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# Domestic Market Power in the International Airline Industry

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**Abstract**

We posit and empirically test the hypothesis that airlines are able to charge a fare premium in markets that originate in their domestic country, relative to similar markets that originate in foreign countries. To this end, we focus on international one-stop air travel trips for which the main, intercontinental, flight legs are identical, while the feeder legs depart from a mixture of domestic and foreign airports. We collect a unique database of published fares for such trips and estimate reduced form fare regressions with main flight leg fixed effects. We find that trips from and to domestic airports (compared with foreign airports) are characterized by about 9 per cent higher fares, even after controlling for the competitive environment and a large range of origin characteristics. These findings demonstrate that airlines have substantial domestic market power, enabling them to raise fares at their domestic airports irrespective of aforementioned market conditions. The magnitude of this domestic country premium is large relative to the traditional airport dominance premium, suggesting that the distinction between domestic and foreign origins is a crucial determinant of the degree of market power that airlines can exert in the international airline industry.

**JEL classifications:** L11, L13, L93, R40

**Keywords:** market power, airline competition, price discrimination, international aviation

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## 1 Introduction

This paper offers a new perspective on the sources of market power in the airline industry. We assess the degree to which airlines have domestic market power, by which we mean the ability to charge higher fares, other things equal, in their domestic country relative to foreign countries. To this end, we depart from the extant focus of airline market power studies on domestic airline competition, and consider an international airline industry in which airlines compete for traffic in their domestic country as well as in countries other than the one where they are principally established.

The study of the sources and consequences of airline market power has been central in the aviation economics literature since Levine (1987) and Borenstein (1989). Domestic airline industries, in particular the US domestic airline industry, have received considerable attention. Here, it has been firmly established that one of the most important sources of airline market power is airport dominance, resulting in higher average fares paid for travel out of and into airports where one airline serves a large share of the market (see, e.g., Borenstein, 1989; Berry, 1990; Evans and Kessides, 1993; Lee and Luengo-Prado, 2005; Berry et al., 2006; Bilotkach and Pai, 2014; Zhang et al., 2014). This airport dominance effect is more important than route dominance in determining the degree of airline market power (Evans and Kessides, 1993; Bilotkach and Lakew, 2014). Others have demonstrated that the relative value of the dominant airline's frequent flier program (Lederman, 2008), and bureaucratic control over (scarce) airport facilities (Ciliberto and Williams, 2010; Snider and Williams, 2015), represent two mechanisms through which airlines transform their dominant position into higher fares. Beyond domestic markets, the studies by Lijesen et al. (2001) and Bilotkach (2007) provide evidence of the airport dominance effect in international markets.

The main thrust of our paper concerns the ability of airlines to charge a fare premium at airports within their domestic country. We conceptualize the airline's national identity as an alternative source of market power that might play an important role in international airline competition. To empirically investigate this issue, we set out a novel identification strategy that enables estimation of the additional rate charged by airlines for trips made to and from domestic airports over the fares that they charge for comparable trips from foreign airports. An important aspect of our empirical approach is that we, among others, separate this "domestic country premium" from the traditional "airport dominance premium", so that the former indicates the fare markup that airlines can command at their domestic airports independent of whether they serve a large or small share of the market at that airport.

Our focus on domestic market power in the airline industry is motivated by a number of demand and supply side factors favoring domestic airlines. On the demand side, it is likely that travelers view domestic and foreign airlines as imperfect substitutes (Armington, 1969). Travelers may be positively biased towards domestic products and services due to nationalistic sentiments or a desire to protect the domestic economy (Shimp and Sharma, 1987; Verlegh and Steenkamp, 1999; Verlegh, 2007). Such motives might be especially prevalent in the airline industry, since airlines are typically regarded as important drivers of economic activity and to some extent still represent objects of national pride. In addition, airlines typically have a long history of market presence in their domestic country. This may confer domestic airlines with persistent competitive advantages such as brand familiarity, persistent beliefs about the quality of the brand, or brand buying habits, that are not easily copied by (foreign) competitors that have entered the market at a later stage (see, e.g., Bain, 1956; Schmalensee, 1982; Bronnenberg et al., 2009, 2012). Domestic airlines may also be better able to tailor their services to local tastes, for instance by serving local food and communication in the local language.[1] These competitive advantages may be reinforced by the domestic airline's frequent flier program, which creates switching costs and incentives to concentrate purchases with a single airline (Carlsson and Löfgren, 2006; Lederman, 2007, 2008). In a recent paper, De Jong et al. (2018) show that domestic consumers are much more likely to be member of their own domestic airline's frequent flier program and may therefore have higher switching costs relative to foreign consumers.[2]

On the supply side, concerns remain regarding distortionary governmental involvement in the airline industry (see, e.g., De Wit, 2014; Morrison and De Wit, 2016). De Wit (2014) provides an overview of protectionist measures taken by European governments in favor of their domestic airline. Some measures go as far as forbidding price leadership by foreign airlines.[3] It is straightforward that governmental interventions of this sort hinders (foreign) competition and may sustain the ability of airlines to charge relatively high fares on their domestic-originating routes. The airlines' better ability to lobby, or higher degree of political connectedness in their domestic countries, may further harness their favorable position (Brown, 2016).

[1] A similar mechanism is known to provide European automobile brands with competitive advantages in their domestic markets (Cosar et al., 2018).

[2] In light of frequent flier programs, one might be concerned that the premium paid by travelers reflects the implied price subsidy of the accumulated frequent flier miles. A back-of-the-envelope calculation provided in a later section, illustrates how our estimates of the domestic country premium are much larger than the upper bound of this implied price subsidy.

[3] De Wit (2014) describes a particular case in which the German Federal Office for Goods Transport forced Emirates to increase prices of its business-class tickets.

For our empirical analysis, we collect a unique dataset including published fares offered by two leading European airlines: Air France and Lufthansa. Published fares provide the opportunity to examine the revenue-maximizing price setting behavior of airlines, thus revealing their (anticipated) ability to command higher prices. The European airline industry is well-suited for our analysis because it is characterized by multiple closely spaced countries, a fine-meshed web of borders and distinct domestic airline brands (e.g., Air France for France, Lufthansa for Germany). Our identification strategy relies on the route network structure of European airlines, which typically contain a large number of one-stop connecting flights to a given destination from a mixture of domestic and foreign origins. Taking advantage of this particular route network structure, we estimate the fare differences between domestic and foreign-originating trips to intercontinental destinations that share the same main, intercontinental, flight leg. This allows us to answer the question whether airlines (e.g., Air France) charge higher fares for domestic-originating trips (e.g., Nice - Paris - New York) compared with highly equivalent foreign-originating trips (e.g., Turin - Paris - New York).

To disentangle the domestic country premium from the airport dominance premium, we match the fare data with data on the airlines' share of the total scheduled departing seats at each origin airport in our data. As detailed in a later section, we argue that this measure of airport dominance is exogenous to the route-level fares in our fare data, because the number of scheduled departing seats is typically determined well in advance and is defined at the airport-level. We estimate reduced-form fare regressions with main flight leg fixed effects, trip characteristics, an indicator for domestic origins, and the measure for airport dominance. To further isolate the domestic country premium, we explicitly control for the level of competition on the markets and a wide range of origin airport and demand characteristics known or suspected to affect fare levels.

We report three main findings. First, fares for trips originating in the airlines' domestic airports are about 9 per cent more expensive than fares for virtually identical trips that originate in foreign airports, even after adding the aforementioned controls. Second, in the international airline markets considered in our analysis, the domestic country premium appears to prevail over the traditional airport dominance premium. Specifically, the domestic country premium approximates the premium an airline would be able to charge after an approximately 60 per cent point increase in its airport-specific market share. Third, the domestic country premium is three times as large on trips without a Saturday-night stayover relative to trips with a Saturday-night stayover — 18 versus 6 per cent —, which suggests that the premium applies in particular to the domestic business travel segment and corroborates a market power interpretation of the findings.

Although it has been known that airlines engage in international price discrimination (see, e.g., Bachis and Piga, 2011), our analysis is the first to document that airlines charge a substantial premium over average fares for trips originating in their domestic country. Our findings suggest that, despite substantial deregulation of the international airline industry, airlines have a higher degree of market power on routes that originate in their domestic country relative to routes that originate in foreign countries. While a welfare assessment of this effect is beyond the scope of this paper, a key implication of our analysis is that domestic market power represents a substantial barrier for international airline industries to reach perfect competitiveness. Another major implication of our analysis is that, in international airline industries, a decrease in an airline's market share at one of its domestic airports would do little harm to the market power of this airline. This represents a crucial difference with domestic airline industries, where a distinction between domestic and foreign airlines is not applicable and policy making has been predominantly concerned with airline market power at dominated airports (see e.g., the AIR-21 legislation in the US airline industry, described and evaluated by Snider and Williams, 2015).

Existing insights on airline market power are predominantly established in domestic airline industries. Our findings demonstrate that these insights are not always directly transferable to an international context. In order to gain a more comprehensive understanding of competition between domestic and foreign airlines, more research that addresses the particular institutional, geographical and cultural aspects of international airline markets is warranted.

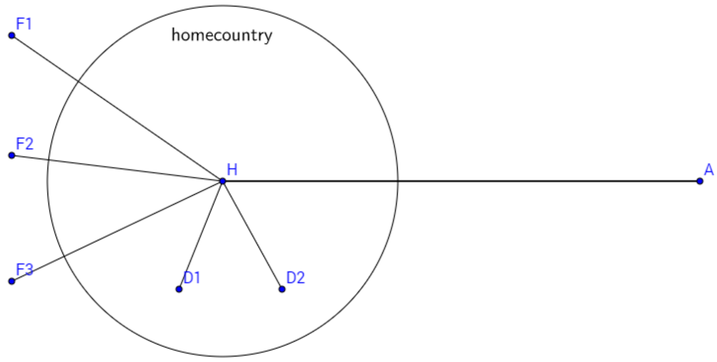
This paper proceeds as follows. Section 2 presents our identification strategy. Section 3 provides a description of the data and preliminary evidence. Section 4 discusses the empirical analysis and findings. Section 5 concludes.

## 2 Identification Strategy

To estimate the premium over average fares that airlines command on trips from and to their domestic country, we set out a novel identification strategy that relies on the route network structures of European airlines. Consider a stylized display of such a route network in Figure 1. The airline provides services to destination $A$, via its hub $H$, from a set of domestic airports $D = \{D_1, D_2\}$, and foreign airports $F = \{F_1, F_2, F_3\}$. Our identification strategy focuses on the question whether this airline charges higher fares, other things equal, for the flights leaving from the domestic airports $D$ compared with those leaving from the foreign airports $F$.

We exploit the fact that seats on flights from hub $H$ to destination $A$ are offered both with

Figure 1: Stylized route network of a European airline




seats on domestic-originating feeder flights as well as foreign-originating feeder flights, while the fares are defined on the origin-destination level. Thus, a domestic and a foreign-originating traveler that share the same airplane for the vast majority of their trip potentially face completely different fares. By comparing the fares charged to these two groups of travelers, while keeping fixed other ticket characteristics such as the type of seat and number of days booked in advance, we isolate the domestic country premium. Simultaneously, we use variation in airport-specific airline market shares, the number and identity of the competitors on the origin-destination market, and origin airport and catchment area characteristics, to disentangle the domestic country premium from the effects of airport dominance, competition, and demand characteristics, respectively.

To clarify our choice for this identification strategy, we briefly discuss some advantages over other candidate strategies. For instance, one might consider to identify the domestic country premium by estimating the fare differential between domestic and foreign airlines serving the same markets (i.e., an inter-airline comparison strategy instead of our intra-airline comparison strategy). Nevertheless, it is key to note that the majority of the non-stop markets with presence of both domestic and foreign airlines are operated from and to strongly dominated (hub) airports. An inter-airline comparison on non-stop markets would therefore perfectly confound the domestic country premium with the airport dominance effect. Alternatively, one could consider an inter-airline comparison on one-stop markets. However, this becomes problematic as airlines serving the same market are not necessarily serving the same routes, introducing substantial noise to the estimation (e.g., different hubs and levels of detour). Instead, our identification strategy enables us to empirically separate the domestic country premium from the airport dominance premium, and at the same time ensures the comparability of the domestic and foreign-originating trips due to the identical main flight leg.

Table 1: Data dimensions

| Dimension | Instances |
|---|---|
| Airlines (2) | Air France (AF), Lufthansa (LH) |
| Destinations (4) | Sao-Paolo (GRU), New-York (JFK), Los-Angeles (LAX), Shanghai (PVG) |
| Origins (72) | Amsterdam (AMS), Milan Bergamo (BGY), Birmingham (BHX), Bastia (BIA), Biarritz (BIQ), Billund (BLL), Bologna (BLQ), Bordeaux (BOD), Bremen (BRE), Bristol (BRS), Brussels (BRU), Basel (BSL), Bratislava (BTS), Cologne Bonn (CGN), Copenhagen (CPH), Brussels Charleroi (CRL), Cardiff (CWL), Dresden (DRS), Dortmund (DTM), Dsseldorf (DUS), Eindhoven (EIN), East Midlands (EMA), Florence (FLR), Genoa (GOA), Geneva (GVA), Hannover (HAJ), Hamburg (HAM), Hahn (HHN), Jersey (JER), Leeds Bradford (LBA), London City (LCY), Leipzig/Halle (LEJ), London Gatwick (LGW), London Heathrow (LHR), Lille (LIL), Milan Linate (LIN), Ljubljana (LJU), Liverpool (LPL), London Luton (LTN), Luxembourg (LUX), Lyon (LYS), Manchester (MAN), Malmo (MMX), Montpellier (MPL), Marseille (MRS), Milan Malpensa (MXP), Nice (NCE), Newcastle (NCL), Weeze (NRN), Nantes (NTE), Nurnberg (NUE), Poznan (POZ), Prague (PRG), Pisa (PSA), Rotterdam (RTM), London Southend (SEN), Southampton (SOU), London Stansted (STN), Stuttgart (STR), Strasbourg (SXB), Berlin Schonefeld (SXF), Salzburg (SZG), Toulouse (TLS), Turin (TRN), Treviso (TSF), Berlin Tegel (TXL), Venice Marco Polo (VCE), Vienna (VIE), Verona (VRN), Wroclaw (WRO), Zagreb (ZAG), Zurich (ZRH) |
| Booking days (2) | 56 days (early-book), 7 days (late-book) |
| Length-of-stay (2) | 10 days (long-stay), 4 days (short-stay) |

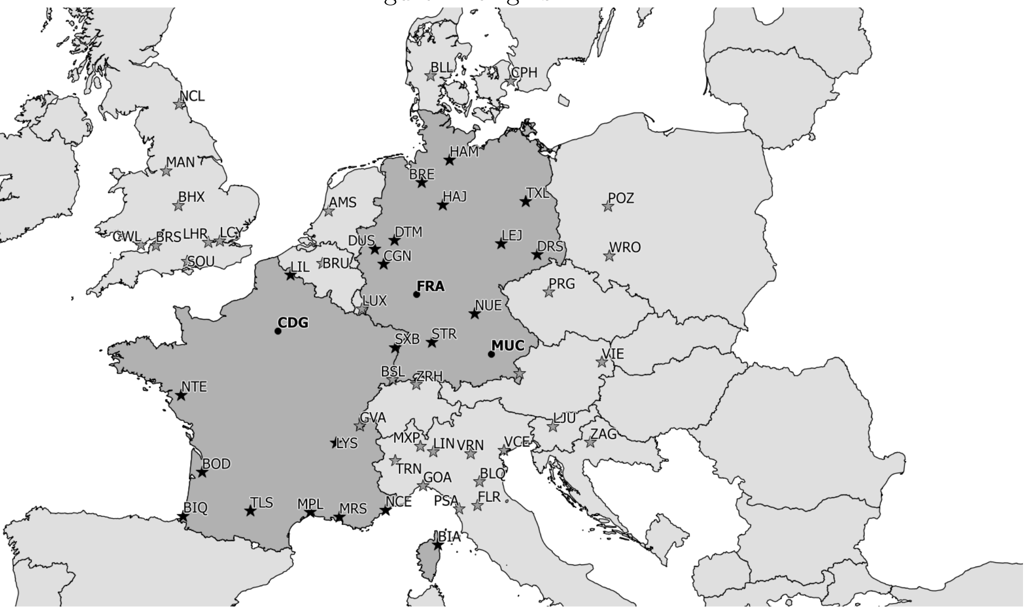
## 3 Data

Our data consists of published fares for return trip air travel in an 8-week period covering February, March and April 2016, offered by two European airlines: Air France and Lufthansa. These airlines are two of the largest airlines in Europe and represent the distinct domestic airline brand in their domestic country. The fares are recovered from the booking pages of the airline websites. Besides fares, we obtain general flight information such as the departure and arrival times and operating airlines. The fare data is further augmented with information on origin airport characteristics (e.g., airline market shares, airport size), regional statistics on the origin catchment area, and data on the number and identity of the competing airlines on the origin-destination markets.

### *3.1 Fare data collection*

The fare data covers 72 European origins and 4 non-European destinations, resulting in 288 origin-destination markets (see Table 1). The number of origins and destinations is the result of a trade-off between the aspire to capture a broad and varied range of markets, and the need to keep the data collection at a manageable level. Specifically, the destinations are geographically dispersed

Figure 2: origins




and represent four of the most economically relevant intercontinental destinations from a European perspective. The set of origins contains all airports with more than a million travelers in 2014, that are either located in France or Germany or within the 750km radius of one of the main hubs of Air France (i.e., Paris) or Lufthansa (i.e., Frankfurt and Munich). The latter ensures that domestic and foreign-originating trips are of roughly similar distance, and that all trips originate in the geographical region of Mid-Western Europe, see Figure 2. Given that our identification strategy relies on fares for one-stop connecting travel, the hubs of Air France and Lufthansa are omitted. In the remaining origin-destination markets the airlines do not operate non-stop services.

For each airline and origin-destination market combination, we collect the available fares from the airlines' websites for four distinct trips that vary based on the number of days due to departure, 56 or 7 days, and the length-of-stay at the destination, 4 or 10 days (i.e., the number of days between the outbound and the return flight). Variation on these dimensions permits us to investigate the differential impact of the domestic country premium on trips booked long or shortly before departure, trips with a short or longer stay at the destination and trips with or without a Saturday-night stayover.

All aforementioned data dimensions are listed in Table 1. Combining these dimensions, we arrive at 2 (airlines) * 4 (destinations) * 72 (origins) * 2 (booking day categories) * 2 (length-of-stay categories) = 2,304 distinct trips. These trips are distributed over the 8-week period between February 8th and April 3rd 2016, so that each trip is assigned a specific departure date within this period. This results in a schedule that governs at what day to collect the fare data for which trips (see Appendix A for further details). Following this schedule, we collect the fares and flight information for all outbound and return flights that are available for a given trip.

For some trips there where no available flights (e.g., due to missing links in the networks of the airlines). From the remaining trips, we select the trips with available one-stop outbound and return flights, with stopovers at a main hub of the ticketing airline. Note that this is a prerequisite for our identification strategy and effectively means that we do not use trips for which the only available flights are multi-stop flights or one-stop flights through a partner's hub. To further ensure the comparability of the trips in our data, we apply four additional criteria.[4] First, we select all flights where the main flight leg is operated by Air France or Lufthansa. This prevents that service quality differences among partner airlines obscure the calculated fare differentials. We do however allow for tickets where the feeder leg is operated by a (regional) partner (e.g., Swiss operating the feeder leg for a one-stop flight offered by Lufthansa), because this is a common practice in the airline industry and would lead to many trips without available flights.[5] Second, we remove all rail-air and bus-air connections to ensure included observations represent air fares only. Third, we drop all flights that include an airport transfer.[6] Flights involving an airport transfer convey additional time and monetary costs on the traveler and are therefore difficult to compare with flights without an airport transfer. Fourth, we only keep flights with a layover time of less than six hours. This excludes, among others, flights that include an overnight-stay at the hub.

The final fare data set contains 1,067 trips that satisfy the above criteria. The last step in constructing our fare data is the selection of an outbound and return flight combination for each of these trips. Within each trip, we select the outbound and the return flights with the lowest fare. In case the fare of two or more flights are equal, the flight with the lowest journey time is selected.

[4]In the section describing the sensitivity analyses, we show that our findings are robust to these selection criteria.

[5]We checked if operation of one or both of the feeder legs by a regional partner (instead of the ticketing airline) impacts fares and found no statistically significant effect. Moreover, inclusion of covariates related to regional partner operations did not substantially alter the point estimates of our main effects or other covariates.

[6]The only flights in our data for which this is the case are flights involving a transfer from Paris Orly International Airport (ORY) to Paris Charles de Gaulle Airport (CDG), or vice versa.

### *3.2 Supplementary data*

The fare data is augmented with data from four additional sources. First, we retrieve an extensive range of origin airport characteristics from the Official Airline Guide (OAG, 2018). For our purposes, the most important information are the airline market shares at each origin airport in our fare data.[7] In order to assess the potentially different impacts of airline and alliance market share, we calculate both the share of departing seats operated by the airline or one of its affiliates (i.e., subsidiary airlines in which the major airline owns a majority stake), and the share of departing seats operated by the airline or one its alliance partners and their respective affiliates. These data further characterize each origin airport in terms of number of seats and destinations, type of destinations (i.e., short, medium or long-haul), share of business seats, and the distance to the hub.[8]

Second, we collect information on airport-level capacity constraints from the International Air Transport Association (IATA, 2016). These data list all airports that need to be slot coordinated because they operate at full or close to full capacity. We use this information to construct an indicator for capacity constrained airports.

Third, we collect the most recent data on population and gross domestic product per capita of each origin airport's catchment area from Eurostat (Eurostat, 2016). In line with studies on airport catchment areas in Europe (e.g., Maertens, 2012), we model the airport catchment areas as the NUTS 3 regions whose geographical midpoints are within the 100km radius of the airport. The origin catchment population is equal to the sum of the population of all NUTS 3 regions within the origin airport's catchment area. Likewise, the origin gross domestic product per inhabitant is the weighted average of the gross domestic product per inhabitant of each relevant NUTS 3 region.

Fourth, we manually collect information on the competing airlines in each of the markets in our data by consulting the ITA Matrix (ITA Software, 2016). The number of competitors on a given market is defined as the number of non-cooperating airlines operating flights on that market. Thus, airlines within the same alliance or codesharing agreement are regarded as a single competitor.

[7]The market shares are measured in terms of the airlines' scheduled departing seats operated at the airport in March 2016.

[8]We use the latter to calculate the length of the feeder flight legs for each trip.

Table 2: Descriptives of total sample and domestic and foreign-originating subsamples

| | Total sample | | Domestic-originating | | Foreign-originating | |
|---|---|---|---|---|---|---|
| Variable | Mean | St. Dev. | Mean | St. Dev. | Mean | St. Dev. |
| *Main variables* | | | | | | |
| Fare (EURO) | 963.977 | 384.852 | 1083.178 | 440.445 | 925.962 | 357.376 |
| Domestic origin (1/0) | 0.242 | 0.428 | 1.000 | 0.000 | 0.000 | 0.000 |
| Market share$^{airline}$(%) | 21.514 | 19.840 | 47.213 | 13.948 | 13.318 | 13.389 |
| Market share$^{alliance}$(%) | 29.859 | 22.274 | 50.733 | 13.540 | 23.203 | 20.316 |
| *Trip characteristics* | | | | | | |
| Flight time (hrs) | 24.056 | 3.146 | 23.717 | 3.100 | 24.164 | 3.155 |
| Feeder leg length (km) | 1126.591 | 420.387 | 869.795 | 312.348 | 1208.487 | 417.555 |
| Late book (0/1) | 0.480 | 0.500 | 0.484 | 0.501 | 0.478 | 0.500 |
| Short stay (0/1) | 0.491 | 0.500 | 0.488 | 0.501 | 0.492 | 0.500 |
| Saturday-night stayover (0/1) | 0.721 | 0.449 | 0.721 | 0.449 | 0.721 | 0.449 |
| *Competitive environment* | | | | | | |
| Competitors (#) | 2.580 | 1.216 | 2.062 | 1.142 | 2.745 | 1.193 |
| Non stop (1/0) | 0.207 | 0.424 | 0.078 | 0.268 | 0.248 | 0.455 |
| *Origin characteristics* | | | | | | |
| Seats (#) | 664.344 | 764.137 | 423.035 | 322.739 | 741.301 | 844.214 |
| Destinations (#) | 77.464 | 47.953 | 59.422 | 31.859 | 83.218 | 50.733 |
| Long-haul airport (0/1) | 0.648 | 0.478 | 0.581 | 0.494 | 0.669 | 0.471 |
| Share of bussiness seats (%) | 8.244 | 5.422 | 7.092 | 2.848 | 8.611 | 5.971 |
| Capacity constrained (0/1) | 0.891 | 0.311 | 0.787 | 0.410 | 0.925 | 0.264 |
| Population (mio) | 6.920 | 4.466 | 6.365 | 4.462 | 7.097 | 4.456 |
| GDP per capita (k) | 33.046 | 8.503 | 32.288 | 4.596 | 33.288 | 9.404 |

*Note(s):* Units of measurement given in parentheses.

### *3.3 Descriptive statistics*

The 1,067 trips in our data relate to 49 origins, 4 destinations, and 187 origin-destination markets.[9] Of these trips, 258 are domestic-originating (≈ 24 per cent) and 809 are foreign-originating (≈ 76 per cent). Table 2 provides descriptive statistics for the total data and these two subgroups.

The mean fare in the data is 964 EURO. The domestic-originating trips are priced higher, on average, than the foreign-originating trips. Not surprisingly, both the airline and alliance market shares are higher at domestic airports. The average domestic airport market share of the airlines and alliances are 47 and 51 per cent respectively, versus 13 and 23 per cent at foreign airports.

[9]The discrepancy between the number of origins and destinations on the one hand, and the number of origin-destination markets on the other hand, arises as not every origin is connected to every destination.

The average round-trip flight time in the data is 24 hours, and the domestic and foreign-originating flight times tend to coincide due to the identical main flight legs which constitute the majority of the total flight time. The domestic-originating trips, however, are characterized by shorter feeder flight leg lengths. Further, the ratios of late or early-booked trips (1 = early; 0 = late), short or long-stay trips (1 = short; 0 = late) and trips including or excluding a Saturday night-stayover (1 = including; 2 = excluding) are more or less evenly distributed over the domestic and foreign-originating trips.

The summary statistics furthermore show that airlines face slightly less competition in domestic relative to foreign-originating markets. This holds for both the number of competitors and the number of markets in which a non-stop service is present. The foreign origin airports tend to serve a larger number of seats and destinations, are characterized by a higher share of business seats and are more likely to be capacity constrained. Nevertheless, given the large standard deviations, there is substantial variation within the sets of domestic and foreign airports in the aforementioned airport characteristics. Finally, in terms of the average population and gross domestic product per capita, the domestic and foreign origins are very similar.

### *3.4 Preliminary evidence*

To further explore the patterns in our data, we provide several data visualizations.[10] Figures 3 and 4 show the distributions of domestic and foreign-originating fares by airline and destination, respectively. The dashed curve represents the domestic-originating fares, while the solid curve represents the foreign-originating fares. The means of the two distributions are depicted by the dashed and solid vertical lines, respectively. Congruent with the descriptives, the figures show that domestic-originating trips are generally more expensive. Importantly, this pattern is persistent across the two airlines and the four destinations. In terms of destinations, it is worth noting that the fare difference is especially prevalent for trips to Shanghai. The most striking insight, however, is that the distributions of the domestic-originating fares are roughly bimodal, whereas the foreign-originating fares approximate unimodal distributions. This pattern is consistent with an underlying interaction effect between the indicator for domestic-originating trips on the one hand, and a binary variable such as

[10] All figures throughout this section make a distinction between domestic and foreign-originating fares. In Appendix B we provide a second set of figures with an additional distinction between trips that are booked 56 and 7-days in advance. These figures show that the number of booking days has a substantial impact on fares and, importantly, that our main observation of higher domestic relative to foreign-originating fares also holds in the subsets of trips that are booked 56 and 7-days in advance.

Figure 3: Domestic-originating versus foreign-originating fares by airline

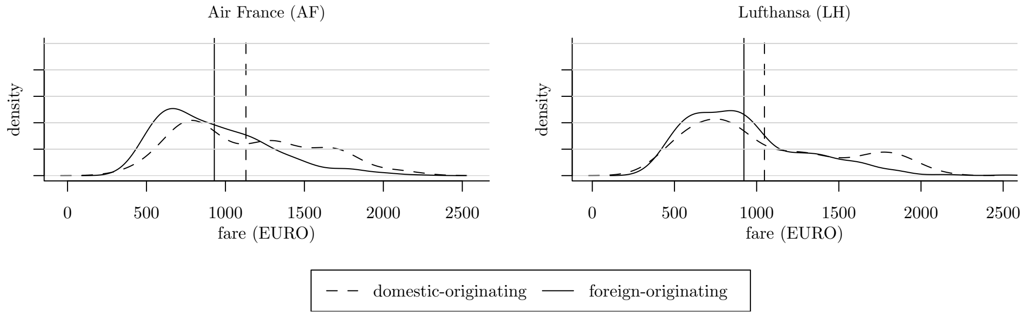
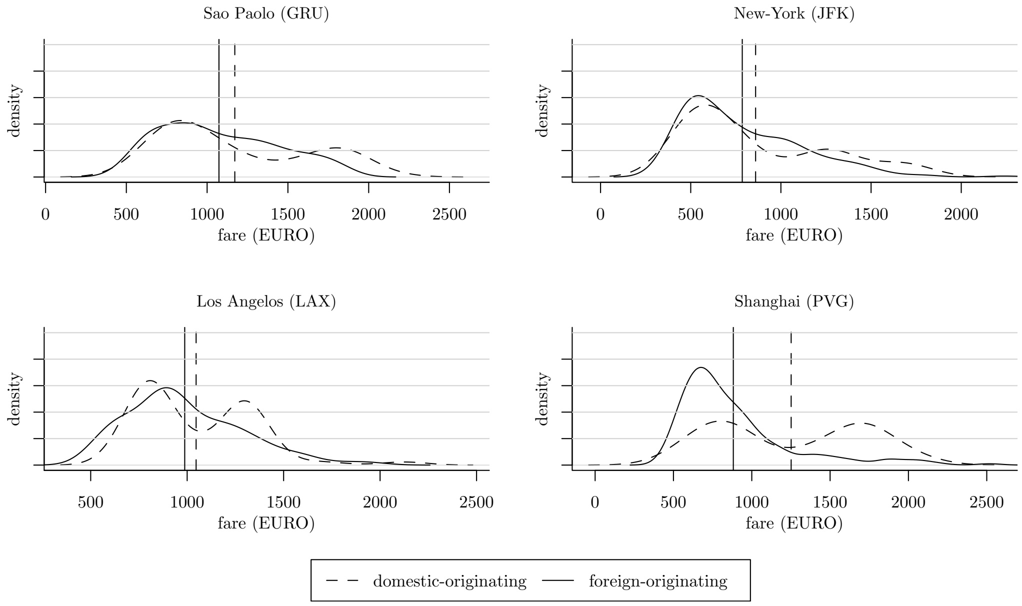



Figure 4: Domestic-originating versus foreign-originating fares by destination




the indicators for booking days, length-of-stay or Saturday-night stayovers on the other hand.

We further explore the bimodality of the domestic-originating fare distributions by plotting domestic versus foreign-originating fares on subsets created by splitting the data by the aforementioned binary indicators in Figures 5-7. Figure 5 presents the most interesting of these figures, depicting the distribution of domestic and foreign-originating fares for trips with and without a Saturday-night stayover separately.[11] The patterns strongly suggest that the bimodality of domestic-originating

[11] Closer inspection of Figures (6) and (7), leads to the conclusion that there is no clear interaction between domestic-originating trips and the number of days booked in advance and only a marginal interaction between domestic-

Figure 5: Domestic-originating versus foreign-originating fares by Saturday-night stayover

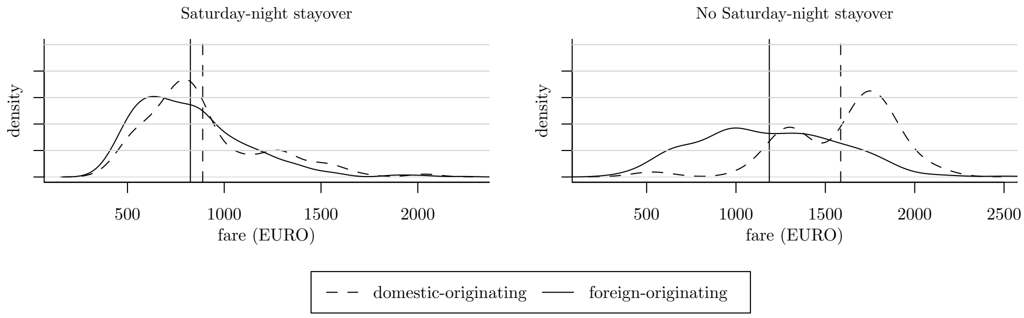



Figure 6: Domestic-originating versus foreign-originating fares by booking days due to departure

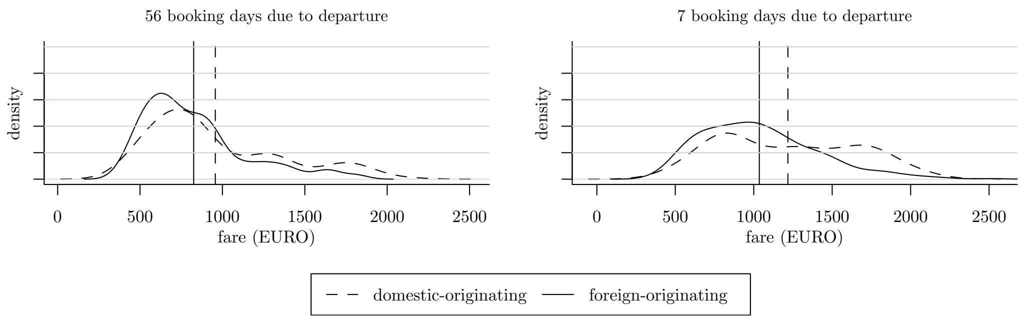



Figure 7: Domestic-originating versus foreign-originating fares by length-of-stay at destination

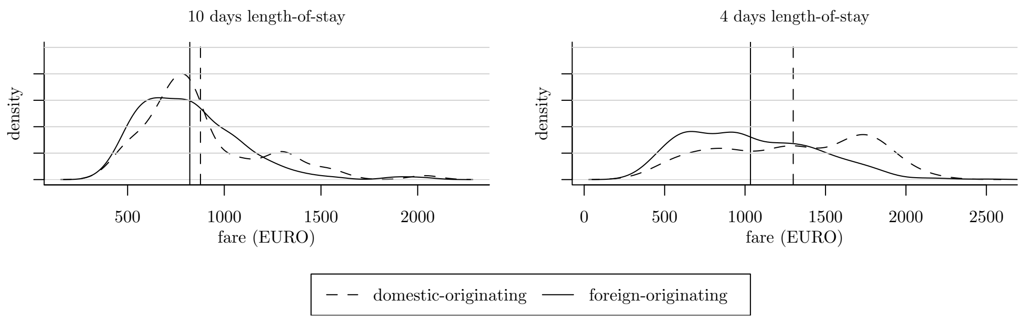
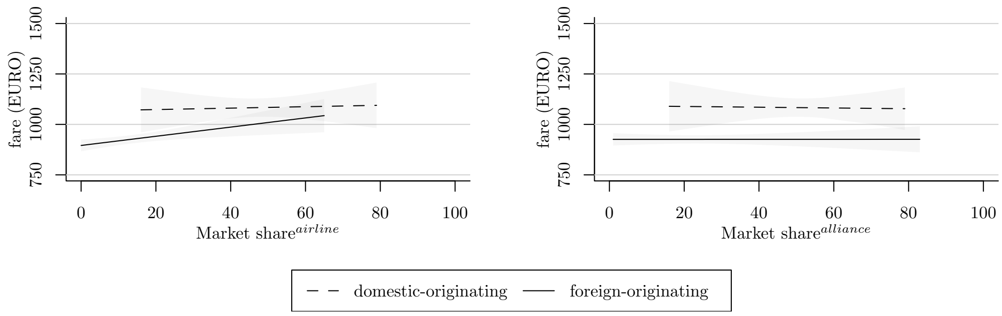


Figure 8: Association between fares and market shares for domestic and foreign-originating trips




fare distributions is caused by an interaction between domestic-originating trips and trips without a Saturday-night stayover. More specifically, although domestic-originating trips are priced higher in general, the difference between domestic and foreign-originating trips is vastly more profound in the subset containing the trips without a Saturday-night stayover. Given that trips without a Saturday-night stayover are predominantly bought by business travelers (see, e.g., Stavins, 2001), this suggests that the domestic country premium applies in particular to the business travel segment.

An obvious drawback of the figures provided so far, is that they do not disentangle the fare impact of originating from an airline's domestic country from the fare impact that can be attributed to airport dominance. Therefore, Figure 8 shows the association between fares and airport dominance in the subsets of domestic and foreign originating trips. The airport dominance can again be defined as market share of the airline (Figure 8's left panel) or market share of the alliance (Figure 8's right panel). The associations shown are trend lines based on a simple linear regression of the underlying price and market share observations in each of the subsets. The 90 per cent confidence intervals around the slopes of the trend lines are depicted by the shaded areas. The dashed line represents the association between fares and market shares for the subset of domestic-originating trips, whereas the solid line represents this association for the subset of foreign-originating trips.

These figures portray a main premise of this paper: given an airport-specific airline or alliance market share, airlines charge higher fares for domestic-originating trips compared with their foreign-originating counterparts. In the following section, we turn to the econometric analysis of this effect, in order to account for other potential confounding factors and provide an explicit estimate of this domestic country premium.

originating trips and the length-of-stay. The latter, however, likely results from the strong correlation between trips with a 4 days length-of-stay and trips without a Saturday-night stayover.

## 4 Empirical Analysis

### *4.1 Model specifications*

In line with our identification strategy, we employ reduced form fare regressions with main flight leg fixed effects. Note that within main flight legs the airline and destination are given, therefore heterogeneity from these sources will be captured by the fixed effects. To identify the domestic country premium, the specification includes a dummy variable indicating whether or not the trip originates from a domestic origin airport. We then use variation in the airline market shares at the origin airports to separate the domestic country premium from the airport dominance premium. In addition, we control for trip, origin airport and demand characteristics, and the competitive environment on the origin-destination market.

The trip characteristics include indicators for booking days, length-of-stay and Saturday-night stayovers, as well as the feeder leg length to capture the fare impact of flight distance (see, e.g., Hotle et al., 2015).[12] The origin airport characteristics include the number of seats and destinations served from the airport, share of business seats, an indicator for whether there are long-haul services departing from the airport, and an indicator for whether or not the airport is capacity constrained. These variables control for, among others, the potential fare impact of different types of origin airports (Hess, 2010) and airport capacity constraints (Ciliberto and Williams, 2010). In addition, we follow Van Dender (2007), Brueckner et al. (2013), and Bilotkach and Lakew (2014) in controlling for origin demand and willingness-to-pay by the origin catchment area population and gross domestic product. Finally, we include two competition controls that capture the competitive environment in the origin-destination market. In line with Brueckner et al. (2013), we control for the competitive environment by using competitor counts.[13] Moreover, we include an indicator for whether non-stop alternatives are being offered in the market.

Thus, we measure average fare differences between domestic and foreign-originating trips, that

[12]The feeder leg length enters linearly in our model specifications. We tried various non-linear specifications, which all did not lead to different results.

[13]The main reason for choosing a competitor count approach instead of, for example, the Herfindahl-Hirschman Index, is that the market shares at the market level needed to calculate this index cannot be defined in a straightforward way for connecting markets. Note that connecting markets consist of two separate leg markets. Moreover, a given origin-destination market consists of a multitude of different leg market combinations. Even if one would collect market shares for all these separate leg markets, it is not possible to determine which part of these market shares can be attributed to a specific origin-destination market, as the individual leg markets are typically part of multiple different origin-destination markets.

have identical main flight legs and are equal in terms of booking days, length-of-stay and Saturday-night stayover while explicitly controlling for feeder flight length, origin airport and demand characteristics, and the competitive environment on the origin-destination market.[14] The accompanying baseline model specification is as follows:

$$\ln Fare^{i}_{jmod} = \gamma DomestOrig_{jo} + \theta MarketShare_{jo} + \omega \mathbf{z}^{i} + \lambda \mathbf{x}_{o} + \eta \mathbf{w}_{od} + \delta_{m} + \varepsilon^{i}_{jmod}, \quad (1)$$

where $\ln Fare^{i}_{jmod}$ is the natural log of the fare on trip $i$, offered by airline $j$, operating main flight leg $m$, from origin $o$ to destination $d$. The indicator variable for domestic origins $DomestOrig_{jo}$ is defined as follows:

$$DomestOrig_{jo} = \begin{cases} 1, & \text{if origin airport } o \text{ is in the domestic country of airline } j, \\ 0, & \text{else.} \end{cases}$$

The variable $MarketShare_{jo}$ is a measure of the market share of airline $j$ on origin airport $o$. The vectors $\mathbf{z}^{i}$, $\mathbf{x}_{o}$, and $\mathbf{w}_{od}$ respectively capture characteristics of trip $i$, airport and demand characteristics at origin $o$, and the competitive environment on the origin-destination market $od$, as discussed above. The main flight leg fixed effect is denoted by $\delta_{m}$, and the random error term by $\varepsilon^{i}_{jmod}$.

The main parameters of interest are $\gamma$ and $\theta$. The parameter $\gamma$ provides an estimate of the *domestic country premium* — i.e., the percentage fare differential between trips that depart from domestic airports and those that depart from foreign airports, whereas $\theta$ provides an estimate of the *airport dominance premium* — i.e., the percentage fare impact of one additional percent point market share at the origin airport.

To account for the interaction between domestic country and Saturday-night stayover effects, we specify the following interaction model:

$$\begin{aligned} \ln Fare^{i}_{jmod} = {} & \gamma_{1}\big[DomestOrigin_{jo} \cdot (1 - SatNight^{i})\big] + \gamma_{2}\big[DomestOrigin_{jo} \cdot SatNight^{i}\big] + \\ & \theta_{1}\big[MarketShare_{jo} \cdot (1 - SatNight^{i})\big] + \theta_{2}\big[MarketShare_{jo} \cdot SatNight^{i}\big] + \\ & \omega \mathbf{z}^{i} + \lambda \mathbf{x}_{o} + \eta \mathbf{w}_{od} + \delta_{m} + \varepsilon^{i}_{jmod}, \end{aligned} \quad (2)$$

[14] Note that we implicitly assume that, conditional on main flight leg and trip characteristics, the fares for the trips are date and day-of-the-week invariant. This seems a reasonable assumption given that we randomly assigned the trips to the departure dates. In a later section, we provide the results of a sensitivity analysis that proves the robustness of our estimates to this assumption.

where $SatNight_i$ is an indicator for trips that include a Saturday-night stayover, defined as follows:

$$SatNight^i = \begin{cases} 1, & \text{if trip } i \text{ involves a Saturday-night stayover,} \\ 0, & \text{else.} \end{cases}$$

Here, $\gamma_1$ provides the domestic country premium for trips without a Saturday-night stayover, while $\gamma_2$ denotes this premium for trips with a Saturday-night stayover. Similarly, $\theta_1$ and $\theta_2$ indicate the airport dominance premium on trips without and with a Saturday-night stayover, respectively.

A potential econometric concern with our model specifications, is the endogeneity of the market share measures. However, it is important to note that we calculate market shares based on the number of scheduled seats. These are directly related to the number of scheduled flights and aircraft type, which in the airline industry are typically determined well in advance. Thus, our market share measures resemble the lagged endogenous instruments frequently used in the aviation economics literature to avoid simultaneity bias (i.e., the current fare level is not likely to affect the schedule made months ago) and diminish the potential for omitted variable bias (see, e.g., Greenfield, 2014). Moreover, given that the market shares are defined at the airport level, inconsistent estimates only arise in case of omitted variables that affect the airline's aggregate market share at the origin airport. For these reasons, we conjecture the costs of an adjustment (e.g., using an instrumental variable approach) to be worse than the conceivably limited impact of endogeneity.

### *4.2 Estimation results*

Table 3 shows the estimation results of the baseline models, as specified in Eq. (1). The table reports the coefficient estimates on the domestic origin indicator and market share measures, with their corresponding standard errors in parentheses. As these key independent variables vary on the origin-airline level, we allow standard errors to be correlated within origin-airline clusters. Intuitively, this adjusts the standard errors for the fact that additional observations in the same cluster do not provide completely independent pieces of information.[15] Full estimation results for both the baseline and interaction models, including the coefficient estimates and standard errors of the control variables, are provided in Appendix C.

Column (1) provides the results of a simple model, regressing the natural log of fares on the domestic origin indicator, main flight leg fixed effects, and trip characteristics. The coefficient on

[15]Not adjusting for within-cluster error correlation leads to standard errors that may be too small, which increases the probability of Type 1 errors (i.e., falsely rejecting the null hypothesis). See, for example, Cameron and Miller (2015) for an extensive treatment of these so-called cluster-robust standard errors.

Table 3: Baseline model estimation results

| | *Dependent variable:* lnFare | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| Domestic origin | 0.1414*** | 0.0948*** | 0.1352*** | 0.0968*** | 0.0885*** |
| | (0.0212) | (0.0322) | (0.0333) | (0.0307) | (0.0324) |
| Market share$^{airline}$ | | 0.0015** | | 0.0014** | 0.0016** |
| | | (0.0008) | | (0.0007) | (0.0008) |
| Market share$^{alliance}$ | | | 0.0002 | | |
| | | | (0.0008) | | |
| Main flight leg fixed effect | Yes | Yes | Yes | Yes | Yes |
| Trip characteristics controls | Yes | Yes | Yes | Yes | Yes |
| Competitive environment controls | No | No | No | Yes | Yes |
| Origin characteristics controls | No | No | No | No | Yes |
| Observations | 1,067 | 1,067 | 1,067 | 1,067 | 1,067 |
| Adjusted $R^2$ | 0.5100 | 0.5121 | 0.5097 | 0.5137 | 0.5166 |

*Note(s):* Cluster-robust standard errors in parentheses.*p<0.1; **p<0.05; ***p<0.01

the domestic origin indicator is equal to 0.1414, which reflects a domestic country premium of about 14 per cent. To control for airport dominance, we add the airport-specific market shares on the airline and the alliance levels in columns (2) and (3), respectively. The airline market share substantially reduces the fare differential between domestic and foreign-originating trips to around 9.5 per cent. Although the direct effect of airport dominance on fares is small, the impact on the domestic country premium demonstrates the importance of disentangling the airport dominance effect.[16] On the other hand, significant effects for airport-specific market shares do not arise when market shares are defined on the alliance level, as reported in column (3). Thus, while airlines are able to raise fares at airports where they serve a large share of the market, we do not find evidence of an umbrella effect at airports where their alliance partners are dominant.

In addition to the airport-specific market shares at the airline level, columns (4) and (5) respectively add the set of controls for the competitive environment and origin characteristics as discussed in the previous section. The estimates of the domestic country premium remain virtually identical

[16] The correlation of 0.73 between the domestic origin indicator and the airport-specific airline market share measure, might raise concerns about multicollinearity. The variation inflation factor of the domestic origin indicator, however, ranges between 1.47 and 2.72 in the baseline models, which is well below of what is usually considered problematic. In addition, the estimates are stable over the different model specifications. Hence, we conjecture multicollinearity not to be a substantial concern.

Table 4: Interaction model estimation results

| | *Dependent variable:* lnFare | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Domestic origin$_{noSaturday-night}$ | 0.3103*** | 0.1882*** | 0.1899*** | 0.1810*** |
| | (0.0365) | (0.0434) | (0.0433) | (0.0469) |
| Domestic origin$_{Saturday-night}$ | 0.0775*** | 0.0635* | 0.0658** | 0.0541 |
| | (0.0223) | (0.0346) | (0.0330) | (0.0342) |
| Market share$^{airline}_{Saturday-night}$ | | 0.0040*** | 0.0039*** | 0.0040*** |
| | | (0.0010) | (0.0009) | (0.0010) |
| Market share$^{airline}_{noSaturday-night}$ | | 0.0005 | 0.0005 | 0.0007 |
| | | (0.0008) | (0.0008) | (0.0008) |
| Main flight leg fixed effect | Yes | Yes | Yes | Yes |
| Trip characteristics controls | Yes | Yes | Yes | Yes |
| Competitive environment controls | No | No | Yes | Yes |
| Origin characteristics controls | No | No | No | Yes |
| Observations | 1,067 | 1,067 | 1,067 | 1,067 |
| Adjusted $R^2$ | 0.5231 | 0.5286 | 0.5300 | 0.5324 |

*Note(s):* Cluster-robust standard errors in parentheses. *p<0.1; **p<0.05; ***p<0.01

to the model without these additional controls. This provides confidence that the coefficient on the domestic origin indicator captures something specifically related to domestic-originating markets allowing the airline to charge higher prices, which cannot be captured by conventional controls for the competitive environment and origin airport and demand characteristics.[17]

Table 4 shows the estimation results of the interaction models in Eq. (2). The table reports the estimates of the domestic country and airport dominance premiums for trips with and without Saturday-night stayover separately. Similar to the baseline models, cluster-robust standard errors with clustering at the origin-airline level are given in parentheses.

Column (1) shows the results of a model in which the regressors consist of main flight leg fixed effects, the trip characteristics (i.e., including a general Saturday-night stayover indicator), and the interactions between the domestic origin and Saturday-night stayover indicators. The coefficient on the indicator for domestic-originating trips without a Saturday-night stayover equals 0.3103. In other words, domestic-originating trips that do not include a Saturday-night stayover are about 31 per cent more expensive relative to foreign-originating trips that also do not include Saturday-night stayover.

[17] Coefficient estimates on the control variables are reported in Appendix C. The majority of the control variables are not significant and of low magnitude. The number of competitors on the origin-destination market, however, has a substantial and significant negative impact on the fare levels.

In comparison, the point estimate of the domestic country premium on trips with a Saturday-night stayover of 0.0775 suggests that domestic-originating trips that include a Saturday-night stayover are only about 7.8 per cent more expensive than foreign-originating trips that include a Saturday-night stayover. Hence, the model estimates confirms our observation from the data visualizations that the domestic country premium is vastly more profound on trips without a Saturday-night stayover.

Column (2) includes the airport-specific airline market shares, interacted with the Saturday-night stayover. The coefficients on these market share measures suggest that the fare impact of airport dominance is statistically and economically relevant on trips excluding a Saturday-night stayover, but not on trips including a Saturday-night stayover. As is the case in our baseline models, controlling for the airport dominance effect substantially reduces the domestic country premiums. Specifically, our estimate of the domestic country fare premium on trips without a Saturday-night stayover decreases from 31.0 to 18.8 per cent, whereas the premium on trips with a Saturday-night stayover decreases from 7.8 to 6.4 per cent and is no longer statistically significant at conventional significance levels.[18] Including the set of competition and origin controls, as is done in columns (3) and (4), does not substantially alter these findings.

The model estimation results offer the following three main takeaways. First, international trips to and from domestic origin airports are characterized by substantially higher fares relative to comparable trips originating in foreign airports, even after controlling for airport dominance, the competitive environment and a wide range of origin airport and demand characteristics. Second, the domestic country premium appears to prevail over the traditional airport dominance premium in the international air transport markets considered here. While controlling for airport-specific airline market share, we find an average domestic country fare premium of 8.8-9.5 per cent (depending on additional controls). In comparison, this premium is approximately equal to the premium an airline would be able to charge after a 54-64 per cent point increase in its airport-specific market share. Third, the domestic country premium on trips without a Saturday-night stayover — about 18 per cent — is three times as large as the domestic country premium on trips that do not involve a Saturday-night stayover — about 6 per cent. Hence, in line with results from the airport dominance literature (e.g., Lee and Luengo-Prado, 2005), the domestic country premium appears to apply in particular to travelers flying for business purposes.

[18]Note that these estimates relate to a model in which we control for airport dominance by the airline, using the airport-specific market shares of the airlines. Controlling for airport dominance by the alliance (we do not explicitly report this model in Table 4), results in insignificant estimates of the airport dominance and contributes very little to the model reported in column (1).

### *4.3 Robustness checks*

Table 5 reports various sensitivity analyses that explore the robustness of our interaction model estimates. All models include as regressors the interactions of the domestic origin indicator and airport-specific airline market share with the Saturday-night stayover indicators, as well as the full range of trip characteristics, competition and origin controls.

Columns (1) and (2) report the results of two models with alternative fixed effects specifications In column (1) the fixed effects are defined as the combination of the outbound and return main leg flight numbers. Trips operated under the same flight number are likely to have similar unobservable characteristics, such as, for example, departure and arrival times, and type of aircraft. Hence this specification controls explicitly for such unobservable heterogeneity that, if not randomly distributed across domestic and foreign-originating trips, might confound our estimates. In column (2) we employ flight date fixed effects in addition to the regular main flight leg fixed effects. These flight date fixed effects control for any unobservable fare trend or day-of-the-week effect. The estimates of the domestic country and airport dominance premiums provided by these alternative fixed effects specifications are in line with the estimates provided by the main flight leg fixed effects specifications reported in Table 4. The point estimates of the domestic country premium are virtually the same using the main leg flight number fixed effects, and slightly larger using the combination of main flight leg and flight dates fixed effects. However, in both cases the point estimates are well within the 95 confidence interval of the reported premium in column (5) of Table 4, suggesting that any bias due to unobservable heterogeneity across flight numbers, booking and flying dates does not impact substantially the estimated parameters of interest. Hence, these results do not warrant altering our fixed effects specification and we continue — in line with our identification strategy — with the main flight leg fixed effects.

As mentioned in the discussion about the collection of fare data, we applied a number of criteria to ensure the comparability of the trips in our data. To check whether our estimates are sensitive to these criteria, we estimate the preferred interaction model from column (5) in Table 4 on samples where we do not enforce these restrictions. In column (3) we report the results on a sample including potential feeder flights that are operated by bus or rail. Hence, if for certain trips airlines offer a rail-air or bus-air alternative that has a lower fare than the lowest priced air-air alternative, this alternative ends up in our final sample. Similarly, we allow flights with a layover time of more than six hours in column (4) and do not exclude trips that involve an airport transfer in column (5). Although fewer restrictions imply a larger sample size, the obvious disadvantage is that the trip

Table 5: Robustenss checks for interaction model estimation results

| | *Dependent variable:* lnFare | | | | | | |
|---|---|---|---|---|---|---|---|
| | *Alternative fixed effects* | | *Alternative sample selection criteria* | | | *Feeder flight length subsets* | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Domestic origin$_{noSaturday-night}$ | 0.1729$^{***}$ | 0.2072$^{***}$ | 0.1875$^{***}$ | 0.1879$^{***}$ | 0.1561$^{***}$ | 0.2048$^{***}$ | 0.2262$^{***}$ |
| | (0.0496) | (0.0482) | (0.0462) | (0.0457) | (0.0454) | (0.0436) | (0.0606) |
| Domestic origin$_{Saturday-night}$ | 0.0361 | 0.0670$^{*}$ | 0.0375 | 0.0676$^{**}$ | 0.0424 | 0.0486 | 0.0620$^{*}$ |
| | (0.0325) | (0.0352) | (0.0352) | (0.0343) | (0.0315) | (0.0350) | (0.0333) |
| Market share$^{airline}_{Saturday-night}$ | 0.0041$^{***}$ | 0.0037$^{***}$ | 0.0040$^{***}$ | 0.0040$^{***}$ | 0.0036$^{***}$ | 0.0037$^{***}$ | 0.0034$^{**}$ |
| | (0.0011) | (0.0012) | (0.0010) | (0.0010) | (0.0010) | (0.0011) | (0.0014) |
| Market share$^{airline}_{noSaturday-night}$ | 0.0008 | 0.0006 | 0.0005 | 0.0006 | 0.0004 | 0.0010 | 0.0013$^{*}$ |
| | (0.0009) | (0.0009) | (0.0009) | (0.0009) | (0.0008) | (0.0009) | (0.0008) |
| Main flight leg fixed effect | No | Yes | Yes | Yes | Yes | Yes | Yes |
| Main flight nr. fixed effect | Yes | No | No | No | No | No | No |
| Flight dates fixed effect | No | Yes | No | No | No | No | No |
| Trip characteristics controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Competitive environment controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Origin characteristics controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 1,067 | 1,067 | 1,121 | 1,139 | 1,109 | 826 | 508 |
| Adjusted $R^2$ | 0.5584 | 0.7029 | 0.5219 | 0.5215 | 0.5411 | 0.5688 | 0.5925 |

*Note(s):* Cluster-robust standard errors in parentheses.$^{*}$p<0.1; $^{**}$p<0.05; $^{***}$p<0.01

observations are less comparable. Nonetheless, the results on these alternative samples provided in columns (3), (4) and (5) are not dramatically different from the estimates reported in column (3) of Table 4. Most notably, the coefficient of the domestic country premium are somewhat smaller and no longer statistically significant for trips with a Saturday-night stayover in the samples allowing for bus and rail feeder flights and airport transfers. This likely arises as both bus and rail feeder flights and airport transfers are typically lower priced and, at the same time, more common in domestic-originating markets, which causes downward pressure on domestic-originating fares.

Finally, we employ a very strict way of controlling for systematic differences in feeder flight length between domestic and foreign origins by restricting the data based on a certain bandwidth feeder flight length. Specifically, column (6) restricts the data to only include a trip if it is operated from an origin airport within 500 and 1500km of the hub used in that trip, whereas column (7) further restricts this bandwidth to 750 and 1250km. Thus, this substantially increases the comparability of domestic and foreign-originating trips in terms of feeder flight length. Reassuringly, the magnitude of the domestic country premium in these subsets is in line with the estimates obtained on the full sample of origins. If anything, the domestic country premium becomes somewhat larger in these specifications.

In general, our results are robust with respect to various fixed effects specifications, the criteria used in the data collection and subsets of the data based on feeder flight length. Although the domestic country premium on trips with a Saturday-night stayover is somewhat more sensitive, the magnitude of the premiums remain within the same order of magnitude — between 15.6-22.6 per cent for trips without a Saturday-night stayover and 3.6-6.7 per cent for trips with a Saturday-night stayover.

### *4.4 Discussion*

The key takeaway from the preceding sections is that airlines charge a fare premium in markets that originate in their domestic country. This premium brings about substantial fare differences between virtually identical domestic and foreign-originating trips and, importantly, emerges independently of the airport dominance effect, the level of competition on the market, and origin airport and demand characteristics. We therefore interpret these findings as a manifestation of the relative market power of airlines at domestic airports vis-á-vis foreign airports. It is worth stressing that our results should be interpreted as relative effects. That is, the fare differences reflect the ability of airlines to convert competitive advantages in their domestic country into higher fares and increased profits, and at the same time echo that airlines need to employ a foreign discount to attract foreign travelers.[19]

We also find some evidence of the airport dominance effect in our data, although the magnitude of the effect on fare levels is relatively small. This implies that market power in international airline industries is largely independent of the airlines' market share at the origin endpoint. Instead, the distinction between domestic and foreign origins becomes crucial in determining the degree of market power that airlines have. Consequently, an airline is nearly just as able to charge a premium on trips departing from a domestic airport where it has a relatively low market share versus trips from a domestic airport where it has a clearly dominant position. In the same vein, a decrease in an airline's market share at one of its domestic airports would make little difference to the fare premium that this airline is able to command in the international markets connected to that airport.

The finding of differential premiums for trips with and without a Saturday-night stayover rules out that cost differences between the markets are responsible for the fare patterns in our data, and is therefore consistent with our market power interpretation. The higher premium for trips without a Saturday-night stayover conceivably arises because those trips are targeted at business travelers (see, e.g., Stavins, 2001). Although leisure and business travelers may both prefer their domestic airline, the latter are generally assumed to be less price sensitive and therefore might be willing to pay a higher premium. An alternative line of reasoning holds that due to their higher opportunity costs of time, business travelers are less likely to take the effort of searching for lower fares (Bachis and Piga, 2011). Finally, business travelers are more likely to be active participants in frequent flier programs, and may therefore attach a greater value to the miles of the domestic airline.

In our view, it is, nevertheless, unlikely that frequent flier programs drive the entire domestic country premium that is identified in our analysis. Foremost, our analysis focuses on the lowest available fares which qualify for the lowest proportional miles accrual, and in turn, are not likely to be bought by travelers who strongly value frequent flier miles.[20] Moreover, back-of-the-envelope calculations suggest that our estimates of the domestic country premium are large relative to the implied price subsidy of frequent flier miles.[21] Finally, we also find some evidence of the domestic

[19] Note that offering a fare below costs might still be profitable, because it might allow airlines to achieve higher load factors or enable increased frequencies on the main flight leg.

[20] A quick analysis of the Lufthansa tickets in our data, illustrates that 93 per cent of the tickets are Economy Saver, Economy Basic, or Economy Basic Plus tickets, which accrue 50 per cent of the actual trip miles or less. Unfortunately, we cannot provide a similar analysis for the full sample due to unavailability of Air France booking class data.

[21] Consider the following simple calculation to determine the order of magnitude of the implied price subsidy of frequent flier miles. We assume a traveler is flying on a ticket with 100 per cent miles accrual and only qualifies for

country premiums on trips that include a Saturday-night stayover. These flights are typically bought by leisure travelers for which frequent flier programs are not likely to play a major role.

In sum, besides the ability to raise fares through frequent flier programs, our analysis suggests that additional competitive advantages enjoyed by airlines in their domestic country are likely to play a role in sustaining their ability to charge higher fares for domestic-originating travel.

## 5 Conclusion

Our analysis shows that airlines charge a substantial premium of about 9.5 per cent over average fares on trips that originate in domestic airports relative to comparable trips that originate in foreign airports. Importantly, we conceptually and empirically distinguish this domestic country premium from the airport dominance premium and found the former to prevail in the international airline markets studied in this paper. The domestic country premium is substantially higher on trips without a Saturday-night stayover, which indicates that the premium applies in particular to the domestic business segment and corroborates a market power interpretation of the identified fare patterns.

These findings contribute to the empirical literature on airline market power. Whilst our current analysis does not permit us to empirically pinpoint the underlying mechanisms that drive our results, domestic market power is established as an important and policy-relevant economic force in international airline competition. For instance, domestic airlines' favorable position over foreign competitors when operating out of their domestic country could represent a substantial barrier to the ongoing process of liberalization and market integration in international aviation.

A first direction for future research on this subject is to investigate what factors confer market power on domestic airlines. We discussed a number of potential domestic advantages, including a traveler bias for domestic products, general brand effects, frequent flier programs, and governmental

the lowest tier within the frequent flier program (i.e., gains no miles accrual bonus). Under these assumptions, the maximum number of miles to be earned on a domestic-originating trip is approximately 14,000 for both Air France and Lufthansa. Furthermore we assume that travelers spend their award miles on gift vouchers only, as their monetary value is most clear. In both programs there are opportunities to buy gift vouchers of 10 euro for 3000 and 4000 miles. Hence, the implied price subsidy —taking into account the average fare of about 1000 euro in our data set— is in the order of magnitude of 3.5-4.6 per cent. This implied price subsidy is likely to be an overestimation, because not every domestic traveler participates in the airline's frequent flier program, the majority of the tickets in our sample has a miles accrual percentage of 50 per cent or less, and redemption rates are typically far below 100 per cent (e.g., Smith and Sparks, 2009).

protectionism. Discerning the relative importance of such underlying factors is an imperative step towards a welfare assessment of domestic market power. Furthermore, we examine domestic market power in markets that are characterized by the presence of one distinct domestic airline and the absence of low-cost carriers. It would be interesting if further research could investigate to what extent these and other local market conditions, impacts the degree of domestic market power that airlines are able to exercise.

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## A Data collection approach

We collect fare data according to the following schedule. First, we subdivide the 72 origins into 4 groups of 18 origins by dividing the origins into three strata (i.e., French origins, German origins, other origins) and subsequently randomly distributing the origins within each stratum to one of the 4 groups (i.e., stratified random sampling). Next, we combine the airlines (2) * destinations (4) * groups of origins (4) * booking day categories (2) * length-of-stay categories (2) = 128 sets of 18 trips. Note that these sets of trips only vary in terms of origin (i.e., the within-set variation in airline-, destination-, booking days and length-of-stay categories is zero). Finally, we randomly assign each of these 128 sets of trips to one departure date in the 8-week period between February 8th and April 3rd in 2016. This assignment is performed in such a way that each date in this 8-week period is assigned 2 sets of trips, except for all Mondays which are assigned 4 sets of trips to ensure that we will have a fair share of trips without a Saturday-night stayover in our final data set. The top and bottom 4 rows of the data collection schedule are printed in Figure 6 (full schedule available upon request).

Table 6: Data collection schedule (top and bottom)

| Id | Day | Airl | Dest | Origin | Bookdays | LengthStay | Outbound | Return | Booking |
|---|---|---|---|---|---|---|---|---|---|
| 1 | MO | AF | PVG | GR3 | 56 days | 4 days | 8-2-2016 | 12-2-2016 | 14-12-2015 |
| 2 | MO | LH | GRU | GR1 | 56 days | 4 days | 8-2-2016 | 12-2-2016 | 14-12-2015 |
| 3 | TU | LH | LAX | GR1 | 56 days | 4 days | 9-2-2016 | 13-2-2016 | 15-12-2015 |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |
| 126 | TH | LH | GRU | GR3 | 7 days | 10 days | 31-3-2016 | 10-4-2016 | 24-3-2016 |
| 127 | FR | AF | GRU | GR1 | 7 days | 4 days | 1-4-2016 | 5-4-2016 | 25-3-2016 |
| 128 | SA | AF | JFK | GR1 | 7 days | 4 days | 2-4-2016 | 6-4-2016 | 26-3-2016 |

**Example:** On December 14th 2015 we collect the fare data for:

- 18 trips from the origins in group 3 (GR3) to Shanghai (PVG), with an outbound flight departure date of February 8th 2016 and a return flight departure date on February 12th 2016, operated by Air France (AF);
- 18 trips from the origins in group 1 (GR1) to Sao Paolo (GRU), with an outbound flight departure date of February 8th 2016 and a return flight departure date on February 12th 2016, operated by Lufthansa (LH).

# B Additional figures

Figure 9: Domestic-originating versus foreign-originating fares by airline

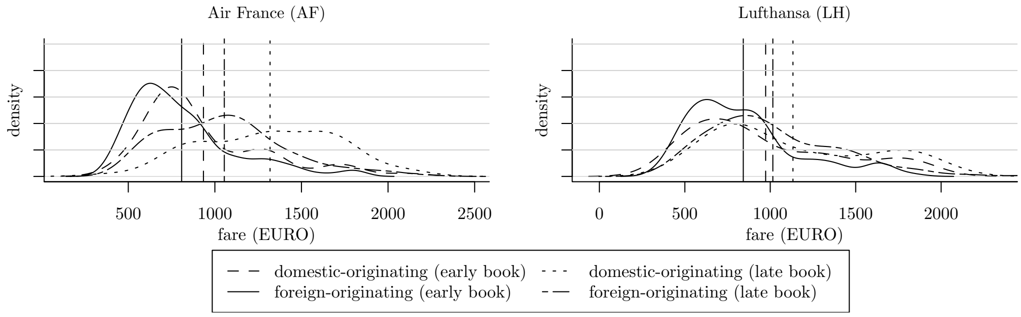



Figure 10: Domestic-originating versus foreign-originating fares by destination

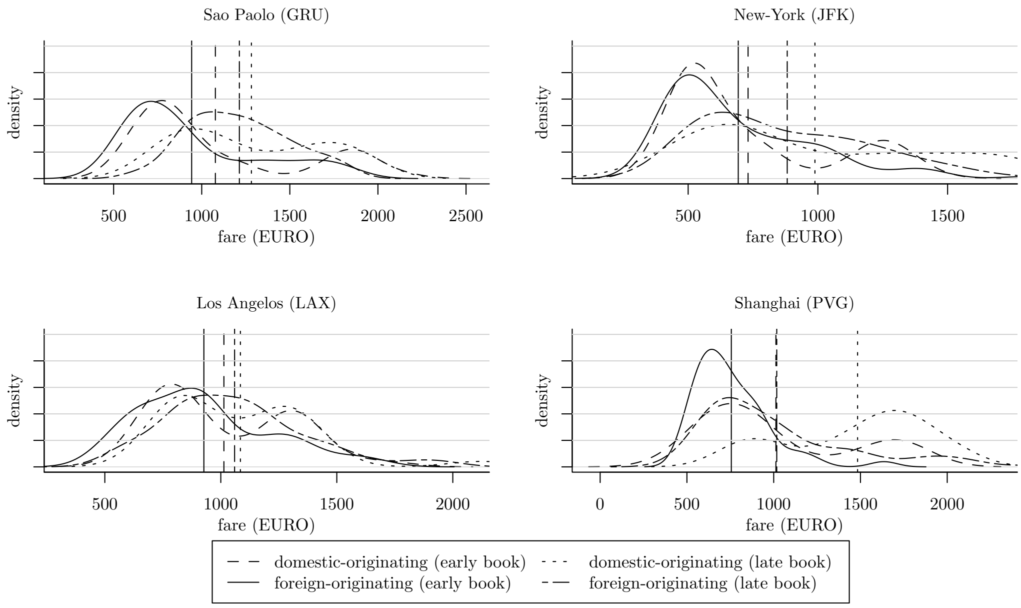


Figure 11: Domestic-originating versus foreign-originating fares by Saturday-night stayover

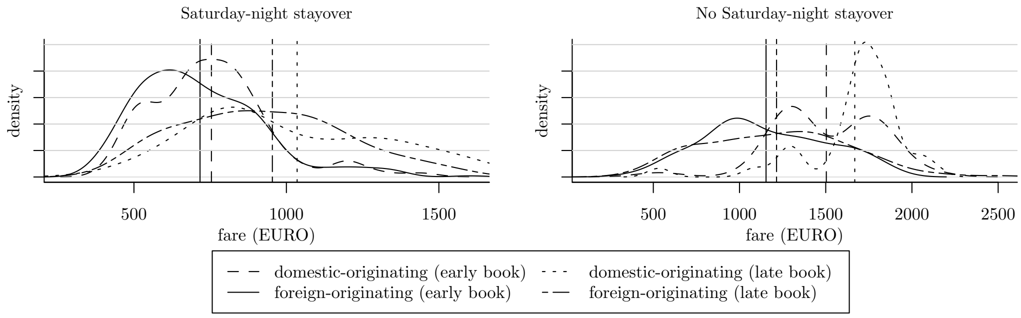



Figure 12: Domestic-originating versus foreign-originating fares by length-of-stay at destination

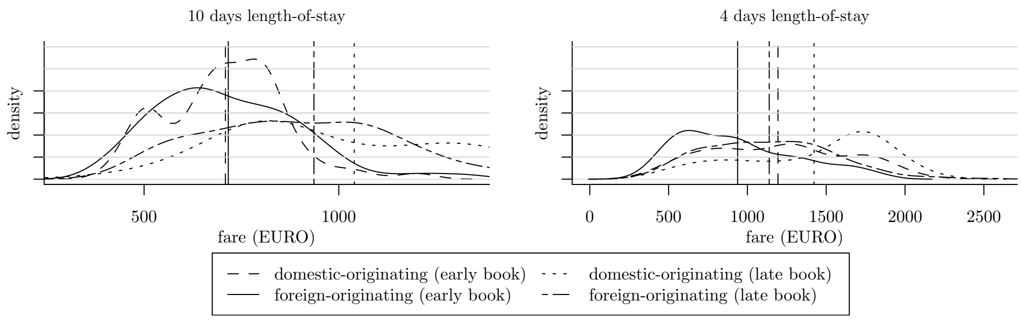
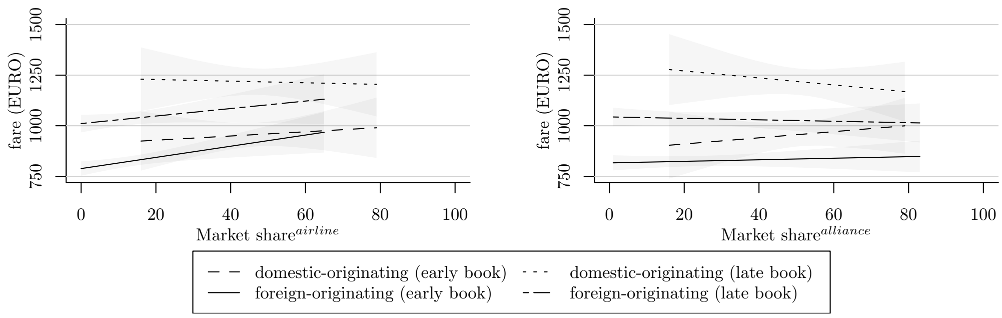



Figure 13: Association between fares and market shares decomposed by domestic and foreign-origins



## C Full estimation results

Table 7: Baseline model estimation results (including coefficients on control variables)

| | *Dependent variable:* lnFare | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| Domestic origin (0/1) | 0.1414*** | 0.0948*** | 0.1352*** | 0.0968*** | 0.0885*** |
| | (0.0212) | (0.0322) | (0.0333) | (0.0307) | (0.0324) |
| Market share$^{airline}$(%) | | 0.0015** | | 0.0014** | 0.0016** |
| | | (0.0008) | | (0.0007) | (0.0008) |
| Market share$^{alliance}$(%) | | | 0.0002 | | |
| | | | (0.0008) | | |
| Feeder leg length (km) | −0.000002 | 0.00001 | −0.000001 | 0.00002 | 0.00003 |
| | (0.00003) | (0.00003) | (0.00003) | (0.00003) | (0.00003) |
| Late book (0/1) | 0.2190*** | 0.2188*** | 0.2189*** | 0.2179*** | 0.2181*** |
| | (0.0162) | (0.0162) | (0.0162) | (0.0162) | (0.0163) |
| Short stay (0/1) | 0.0089 | 0.0091 | 0.0087 | 0.0072 | 0.0080 |
| | (0.0196) | (0.0195) | (0.0195) | (0.0196) | (0.0197) |
| Saturday-night stayover (0/1) | −0.4076*** | −0.4063*** | −0.4079*** | −0.4092*** | −0.4081*** |
| | (0.0246) | (0.0245) | (0.0247) | (0.0245) | (0.0243) |
| Competitors (#) | | | | −0.0139 | −0.0289** |
| | | | | (0.0102) | (0.0134) |
| Non stop (1/0) | | | | 0.0437 | 0.0142 |
| | | | | (0.0330) | (0.0421) |
| Seats (#) | | | | | −0.000002 |
| | | | | | (0.00003) |
| Destinations (#) | | | | | 0.0003 |
| | | | | | (0.0006) |
| Long-haul airport (0/1) | | | | | 0.0515 |
| | | | | | (0.0370) |
| Share of bussiness seats (%) | | | | | −0.0012 |
| | | | | | (0.0018) |
| Capacity constrained (0/1) | | | | | −0.0202 |
| | | | | | (0.0311) |
| Population (mio) | | | | | 0.0001 |
| | | | | | (0.0031) |
| GDP per capita (k) | | | | | 0.0020 |
| | | | | | (0.0017) |
| Main flight leg fixed effect | Yes | Yes | Yes | Yes | Yes |
| Observations | 1,067 | 1,067 | 1,067 | 1,067 | 1,067 |
| Adjusted $R^2$ | 0.5100 | 0.5121 | 0.5097 | 0.5137 | 0.5166 |

*Note(s):* Cluster-robust standard errors in parentheses. Coefficients on fixed effects not reported, but available upon request.
*p<0.1; **p<0.05; ***p<0.01

Table 8: Interaction model estimation results (including coefficients on control variables)

| | *Dependent variable:* lnFare | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Domestic origin$_{noSaturday-night}$ | 0.3103$^{***}$ | 0.1882$^{***}$ | 0.1899$^{***}$ | 0.1810$^{***}$ |
| | (0.0365) | (0.0434) | (0.0433) | (0.0469) |
| Domestic origin$_{Saturday-night}$ | 0.0775$^{***}$ | 0.0635$^{*}$ | 0.0658$^{**}$ | 0.0541 |
| | (0.0223) | (0.0346) | (0.0330) | (0.0342) |
| Market share$^{airline}_{Saturday-night}$ | | 0.0040$^{***}$ | 0.0039$^{***}$ | 0.0040$^{***}$ |
| | | (0.0010) | (0.0009) | (0.0010) |
| Market share$^{airline}_{noSaturday-night}$ | | 0.0005 | 0.0005 | 0.0007 |
| | | (0.0008) | (0.0008) | (0.0008) |
| Feeder leg length (km) | 0.000002 | 0.00002 | 0.00002 | 0.00004 |
| | (0.00003) | (0.00003) | (0.00003) | (0.00003) |
| Late book (0/1) | 0.2203$^{***}$ | 0.2216$^{***}$ | 0.2208$^{***}$ | 0.2207$^{***}$ |
| | (0.0157) | (0.0158) | (0.0159) | (0.0159) |
| Short stay (0/1) | 0.0094 | 0.0086 | 0.0067 | 0.0074 |
| | (0.0198) | (0.0198) | (0.0198) | (0.0200) |
| Saturday-night stayover (0/1) | −0.3505$^{***}$ | −0.3000$^{***}$ | −0.3033$^{***}$ | −0.3052$^{***}$ |
| | (0.0276) | (0.0317) | (0.0320) | (0.0316) |
| Competitors (#) | | | −0.0133 | −0.0262$^{*}$ |
| | | | (0.0103) | (0.0135) |
| Non stop (1/0) | | | 0.0429 | 0.0207 |
| | | | (0.0332) | (0.0419) |
| Seats (#) | | | | −0.000001 |
| | | | | (0.00003) |
| Destinations (#) | | | | 0.0002 |
| | | | | (0.0006) |
| Long-haul airport (0/1) | | | | 0.0553 |
| | | | | (0.0372) |
| Share of bussiness seats (%) | | | | −0.0013 |
| | | | | (0.0018) |
| Capacity constrained (0/1) | | | | −0.0311 |
| | | | | (0.0324) |
| Population (mio) | | | | −0.0002 |
| | | | | (0.0033) |
| GDP per capita (k) | | | | 0.0020 |
| | | | | (0.0017) |
| Main flight leg fixed effect | Yes | Yes | Yes | Yes |
| Observations | 1,067 | 1,067 | 1,067 | 1,067 |
| Adjusted $R^2$ | 0.5231 | 0.5286 | 0.5300 | 0.5324 |

*Note(s):* Cluster-robust standard errors in parentheses. Coefficients on fixed effects not reported, but available upon request.
$^{*}$p<0.1; $^{**}$p<0.05; $^{***}$p<0.01