Figure 6:** Graphical comparison of the treatment and control group

---

19
The estimation is performed by using a GMM. Dependent variable is the daily fares and is expressed in logarithm. The regression include route fixed-effects. Cluster-robust standard errors (clustered on route level) are presented in parentheses. Statistics are significant for * p < 0.5, ** p < 0.01, *** p < 0.001.

Table 3: Spillover effects - Regression results with the difference-in-differences approach

Other than the real market entry takes place. The estimated result is typically calculated for a period before the actual treatment occurs. If the results are significant even though the market entry has not yet take place, this gives rise to a violation of the parallel trend assumption\(^5\). Therefore the observation period was limited to eight weeks prior the market entry. In order to check if trend deviations in both prices and frequencies occur during this period, three estimates were made using the DiD approach. The following two equations were used:

\[
\begin{align*}
\ln P_{i,t} &= X'_t \beta_1 + \beta_2 D_{ME \text{Placebo},t} + \beta_3 D_{ME \text{Placebo},t} D_{\text{Treat},i} + \alpha_i + \epsilon_{i,t} \\
\ln F_{i,t} &= X'_t \beta_1 + \beta_2 D_{ME \text{Placebo},t} + \beta_3 D_{ME \text{Placebo},t} D_{\text{Treat},i} + \alpha_i + \epsilon_{i,t}.
\end{align*}
\]

The dependent variable is the logarithm of fares per flight and the frequencies, respectively for each route \(i\) for day \(t\). The dummy variable \(X_t\) is defined according to the equation 11 and 12, respectively. In addition, a placebo market entry was accepted in each case, which was postponed by fourteen days. Therefore, the variable \(D_{ME}\) assumes the value 1

---

\(^5\)See details on placebo tests Angrist and Krueger (1999); Abadie et al. (2010); Heckman and Hotz (1989).
once from 23 November 2017, 07 December 2017 and 21 December 2017 and is 0 before that. With the interaction term $D_{MEPlacebo}D_{Treat,i}$ we measure the price and frequency changes on the treatment routes after the placebo market entry, respectively. The results for the multiplication term in table 4 show that there is no evidence for an early change of the price trends between the two groups. Only the frequencies via the Christmas holidays show slightly a significant effect between the two groups. However, this should be due to the temporal change in demand over Christmas and New Year’s Eve and therefore have no long-term effects. Therefore, it can be assumed that before the market entry occur the treatment and control routes show the same path.

<table>
<thead>
<tr>
<th></th>
<th>Price determinant</th>
<th>Frequency determinant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>(SE)</td>
</tr>
<tr>
<td><strong>Treatment 23.11.2017</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$D_{MEPlacebo}D_{Treat}$</td>
<td>.0302</td>
<td>(.0326)</td>
</tr>
<tr>
<td><strong>Treatment 07.12.2017</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$D_{MEPlacebo}D_{Treat}$</td>
<td>.0072</td>
<td>(.0372)</td>
</tr>
<tr>
<td><strong>Treatment 21.12.2017</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$D_{MEPlacebo}D_{Treat}$</td>
<td>-.0037</td>
<td>(.0474)</td>
</tr>
</tbody>
</table>

The estimation is performed by using a GMM. Dependent variable is the daily fares or frequencies and is expressed in logarithm. The regression include route fixed-effects. Cluster-robust standard errors (clustered on route level) are presented in parentheses. Statistics are significant for * $p < 0.5$, ** $p < 0.01$, *** $p < 0.001$.  

**Table 4: Placebo market entry - Fixed-Effects Panel regression results**

VII. DISCUSSION

This paper identified the causal effect of a low-cost carrier (LCC) entry on the national air passenger flows in Germany. In addition, to determine the price and frequency response of the traditional network full-service carriers (FSNCs) after the entry, we examine how this response influenced the further slot allocation on congested airports in Europe. We using a data set contains fares and flight information for all domestic flights offers from airline between 10 November 2017 until 10 March 2018. In this time period, the German aviation market goes through a considerable change in the competitive situation. The insolvency of Air Berlin has given Lufthansa a monopoly position in the short term before a new LCC, easyJet, enters the market. The competition between LCCs and FSNCs presents an excellent place for the analysis of the effect of entry with vertical product differentiation (Bilotkach et al., 2018). The new entrant offers a low quality in terms of cost of travel which includes monetary costs like fares as also the frequency offered as an indicator for the discrepancy between the passenger most preferred and scheduled departure or arrival time. In order to determine the impact of entry on prices and frequencies, the paper utilized
a difference-in-differences (DID) approach. The results consistently show that the entry of an LCC, first, reduce fares much more on competitive routes with an average decrease of 21%. Second, the effect on the frequency through the new competition shows an average increase of 19% in comparison to non-competitive routes. Consequently, the results suggest that the market entry, compared to the previous monopoly situation, leads to lower ticket prices and greater consumer choice, c.p. an increase in consumer welfare.

The results of this work support the decision of the European Commission, that first, the acquisition of parts of Air Berlin by easyJet reduce the dominant position from Lufthansa on these routes (European Commission, 2017b) and that it cannot be assumed that the development of fares would have been similarly favorable if the takeover of those main routes through a second, independent supplier does not take place (Bundeskartellamt, 2018). Despite the conspicuous differences between the two business models and the service they offer, they compete aggressively with each other. And so this shows that, second, the lack of attractive and economically feasible slot at congested airports can influences the maintenance of effective competition. In the context of the increasing capacity bottlenecks of major airport infrastructure and the criticized slot allocation in Europe access to congested airport infrastructure remains a critical entry barrier, particularly at hub airports. Besides slot misuse and low utilization of airport resources (Zografos et al., 2012), the so-called grandfather rights makes the redistributed of once distributed slots extremely difficult. Hence, the European environment is still linked with the clear protection of the countries to their flag carriers as also see in Germany. Thereby the final outcome will depend on access to airport facilities that at present are tightly controlled by the national flag carriers.

This observation can give implication for the future handling of slot allocation on congested airports in Europe, however, it is still left for future research especially through the increasing consolidation trend and route density problems. One margin of extension is a complete evaluation based on long-term effects after the entry occurred. Windle and Dresner (1995) note that the average price reductions resulting from the entry of a low-cost airline can still be seen one year later. Also, it would be interesting to see how the entry barriers of airlines through the slot regulation influenced the cross-national European development.
REFERENCES


European Commission 2017c. Mergers: Commission approves acquisition by Lufthansa of Air Berlin subsidiary LGW, subject to conditions.


IATA 2017. 2036 Forecast Reveals Air Passengers Will Nearly Double to 7.8 Billion.


The world bank 2018. Air transport, passengers carried.


