Market Structure and Spillovers Across Complementary Industries:

Evidence from Airlines and Hotels

by

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Abstract

Economists have long been interested in the transmission of shocks across different industries. We investigate how changes in the airline industry market structure affect a complementary industry - hotels. During our time period, low-cost airlines substantially increased their market share. Offering offer lower prices than established airlines and increasing overall competition - they bring more passengers. But the marginal passengers may have lower willingness-to-pay not only for airfare, but also for hotels. We find that such airline industry changes bring performance spillovers to hotels. Specifically, all passengers raise hotel revenue per available room, room price and occupancy rates, but the largest benefits are generated by passengers on legacy carriers and routes without competition.

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1. Introduction

How economic shocks are transmitted across firms, industries and the overall economy has long been of interest to academics, policy makers and managers. Many economic shocks are unexpected, but others, especially those related to policy and regulatory changes are in fact expected and desired. The impact of those is very much in the center of attention in the fields of economics, finance as well as management.

One industry that has been significantly shaped by changes in regulation and competitiveness, not only in the U.S. but worldwide, is the airline industry (Borenstein and Rose, 2014). Hence, numerous studies have been documenting such changes, analyzing their impact on various firm and industry outcomes and studying the evolution the airline industry over time (e.g., Borenstein, 1992; Morrison and Winston, 1995; Hüschelrath and Müller, 2011). The deregulation of the U.S. airline industry in 1978 fundamentally changed the airline business and substantially changed the industry structure. New entry and price competition led to many more choices and lower fares (e.g., Borenstein 2005). This in turn heavily increased volumes of passengers and made flying more affordable way of transportation for general public. More recently, the emergence of low-cost carriers since the early 2000's has further transformed the industry, leading to even lower fares and further increases in passenger traffic (e.g. Berry and Jia, 2010; Goolsbee and Syverson, 2008).

The above raises the question whether such changes in market structure that airlines have been experiencing over time also affect performance or "spill over" into other - closely related - industries. To investigate this question, we focus on the relationship between the airline industry and the hotel industry. To our knowledge, we are among the first to directly analyze such spillovers between complementary industries.

Airline travel is an important complementary product for the hotel industry. According to the American Travel Survey from 1995, 42 percent of overnight trips included a hotel stay. Of the households who traveled by plane, 61 percent stayed in hotels. It is therefore likely that demand shocks or changes in market structure in the airline industry have spillover effects to the hotel industry.

When an increase in the level of competition in one industry results in lower prices in that industry, there are at least two effects on the complementary industry. First, existing consumers face a reduction in the price of one product in the bundle of complements, which may raise their willingness-to-pay for the complementary product. Second, the price decrease brings new consumers. While this raises overall demand for the complementary product, the new consumers may have a lower willingness-to-pay for the complementary product, compared to existing consumers. Overall, the effect on prices in the complementary industry is therefore ambiguous, whereas the effect on the equilibrium quantity is unambiguously positive.

To analyze this question empirically, we combine a unique panel data set for US hotel properties from 2000-2008 with data on the number of passengers traveling to nearby airports. Our final sample covers 31,493 hotels, distributed across 50 states, 2237 counties and 7785 zip-codes. Our data include standard industry measures of hotel financial and operational performance, specifically - average revenue per available room (RevPAR), room price and occupancy rate. We also have time-varying information on hotel and market/county characteristics. 64 percent of our hotels have at least one airport within 30 miles and 78 percent have at least one airport within 50 miles of their location. We merge the hotel data with information on the number of passengers traveling to nearby airports. For each passenger, we can identify the airline she/he traveled on and the degree of competition/ market structure on traveled route.

Our empirical approach is to estimate the effect of various airline passenger volumes (capturing the changes in airline market structure) on the above measures of hotel's performance. In our analyses, we instrument for the number of passengers arriving from city A into city B using changes in the airline's flight network in city A but not involving city B. This instrument is correlated with the number of passengers traveling from city A but unrelated to local shocks involving city B. We control for segment specific year fixed effects to absorb shocks to hotel demand over time. We also include hotel fixed effects and other time-varying hotel and market characteristics. Given that different hotels serve different market segments, we also explore whether airline industry spillovers vary across hotels with different quality levels.

We find that all types of passengers increase hotel RevPAR, room prices and occupancy rates. We also find that hotel performance spillovers vary by the type of passengers. Specifically, passengers traveling on legacy carriers and on monopoly routes have the largest positive impact. Passengers on competitive routes and passengers traveling on low-cost carriers (LCC) have smaller positive impacts. When it comes to hotel quality - we find that hotels across all quality segments benefit. But for high quality branded hotels (luxury and upscale hotels) the positive spillovers arrive only via increases in price, not in occupancy rate. Overall, our findings imply that performance of the hotel industry has been importantly impacted by changes in the market structure and segmentation taking place in its complementary industry – the airline industry.

Hence, from a policy and managerial perspective, our paper shows how and to what extent market structure changes that one industry has been experiencing (in our case airlines) may affect performance in other - closely related - industry (in our case hotels). Already Porter (1979) raised importance of understanding the nature of such inter-industry interactions. Despite of various theoretical debates, we do not have much direct empirical evidence yet.

More broadly, we also contribute to other streams of literature analyzing sources of "inter-industry spillovers" in other contexts. These include studies looking at spillovers from FDI (foreign direct investment); studies analyzing employment or agglomeration spillovers, as well as macroeconomic and finance studies focusing on business cycles and industry co-movements.

The rest of the paper is organized as follows: Section 2 provides institutional and conceptual framework, explaining complementarity between airlines and hotel industry. Section 3 discusses related literature. Section 4 describes data and aggregate data patterns. Sections 5 and 6 discuss our estimation methodology and results. Section 7 concludes.

2. Conceptual Framework: Hotels, Airlines and Inter-Industry Spillovers

Hospitality, travel and tourism represent a growing part of the U.S. economy. In 2017 this sector generated over $1.6 trillion in sales – about 2.8% of GDP – and supported about 7.8 million U.S. jobs. It also accounted for nearly a third of all U.S. services exports and about 11% of all US exports.[1] Accommodation and air travel, specifically - represent the largest two industries within this sector. In 2016, the accommodation accounted for 19% ($293 billion) and air travel for 17% ($265 billion) of total travel and tourism spending. Both industries play also an important role in terms of employment. According to American Hotel & Lodging Association (AHLA, 2016): "A typical hotel with 100 occupied rooms per night supports over 250 local jobs every year." Overall, hotels contributed to about 4.5 million direct jobs and generated about $355 billion in total labor income. At the same time, air transportation services supported nearly 900,000 U.S. jobs.

[1] https://www.selectusa.gov/travel-tourism-and-hospitality-industry-united-states.

The fact that hotels and airlines go hand in hand, as per figures above, is perhaps not surprising as travelers typically need both – transportation and accommodation. The fact that a large portion of airline passengers stay in hotels raises the question to what extend economic shocks "spill over" into its closely related counterpart - the hotel industry.

There are also additional business linkages between airlines and hotels that could further increase possibility of such economic spillovers. For example, customer loyalty programs used by airlines, and points collected by airlines travelers, can often be applied to hotels, too. In addition, airlines themselves regularly contract for hotel rooms for their crew or passengers stranded due to overbooking, mechanical delays or unexpected weather (Fogarty, 2015). Such airline business practices further increase demand for hotel accommodation and thus could affect hotel performance in terms of room occupancy rates, prices and revenues.

Furthermore, most passengers are nowadays booking trips online[2] – whereas online travel agencies (e.g., Expedia, Orbitz, Priceline or American Express Travel) typically offer a bundle "airplane and hotel" for one price, while a customer may not even realize how the expenditures are split between airfare and hotel room. Hence, for a given passenger's budget constraint, this allows quite easy re-distribution of travel costs from airline tickets to hotels.[3] This again suggests that whatever shocks airlines industry has been experiencing should affect hotel performance as well.

In particular, as we discuss in more detail in next section – unlike the hotel industry, airlines have seen substantial changes in market structure over the past decades. As a result, on average domestic fare prices significantly dropped and volumes of air passengers increased – especially those who are more price sensitive. Such shifts, however, also reduced "ambiance" of flying; hotel industry practitioners often comment on this by saying that "airlines became a commodity". Aggressive competition also brought bankruptcies followed by mergers between several airlines. Compared to that hotel industry has remained relatively stable without major shifts in market structure and highly differentiated in terms of product and service quality (we provide more details further below and in Data section).

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[2] As Borenstein and Rose (2014) discuss, online ticketing represented 30% of sales already in 2002. Our analysis starts in 2000.

[3] Online search engines (similarly as when people are booking flight and accommodation themselves), are typically looking for hotels in a given passenger's destination only after the flight was selected, not vice versa. Thus how much a passenger can spend on hotel is a residual part of the budget after airfare.

This institutional background, together with customer overlap and linkages between hotels and airlines discussed above, make the two industries an ideal research context to study inter-industry spillovers - triggered by the changes in airline regulation and subsequent increase in market competition of airline industry.

Such changes should benefit hotel performance via increased volume of airline passengers and boost thus demand for hotel rooms and facilities, increase hotel occupancy rates, room prices and ultimately raise hotel revenues. Cheaper flights and expansion of LCC could also boost tourism and bring additional hotel guests during holidays and off-peak seasons and smooth out seasonality of hotel performance throughout the year. Such changes could, however, also reduce hotel performance if lower airfare and LCC attract mostly low-income passengers, who may prefer cheaper forms of accommodation (e.g., staying with friends, hostels) rather than staying in a hotel.[4]

One would also expect that if the passengers save money on airfare, they could use such cost-savings and stay in higher-quality hotels. Specifically, hotels in higher quality segments are typically larger and pricier, while offering more and better amenities suitable for business clients or organizing big events and meetings (e.g., conference rooms, restaurants). Lower quality hotels tend to accommodate more leisure and price sensitive travelers. The expansion of low-cost airlines and higher shares/volumes of price sensitive passengers could also potentially crowd out business travelers and reduce the number and/or length of business trips, conferences or meetings, while increasing the number and length of leisure and family vacations. In that case, higher volumes of airline passengers should bring positive performance spill overs to lower quality hotels.

Hence, the impact of airline passengers on hotel performance – capturing the spillovers from regulatory changes and higher competition in the airline to hotel industry – may vary across different quality of hotels, as well as types of passengers brought by different carriers, namely: LCC vs. legacy/traditional airline carriers. Such spillovers may also vary regionally, particularly in the markets where industry restructuring allowed rapid expansion and raised market power of some LCC, e.g. Southwest Airlines.

Hope for positive spillovers and possible synergies have been also historically the reasons why on several occasions airlines have attempted to expand into hotel business. As several press releases point out:

[4] AirBed & Breakfast (or AirBnB) also offers alternative cheaper accommodation to hotels. However, this business model started only after 2008, the end of our sample period.

"The relationship between airlines and hotels has a long history and, at one time, it was common for airlines to even own their own hotels. For example, Le Meridien hotels, now owned by Marriott International, was originally created by Air France in 1972." (Ting, 2018).

"It's hardly revolutionary for an airline to own or build traveller accommodations— Pan American Airways did it right after World War II…. The chain expanded into the InterContinental brand under Pan Am ownership for 35 years before the airline's financial pinch caused it to sell the hotels in 1981"… [Similarly] *"In the 1980s, United Airlines' parent briefly became the Allegis Corp., a full-service travel conglomerate that aimed to meet the full range of travel needs by piecing together the airline with its ownership of Hertz rental cars and the Westin and Hilton hotel chains. (United had acquired Hilton from another airline, TWA.) The conglomeration effort died ignominiously in 1987 ….United's parent sold off everything but the airline."* (Bachman, 2017).

A more recent example involves Allegiant Travel Company - the ninth largest US carrier – which, in 2017, after 18 years of flying decided to enter the hotel business. However, as one executive commented, consistent with the quotes above: "We'll see if Allegiant has more success than other airlines that have entered the hotel business" (Bachman, 2017).

Such anecdotal evidence further highlights importance of understanding inter-industry spillovers from airlines to hotels. More broadly, from a policy and managerial perspective, it helps us to better understand how and to what extent regulatory and market structure changes that one industry has been experiencing over time (in our case airlines) may affect performance in another - closely related - industry (in our case hotels).

3. Related Literature

3.1. Airline Deregulation and Evolution of U.S. Airline Industry

There are several studies and industry reports that document changes in U.S. airline regulation and the overall evolution of the airline industry.[5] As Borenstein and Rose (2014: 63) highlight:

[5] See, e.g. Borenstein and Rose, 2014; Hüschelrath and Müller, 2011; Morrison and Winston, 1995; Borenstein, 1992, as well as industry brief by Heffernan, 2019.

“Government policy, rather than market forces, shaped the development and operation of scheduled passenger air service in almost all markets for the first six decades of the airlines industry’s history”. Moreover, intervention in the U.S. passenger aviation occurred through an explicit formal regulatory system rather than through state-ownership which dominated airline operations in other countries.

Until the mid-1970s, when the transition to a more market-based aviation began, the U.S. airline industry was characterized by intensive regulation that resulted in relatively high fares, inefficient operations, and airline earnings volatility. The federal regulatory agency, the Civil Aeronautics Board, made decisions about how many and which airlines were licensed to fly any given route and what fares those airlines could charge. The Board could even prohibit airlines from terminating service on a given route. From a customer perspective, aviation represented expensive and exclusive means of transportation for limited part of population.

This prompted an important shift in 1978, when the Airline Deregulation Act (ADA) eliminated price and entry regulation of the domestic airline industry and established that regulatory agency, the Civil Aeronautics Board, and its activities will be terminated.[6] Since then, airfares have declined, airlines have opened more routes to more destinations, volumes of passengers have increased and overall efficiency of airline operations has improved; even-though the average industry earnings dropped and their volatility has continued. According to aviation experts (Heffernan, 2018) “over the past 40 years, average roundtrip U.S. domestic airfares have decreased by more than 40%, from $629 to $340 (including fees, based on inflation-adjusted dollar amounts)”. Overall, most consumers benefited from airline deregulation, as flying became more affordable way of transportation for general public. When it comes to airlines, as Borenstein and Rose (2014) point out, for many it has been a costly experiment, though some benefited from the unregulated environment.

More recently, the industry has experienced the expansion of low cost carriers including: Southwest, JetBlue, Frontier, Air Tran, America West and other airlines. At the same time, higher competition forced several incumbent legacy carriers to exit the market (e.g., Trans World

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[6] However, ADA did not cancel federal economic regulation of airlines completely. Instead it granted a limited regulatory authority to Department of Transportation (DOT), including the authority to prohibit airlines from engaging in “unfair or deceptive practices” and “unfair methods of competition”. While doing so, DOT was asked to put “maximum reliance on competitive market forces and on actual and potential competition” as the best way to achieve “efficiency, innovation, and low prices” and “variety and quality of air transportation services.” (Heffernan, 2018).

Airlines, Pan American), while others ended up in mergers & acquisitions (e.g., Northwest Airlines, Continental Airlines, and US Airways). Though such consolidation shifted market power of some players in regional markets, overall the airlines industry seems to remain highly competitive. Meanwhile, the remaining established (or "legacy") airlines have largely mimicked the successful low-cost carrier business model by unbundling many services which were previously included in the regular airline ticket price.

3.2. Assessing the Impact of Airline Deregulation & Subsequent Changes in Industry Structure.

There are several studies that assess impact of airline industry deregulation on different firm or industry outcomes to better understand airline operations in the deregulated airline industry. Hence, below we mention some topic-representative papers, focusing on the most recent ones:

In addition to the above-mentioned studies, Borenstein (2005) also finds that adjusted for inflation, airline prices significantly dropped - more than 20% during his data period, 1995 to 2004. He also found that premia at hub airports, as well as price differences between most and least expensive airports significantly declined. He concludes that in terms of prices that play a major part in consumer value, the industry has been delivering the best results travelers have seen in the past decade.

Berry and Jia (2010) - focus on performance/profitability of legacy carriers. Using a structural model of the airline industry to disentangle the impact of the various factors, they find that: In 2006, air-travel demand was 8% more price sensitive, passengers displayed a stronger preference for nonstop flights, and changes in marginal cost significantly favored nonstop flights, compared to 1999. These factors, together with the expansion of low-cost carriers (their market share of domestic origin-destination passengers increased from 22.6% to 32.9% during 1999-2006) explain more than 80% of the decrease in legacy carriers' variable profits. Similarly, Hüschelrath and Müller (2011) – using 1995-2009 data, compare different pathways of legacy carriers vs. LCC and analyse developments in the structure, conduct and performance of the domestic U.S. airline industry. They conclude that the competitive interaction between legacy and LCC increased substantially and should be considered as the main driver of competition in the domestic U.S. airline industry. They also find that both types of carriers entered about 1200 new routes during 1995-2000. The entry of legacy carriers was more pronounced until 2003, after that LCC entered more markets; while the exit dynamics followed opposite patterns. In turn, average airfare substantially decreased.

Several other studies specifically look at how entry and expansion of LCC affect legacy carriers and overall industry structure. Most of them focus on the impact Southwest airlines which has the largest market share among LCC.[7] In particular, Goolsbee and Syverson (2008) examine how incumbents responded to the threat (rather than actually entry) of Southwest airlines. They find that incumbents significantly cut fares when threatened by Southwest's entry. However, these cuts occur only on threatened routes, not those out of non-Southwest competing airports. In turn, the drop in prices increases number of passengers flying on incumbents prior to entry. Hence, Southwest helped to reduce the average airfare not only by its direct expansion, but also by the threat of entry that its expansion created on the market. Vowles (2001) finds similar results when looking on the impact of *actual* entry of Southwest. Interestingly however, while airfare dropped on both, Southwest-served and non-Southwest-served competing routes - in 17 out of 29 non-Southwest-served markets, lower airfare did not increase passenger volumes. Bogulaski et al. (2004) also look on Southwest entry – but rather focus on its own entry strategies and factors that determine which markets Southwest are likely to enter and which legacy airlines might be affected by its growth in future.

We contribute to the existing literature by making a further step by looking how such important changes in the industry structure as occurred in airlines spill-over to another, closely related industry. To our knowledge we are among the first to analyze such *inter-industry spillovers* from airline industry.

More broadly, we also contribute to other streams of literature that analyze sources of "inter-industry spillovers" in other contexts. The closest to our setting, while exploiting hotel or broader hospitality industry context, are few recent studies. Hubbard and Mazzeo (2019) look how demand increases associated with highway completion affect employment, number and size of hotels/motels, during 1960s-1980s. Kadiyali and Kosová (2012), on the other hand, utilize data on hotel rooms sold to study the inter-industry employment spillovers from U.S. tourism inflows and Basuroy et al.(2020) analyze spillovers from Airbnb entry on local restaurants' revenues. At the same time, many studies in international and development economics have been looking whether there are positive " foreign direct investment (FDI) spillovers" from the presence or activities of

[7] See Figure 2.7 in Borenstein and Rose (2014) or Table 1 in Hüschelrath and Müller (2011).

foreign firms on various performance outcomes (e.g., firm productivity, growth, survival or employment) of domestic firms (e.g., Aitken and Harrison, 1999; Javorcik, 2004; Kugler, 2006; Kosová, 2010; Ayyagari and Kosová, 2010). This literature finds positive inter-industry spillovers via input/output linkages between domestic and foreign firms. Finally, inter-industry spillovers and co-movements across sectors are also important to better understand economic business cycles (e.g., Shea, 2004).

4. Data

4.1. Data Sources

To analyze spillovers from airlines to hotels, we exploit a unique panel data set for US hotel properties during 2000 to 2008 that we obtained from the Smith Travel Research (STR) Company.[8] The STR database covers over 98 percent of existing U.S. hotel properties, including branded and unbranded hotels. Overall, the branded hotels dominate the market and operate under nationally (or even globally) recognized brand-names belonging to one of the large parent hotel companies (e.g., Hilton Worldwide, Holiday Inn, Marriott International). As Rushmore and Baum (2001) point out, the overall hotel chain affiliation rose from 35% in 1970 to over 80% in 2000. Kalnins (2006) further notes that the 10 largest brands control about 50% of the market. As discussed below, the quality and service offerings of branded hotels are benchmarked into standardized quality-tiers (or segments) and individual hotels within the same brand/chain are often indistinguishable from a customer's perspective. Unbranded hotels, on the other hand, are typically local properties, owned and operated by independent owners without nation-wide recognition. Their quality tends to vary to a large extent across individual operators (hence, it is not benchmarked as for branded hotels). In the STR database branded hotels represent about 55% of observations.

The database provides for each hotel a unique identifier, number of rooms, opening date, hotel geographic location including state, county and zip-code, as well as information on hotel's organizational/operations form (franchised, company managed and independent) and hotel industry segments. The segments distinguish unbranded from branded hotels, and further classify

[8] STR is a market research firm that collects information about hotels in the U.S. and internationally. Its Hotel Census Database is the most comprehensive data source on the hotel industry available. We obtained access to their database under confidentiality agreement.

branded hotels into five categories, depending on the amenities and quality of service offered: luxury and upper upscale, upscale, midscale with food & beverage (F&B), midscale without F&B, and economy.[9] Appendix 1 describes product quality differences across segments and provides examples of brands associated with each segment. The information on segments allows us to also assess whether spillover effects from airline industry vary across different hotel quality. In our analyses, we specifically split hotels into 3 groups: High-quality branded hotels (luxury, upper-upscale and upscale segments), Lower-quality branded hotels (midscale and economy hotels) and Unbranded hotels.

In addition to hotel census information, STR collects for almost all branded hotels and some unbranded ones, also monthly information on hotel revenues, hotel rooms available and rooms sold. We use these monthly data to construct annual averages of standard performance measures used in the hotel industry, namely: revenue per available room RevPAR, occupancy rate and room price (average daily room rate) for each hotel-year (see Appendix A1 for more details). Using annual averages allows us to smooth out outliers and avoid seasonality in monthly measures. Other market characteristics we rely on as controls in our analyses also vary only by years.

To control for time-varying market characteristics, we combine the hotel data with data from the Census Bureau and the Bureau of Labor Statistics (BLS), which provide annual information on county population (from the Census Bureau's annual population estimates), unemployment rate (from the BLS), median household income (from the Census Bureau), and the employment in three related industries: Arts, Entertainment & Recreation; Food & Beverage and establishments in the broadly defined Accommodation/lodging industry not just hotels (all from the Census Bureau's County Business Patterns data). We rely on county-level market controls since as Freedman and Kosová (2012) discuss - counties represent the best available approximation to the relevant geographic area in which hotels interact with each other, and within which consumers typically search, when looking for accommodation around their final destination. County-level data also represent the lowest level of aggregation at which time-varying market characteristics are regularly reported at annual basis.

We merge the hotel data with information from the Department of Transportation's Database 1B (DB1B). The DB1B is a 10 percent sample of all domestic airline tickets. The database includes information on departure and arrival airport, any stopover airports, the airline, the ticket price, the

[9] Since there are only few luxury hotels, we merged luxury and upper upscale hotels into one category.

number of passengers on the ticket and the year and quarter in which the ticket was used. There is no information on other ticket characteristics such as advance booking, length of stay, or frequent flyer status. We merge each hotel with all the airports within 30 or 50 miles, based on the hotel's zip-code.[10]

4.2. Descriptive Statistics & Aggregate Data Patterns

Appendix Table 1 summarizes definitions and measurement of our variables and Table 1 shows descriptive statistics. A hotel in our sample is on average 18-19 years old, ranging from newly built properties to historical ones with a long tradition. The average hotel size is 122 rooms, but the capacity varies to a large extent between different properties and/or years.[11] Hotels charge on average about $77 per night, with average occupancy rate about 60 percent per year, yielding about $48 revenues per available room (RevPAR).[12] In terms of hotel quality, among 221,734 observations in our sample: about 16% of observations correspond to high quality branded hotels (luxury, upper-upscale and upscale segments); almost 76% represent low-quality branded hotels (midscale and economy segments) and about 8% correspond to unbranded hotels. Among these, about 17% of hotels are company-operated, almost 70% are franchised and 13% hotels are operated by independent owners..

When it comes to market characteristics, an average hotel in our sample operates in a county with annual population about 786,000 people; median household income of $46,750 and 5% unemployment rate. The hotel market is on average quite competitive – about 129 accommodation establishments per year. However, as overall summary statistics show there is high geographic variation in all these variables. For example, some hotels operate in small counties of only about 607 people, while others operate in very large markets with about 9.8 million population. Our other market characteristics - employment in two hotel related industries: Arts, entertainment & recreation (AE&R) and Restaurants, food & beverage show similar patterns of high county-year variation.

[10] To avoid potential mis-codings in the database, we dropped few airports with less than 30 passengers per day. We also dropped Alaska, as it has much larger proportion of private flights than other US states.

[11] Some properties, especially unbranded ones, include small family operated Bed & Breakfasts. At the same time, however, even large hotels can offer limited number of rooms in years when going through renovations.

[12] For 9 observations Occupancy Rate is above 100%. This can occur for example due to late hotel booking cancellations, when 1-night charge is applied while the same room is also re-booked and sold to another customer; or if extra beds are added to the standard room as per customer request (e.g., families with children).

The rest of Table 1 shows our airline spillover measures. Since many hotels operate in close proximity of multiple airports, some of which are small – we aggregated passenger inflows within the vicinity of 30 miles, and then 50 miles, from hotel's zip code in each year.[13] About 1.7 million passengers arrive within 30 miles of the average hotel in our sample, and about 2.3 million passengers arrive within 50 miles. We then scale these passenger numbers by the number of accommodation establishments in a county (to make interpretation of estimates easier), resulting in about 30,000 passengers per hotel per year arriving within 50 miles. Of those, about 16,500 travel on routes with at least two competing carriers and 10,500 travel on low-cost carriers.

Figure 1- panels A, B, C show the aggregate patterns of three hotel performance measures: (Room) Price, Occupancy Rate, RevPAR and passenger inflows over time.[14] The three smooth lines in each panel show the average number of airline passengers arriving within 30, 50, and 100 miles from a hotel. The Figures show that the patterns of these three passenger measures is quite similar over time. There is a drop in passenger inflows 2001-2002 (see right y-axis scale), when Sept. 11 terrorist attacks occurred,[15] and a smaller decrease in 2008, at the beginning of the financial crisis.

Interestingly, despite the two dips in passenger inflows, hotel room prices (panel A) show a rapid increase (almost 30%) from less than $70 to $90, during 2000-08. At the same time however, occupancy rates (panel B), oscillate within the range of 57.5% to 62%. In turn, RevPAR, capturing the net effect - first decreases from $45 in 2000 to about $41.7 in 2003, and then similarly as prices, increases by approx. 30% to $56 and $55, in 2007-08.

Overall, these aggregate patterns suggest that hotels could potentially benefit, esp. in terms higher prices and larger revenues, from larger passenger inflows and from the emergence of low-cost carriers.

Figure 2 shows the passenger flows per hotel by type, separating passengers on legacy carriers and on low-cost carriers and dividing both groups into passengers flying on monopoly routes vs. competitive routes. The figure shows how the number of legacy passengers fell in 2001. Monopoly

[13] Since about 67% of hotels have all the airports concentrated within 30 miles of hotel's zip-code, we only expand the vicinity of passengers' measurement to 50 miles. Going beyond 50 miles from a hotel's zip-code adds little variation between measures.

[14] To show more robust patterns, the figures are constructed using all the observations with non-missing performance values, before dropping missing observations in our control variables. Figures using only observations in our regression sample are almost identical with the ones presented.

[15] However, as Borenstein and Rose (2014) point out though these attacks resulted in a major setback to the industry finances, such effect was very short lived.

routes operated by legacy carriers had roughly constant passenger numbers after that while legacy carriers on competitive routes experienced increases in passengers from 2003-2005 and a subsequent decline. Low cost carriers, on the other hand, increased their passenger numbers consistently throughout this period.

5. Empirical Methodology

5.1. Hotel Fixed Effects Regressions

To analyze how changes in the airline industry market structure - captured by airline passenger inflows - affect hotel performance, we estimate a general empirical specification as follows:

$$y_{izct} = \beta_1 Pass_{Mt} + \boldsymbol{Z}'\boldsymbol{\Gamma}_{\boldsymbol{it}} + \mathbf{Q}'\boldsymbol{\Omega}_{\boldsymbol{ct}} + \theta_{st} + \delta_i + \varepsilon_{izct} \tag{1}$$

The dependent variable *y* is one of the three hotel performance measures: Log(RevPAR) - revenue per available room, Log(Price) - room price, or Occupancy rate (in percent) of hotel *i,* operating in zipcode *z* of county *c* in year *t.* Our variable(s) of interest are airline passengers, *Pass*, arriving into the radius *M*, i.e. 30 or 50 miles, from hotel's zipcode in a year *t.* We estimated specifications using *Pass* in levels, as well as in logs, and the results were similar. For ease of interpretation, we report most results using *Pass* in levels.

We include the following controls: **Γ** - represents vector of hotel specific variables – hotel age and size (number of rooms) both in logs, as well as six dummies capturing differences across hotel quality/segments and three organizational/operation form dummies (see Section 4.1.).[16] In addition, **Ω**, represents vector of county-level characteristics to control for different economic conditions in which hotels operate: population (in logs), median household income (in logs) and the unemployment rate. These variables capture costs of living and also help us to control for differences in hotel clientele that might be attracted into different areas (e.g. business travelers often stay in richer or highly populated areas). To further control for changes in tourism intensity, local demand and potential competition on hotel market that could affect both hotel performance and passengers inflows, we include employment in two hotel-related industries (in logs) in a given

[16] There are several changes in these dummies over time, so we can include them together with hotel fixed effects.

year: arts, entertainment and recreation (AE&R) and food and beverage (F&B). Given that these industries source from the same labor market as hotels, they also help us to capture possible labor sharing/competition effects with these industries.

In addition, we include a set of segment-year dummies, θ_{st}. These control for unobserved macroeconomic or policy shocks that may affect hotel performance and passenger inflows and allow for potentially different impacts of such shocks across hotel segments. Finally, to control for (to us) unobserved hotel heterogeneity (e.g., good/bad hotel manager) or specifics of hotel location, we control in all our estimations for hotel fixed effects, δ_i.

In the next step, to further delineate sources of spillovers - we analyze the spillovers from passengers based on their type of route and airline carrier. Specifically, we separate the passengers who arrived on competitive routes (with at least two carriers offering service) and those who traveled on low costs carriers. We expand our baseline empirical specification as follows, whereas *Compet* and *LCC* are the shares of passengers on competitive routes and LCC, respectively:

$$y_{izct} = \beta_1 Pass_{Mt} + \beta_2 Pass_{Mt} * Compet_{Mt} + \beta_3 Pass_{Mt} * LCC_{Mt} + \boldsymbol{Z}'\boldsymbol{\Gamma}_{it} + \mathbf{Q}'\boldsymbol{\Omega}_{ct} + \theta_{st} + \delta_i \qquad (2)$$

In all our estimations we cluster the standard errors on hotel zip codes since our passenger variables are at the zip code level.

5.2. Instrumental Variable (IV) Estimation

We present a set of initial results with hotel fixed effects, but we recognize that passenger numbers may be endogenous to hotel performance due to common and unobserved local demand shocks. Therefore, we estimate the equations above while instrumenting for the number of passengers. As instrument, we use *connecting 1-stop routes*, i.e. the number of destinations that can be reached with one-stop flights from the airports located within 30 miles of a given hotel's zip code, in a given year. Similarly, we create the instrument for radius of 50 miles.

For example, as Figure 3 shows - let's assume that airport A has direct flights to the airports B and C. Airport B has direct flights to airports A and D. Airport C has direct flights to airports A, E and F. The value of the instrument for passengers traveling to A would equal to three, counting the one-stop connections from A to D, E, and F, but not the direct connections to B and C. This instrument should satisfy the exclusion restriction since airline entries into routes between B and other airports are not driven by local shocks at the airport A, nearby which a focal hotel operates.

At the same time, the instrument is correlated with the network integration of airport B and thus with the number of passengers arriving from airport B to the focal airport A.

When estimating eq. (2) and splitting passengers by route and carrier, we create the cross-effects between our instrument and shares of passengers arriving on competitive routes and by LCC, similarly as we create the corresponding passenger variables. Overall, our instrument(s) performs quite well across all the specifications; we provide more details when discussing results.

In subsequent analyses we then re-estimate empirical eq. (2) using the above explained IV approach across different sub-samples, in order to assess whether airline spillovers to hotels vary across different quality segments and tourist vs. non-tourist destinations. In Section 6.4. we also look how changes in the airline industry affected hotel entry.

6. Results

6.1. Fixed Effects OLS Regressions

In Table 2, we present our results from fixed effects OLS regressions. Table 2A, we estimate the effect of passengers arriving at nearby airports on RevPAR. We begin in the first column with the number of passengers (in tens of thousands) arriving within a 30-mile radius, divided by the number of hotels in the county. In the second column, we use the equivalent measure for passengers arriving within 50 miles. Columns 3 and 4 use the logs of passenger numbers instead of levels. We find no statistically significant effects of passengers on RevPAR in the two specifications with passengers per hotel in levels, but we find highly significant positive effects when we use the passenger variables in logs. The point estimates imply that an increase in passengers by 10 percent increases hotel revenue by between 1.5 percent when measured in the 30-mile radius and 0.8 percent when measured in the 50-mile radius. On the control variables, we find that increases in population and income and reductions in overall unemployment lead to higher RevPAR and increases in food and beverage employment lead to lower RevPAR.

We also find similar effects of the number of passengers on the price per room and the occupancy rate in Panels B and C. Again, the passenger variables in level have no statistically significant effect, while the passenger variables in logs all have positive effects, suggesting that an increase in passengers leads to higher prices and higher quantity, as we would expect for an increase in demand. The magnitudes imply that a 10 percent increase in passengers will lead to a

3.9 percent increase (30-mile measure) or 1.7 percent increase (50-miles measures) in average prices and an increase in the occupancy rate of 6.2 percentage points (30-mile measure) or 3.3 percentage points (50-mile measure).

6.2. Instrumental Variable Regressions.

In Table 3, we estimate the same specifications as in Table 2 while instrumenting for the number of passengers with the *1-stop connections* instrument described above.[17] We now find across all specifications that an increase in passenger numbers increases RevPAR (Table 3A). The coefficients increase in magnitude relative to the previous OLS regressions. For example, using the 50-mile radius, we find in Column 2 that an additional 100,000 passengers per hotel per year increase RevPar by approximately 1 percent. Using the specification in Column 4, we find that an increase in passengers of 1 percent increases RevPAR by 2.9 percent.

Table 3B shows the effects on prices. We find across all specifications that an increase in passengers leads to higher prices. The coefficients on the passenger variables are a bit smaller in these specifications compared to the RevPAR specifications in Table 3A, suggesting that the RevPAR effect is composed of a positive price response as well as a quantity response. That is indeed what we find in Table 3C, where the coefficients on passengers are again positive in all specifications. In this Table, however, only the passenger variables in levels are statistically significant. Overall, we find evidence in Tables 2 and 3 that an increase in airline passengers leads to a clear increase in demand for hotel services. This is as expected given that these products are complements.

In Table 4, we examine how the composition of airline travelers affects the demand effect in the complementary hotel market. We add interactions between the passenger variable and the share of passengers who traveled on "competitive" routes (with at least two carriers offering service) and the share of passengers who traveled on low-cost carriers. In this table, we use the number of passengers arriving within 50 miles of the hotel (in levels). Focusing on the regressions with both interactions in Column 4, we find that passengers on legacy passengers on monopoly routes have the strongest positive demand effect on hotels. An additional 100,000 of these passengers increase hotel RevPAR by 1.6 percent, prices by 1 percent and occupancy rate by 3.2 percentage points.

[17] First-stage regressions for Table 4 – our main results table – are shown in appendix A.2. First stages for the other IV regressions are available upon request.

Passengers on competitive routes have a significantly smaller effect on RevPAR and on prices than passengers on monopoly routes, and passengers on low-cost carriers have a significantly smaller effect on all three outcome variables than passengers on legacy carriers.[18]

These findings are the key results from our paper, and we can use them to estimate how the emergence of low-cost carriers and changes in airline route-level competition during this time period have affected hotels that are near airports. In 2000, the share of passengers on low-cost carriers was 22.5 percent, and by 2008 it had risen to 30.4 percent. The share of passengers on routes with competition was quite stable during this time period (34.7 percent in 2000 and 34.0 percent in 2008). The average number of passengers arriving at airports within 50 miles of hotels in our sample rose from 2.17 million per year to 2.36 million per year, while the average number of accommodation establishments ("hotels") per county increased from 125 to 129. As a result, the average number of passengers per hotel slightly decreased from 31,255 per year to 30,674 per year.

The average number of passengers per hotel arriving on *legacy carriers* dropped by 4,633, while the average number of passengers on *low-cost carriers* rose by 4,052. Even though the drop in passengers is relatively small, the change in composition has a negative impact on hotel RevPAR. Taking into account the change in composition, the reduction in RevPAR was approximately 4.98 percent. Had the share of legacy carriers remained stable, the same decline in the number of passengers would have reduced RevPAR by only 0.93 percent.

6.3. Do Spillovers vary by Hotel Quality/Segment?

In Table 5, we investigate how the effects differ between high-quality branded hotels, lower-quality branded hotels and unbranded hotels. Appendix A.1 describes the hotel segments including example brands. We combine the branded luxury, upper upscale and upscale segments into a group of high-quality branded hotels, and the midscale and economy segments into a group of lower-quality branded hotels.

We estimate our preferred specification from Table 4, Column 4 separately for each segment. Starting in Panel A with RevPAR as the dependent variable, our estimates show that all three groups of hotels experience the largest positive impact from passengers who travel on legacy carriers on monopoly routes. Across all segments, we find that passengers on competitive routes and passengers on LCC's have a smaller positive impact on RevPAR than passengers on legacy

[18] We have estimated the results from Tables 3 and 4 on a sample that excludes 2001, and our findings are robust.

carriers and monopoly routes. The magnitudes of all effects are similar for high-quality branded and for unbranded hotels, but are smaller for lower-quality branded hotels. We see very similar results in Panel B with log(price) as the dependent variable. In Panel C, we find positive, though not always significant, effects of total passengers. The interaction of passengers with the share on competitive routes is statistically insignificant across all segments, and the interaction of passengers with the share travelling on LCC's is negative and significant in all three segments. In the lower-quality, branded segment, for example, we find that 10,000 additional passengers per hotel on legacy carriers increase the occupancy rate by 3.1 percentage points, but the same number of additional passengers on LCC's only increases occupancy by 0.6 percentage points.

6.4. Do Spillovers Vary by Location?

The impact of low-cost carriers may be different for tourist-oriented locations than for other locations. In order to investigate this, we create a measure of tourist orientation for each county code. Using data from the Census Bureau, we calculate the sum of the number of establishments in Arts, Entertainment, and Recreation and establishments in Accommodation and divide this sum by the total number of establishments in the county. We label the twenty percent of counties with the highest values for this ratio as "tourist-oriented" counties. We then estimate our preferred specification from Table 4, Column 4 separately for tourist-oriented routes and all other routes.

We present these results in Table 6. We find similar patterns as before for tourist and non-tourist routes. Passengers on legacy carriers have a larger positive effect on RevPAR and prices than passengers on LCC's. The coefficient for passengers on competitive routes is negative in both samples, but it is only significant in the non-tourist sample. We find that the effects are larger in magnitude in the tourist sample, indicating that all types of passengers have larger positive effects for hotels located in tourist-oriented counties than in other counties.

For the occupancy rate, we find a different result. An increase in passengers has no statistically significant effect on the hotel occupancy rate in tourist counties. In non-tourist counties, on the other hand, an increase in passengers significantly increases the occupancy rate. The effect is again larger in magnitude for passengers on legacy carriers than on LCC's.

6.5. Do Spillovers Affect Hotel Entry?

The final part of our empirical estimation investigates how lagged changes in passenger numbers affect hotel entry rates. We calculate entry rates at both the county level and the zip code level and estimate our preferred specification using both OLS and IV with fixed effects. In these estimations, we use the total number of passengers arriving at nearby airports, without adjusting for the number of hotels. The results in Table 7 show in the IV specifications that airline passengers have qualitatively the same effect on entry rate as they have on RevPAR. This is what we would expect given that hotels use expected RevPAR as a key metric when making entry decisions. The county-level results imply that an additional 10,000 passengers on legacy carriers and monopoly routes increase the entry rate by 5.1 percentage points. Compared to this, the effect on competitive routes is smaller with 2.1 percentage points. The effect on LCC's is also smaller with 2.6 percentage points. The zip code level results show the same qualitative relationships, but the effects are smaller in magnitude. Overall, these patterns confirm our findings on RevPAR, prices, and occupancy rates.

7. Conclusion

We have investigated how product and market structure changes in one industry – airlines - affect a complementary industry – hotels. We find that the number of airline passengers of all types has a positive effect on hotel revenue per available room and prices, as one would expect from complementary products. We also find positive effects on occupancy rates in most specifications, although sometimes these effects are not statistically significant.

When we decompose airline passengers by type of carrier – legacy carriers vs. low-cost carriers – we find throughout that passengers on legacy carriers have larger positive effects on hotel RevPAR and prices than passengers on low-cost carriers do. This suggests that low-cost airlines carry more price-sensitive travelers and travelers who are less likely to stay in hotels. Since the airline industry experienced a substantial increase in the market share of low-cost carriers during the time period we investigate, our finding has important implications for the performance of the hotel industry. Namely, the expansion of low-cost carriers meant that hotel performance was substantially weaker than it would have been had the same number of passengers traveled on legacy carriers.

Of course, the expansion of low-cost carriers likely increased overall traveler numbers. In ongoing work, we investigate a counterfactual of how many passengers would have traveled if there had been no expansion of low-cost carriers.

Figure 1A: Hotel (Room) Prices & Airline Passenger Inflows, 2000-2008.

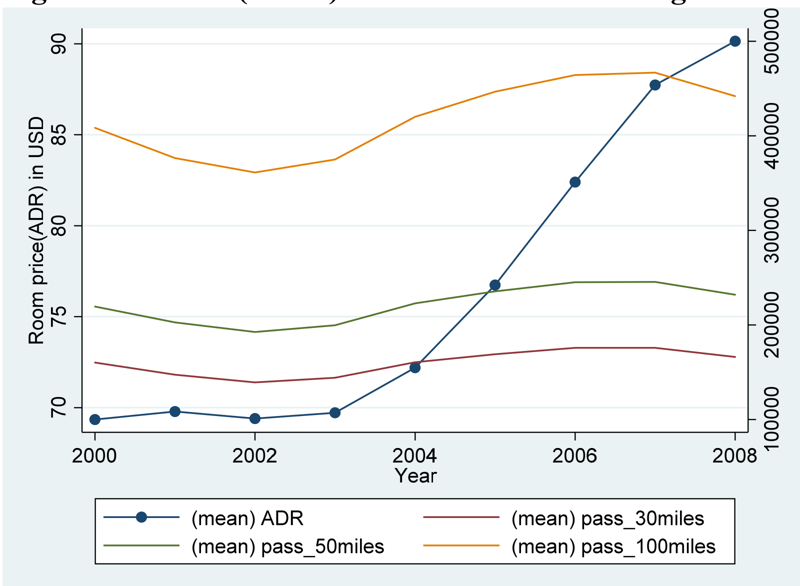

Figure 1B: Hotel Occupancy Rates & Airline Passenger Inflows, 2000-2008.

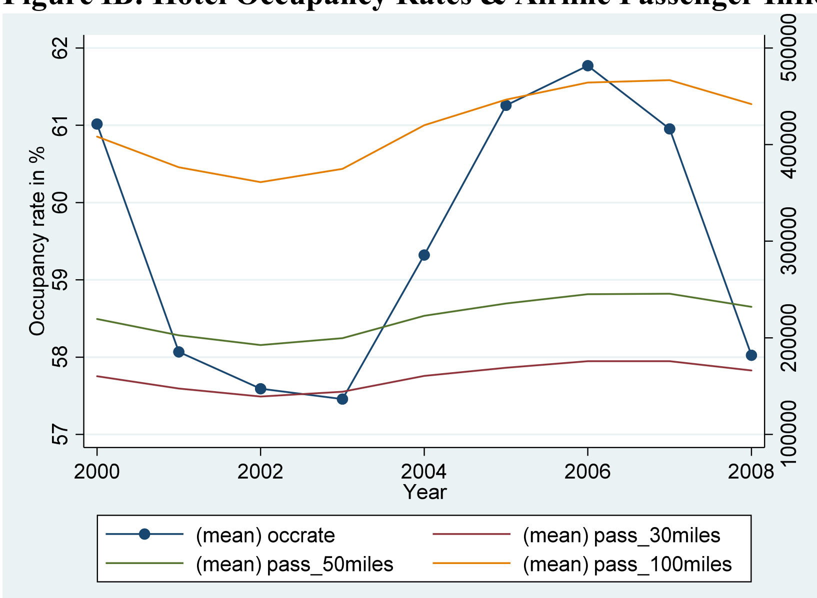

Figure 1C: Hotel RevPAR & Airline Passenger Inflows, 2000-2008.

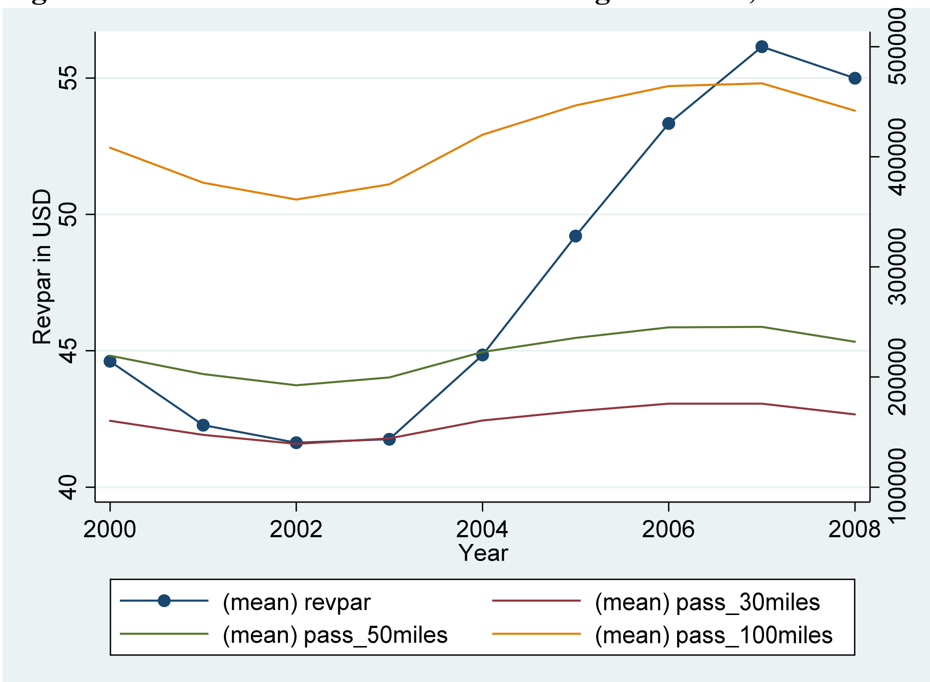

Figure 2: Passengers by Type over Time

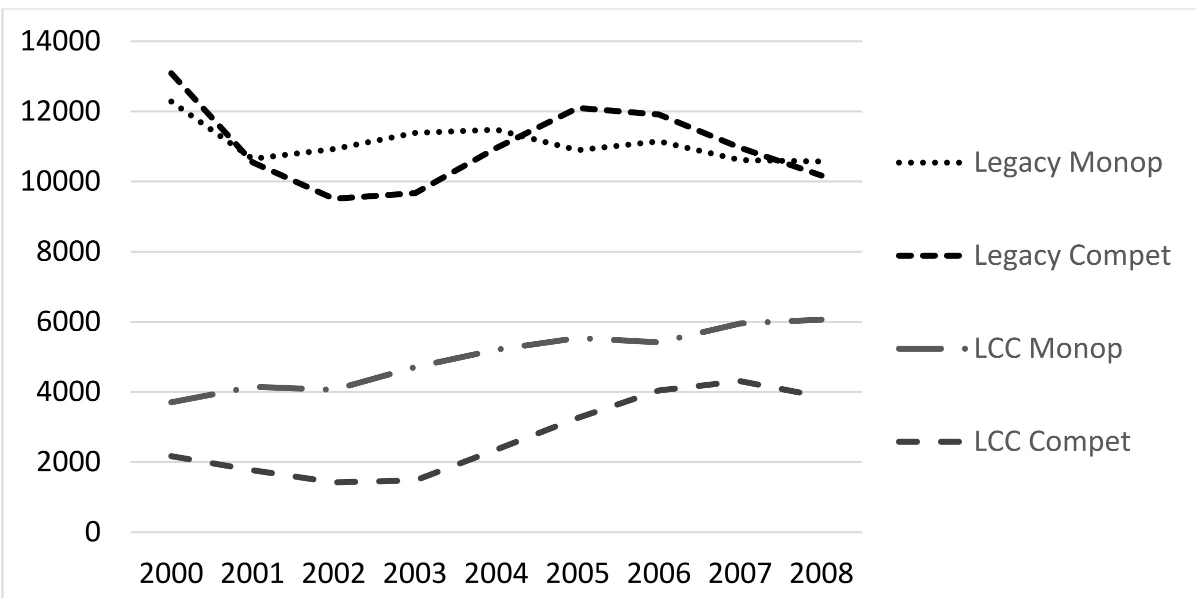

Figure 3: Instruments - Exclusion Restriction.
Airline's entry into route (B-D) or (C-E) or (C-F) routes is not driven by local shocks in a focal airport A.

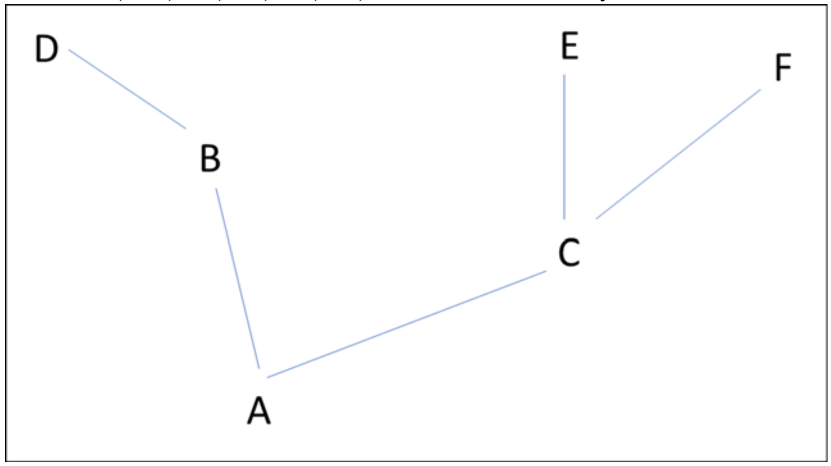

Table 1: Summary Statistics, 2000-2008.

Variable	Obs	Mean	Std. Dev.	Min	Max
Hotel Characteristics					
Revenue per available room (RevPAR)	221,734	48.18	34.60	0.82	798.67
Occupancy Rate	221,734	59.60	15.50	2.04	102.76
(Room) Price	221,734	77.13	44.64	12.66	1,490.26
Rooms	221,734	121.85	119.15	4	3437
Age	221,734	18.68	16.43	1	348
County/Market Characteristics					
(Median HH) Income	221,734	46,750	11,953	17,366	111,582
Unemployment Rate (%)	221,734	5.00	1.54	1.4	22.4
Population	221,734	786,243	1,450,522	607	9,808,494
Accommodation establishments	221,734	128.84	185.31	1	1,260
AE&R employment	221,734	6,588.24	12,550.04	0	85,996
Food & Beverage employment	221,734	26,633.48	44,331.63	0	309,550
Airlines Spillover Variables (all in 10,000's)					
Passengers arriving within 30 miles	221,734	165.90	264.36	0	1,272.99
Passengers arriving within 50 miles	221,734	223.10	317.62	0	1,532.22
Passeng. within 50 miles / Accom. estab.	221,734	2.99	9.09	0	591.76
of those: traveling on competitive routes	221,734	1.65	5.75	0	446.56
of those: traveling on low-cost carriers	221,734	1.05	2.88	0	168.37
Instruments					
Average 1-stop connecting routes for airports within 30 miles	221,734	3.84	3.39	0	9.25
Average 1-stop connecting routes for airports within 50 miles	221,734	4.63	3.18	0	9.25
of those: competitive routes	221,734	2.27	1.97	0	7.29
of those: low-cost carrier routes	221,734	1.72	1.63	0	6.67

Table 2A: Fixed Effects Regression, 2000-2008, Log(RevPAR)

	(1)	(2)	(3)	(4)
Passengers, 30m	0.00043			
	[0.00053]			
Passengers, 50m		0.00034		
		[0.00027]		
Log(Passengers, 30m)			0.15^{***}	
			[0.019]	
Log(Passengers, 50m)				0.080^{***}
				[0.013]
Log(Rooms)	-0.17^{***}	-0.17^{***}	-0.17^{***}	-0.17^{***}
	[0.019]	[0.019]	[0.019]	[0.019]
Log(Age)	0.26^{***}	0.26^{***}	0.26^{***}	0.26^{***}
	[0.0047]	[0.0047]	[0.0047]	[0.0047]
Log(Population)	0.28^{***}	0.28^{***}	0.28^{***}	0.28^{***}
	[0.078]	[0.078]	[0.076]	[0.077]
Log(Income)	0.53^{***}	0.53^{***}	0.53^{***}	0.53^{***}
	[0.039]	[0.039]	[0.038]	[0.039]
Unempl. Rate	-0.053^{***}	-0.053^{***}	-0.052^{***}	-0.053^{***}
	[0.0020]	[0.0020]	[0.0020]	[0.0020]
Log(AE&R empl.)	-0.0019	-0.0019	-0.0016	-0.0018
	[0.0012]	[0.0012]	[0.0012]	[0.0012]
Log(F&B empl.)	-0.0033^{**}	-0.0033^{**}	-0.0032^{**}	-0.0027^{*}
	[0.0016]	[0.0016]	[0.0016]	[0.0016]
Constant	0.61	0.61	0.53	0.56
	[0.38]	[0.38]	[0.38]	[0.38]
Hotel Fixed Effects	Yes	Yes	Yes	Yes
Org.form dummies	Yes	Yes	Yes	Yes
Segment-Year dummies	Yes	Yes	Yes	Yes
Observations	221734	221734	221734	221734
R^2	0.298	0.298	0.300	0.299
No. of hotels	31491	31491	31491	31491
No. of zips (clusters)	7783	7783	7783	7783

Robust standard errors in brackets, adjusted for heteroscedasticity and clusters at hotel zip-code level.
Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2B: Fixed Effects Regression, 2000-2008, Log(Price)

	(1)	(2)	(3)	(4)
Pass per hotel, 30m	0.00011			
	[0.00011]			
Pass per hotel, 50m		-0.000020		
		[0.000087]		
Log(Pass per hotel, 30m)			0.039^{***}	
			[0.010]	
Log(Pass per hotel, 50m)				0.017^{**}
				[0.0071]
Log(Rooms)	-0.015^{*}	-0.015^{*}	-0.015^{*}	-0.015^{*}
	[0.0088]	[0.0088]	[0.0089]	[0.0088]
Log(Age)	0.011^{***}	0.011^{***}	0.011^{***}	0.011^{***}
	[0.0020]	[0.0020]	[0.0020]	[0.0020]
Log(Population)	0.18^{***}	0.18^{***}	0.18^{***}	0.18^{***}
	[0.037]	[0.037]	[0.037]	[0.037]
Log(Income)	0.42^{***}	0.42^{***}	0.42^{***}	0.42^{***}
	[0.021]	[0.021]	[0.021]	[0.021]
Unempl. Rate	-0.019^{***}	-0.019^{***}	-0.019^{***}	-0.019^{***}
	[0.00098]	[0.00098]	[0.00099]	[0.00099]
Log(AE&R empl.)	-0.00038	-0.00039	-0.00032	-0.00037
	[0.00064]	[0.00064]	[0.00065]	[0.00065]
Log(F&B empl.)	-0.000060	-0.000066	-0.000023	0.000065
	[0.00057]	[0.00057]	[0.00057]	[0.00057]
Constant	1.79^{***}	1.79^{***}	1.77^{***}	1.78^{***}
	[0.19]	[0.19]	[0.19]	[0.19]
Hotel Fixed Effects	Yes	Yes	Yes	Yes
Org.form dummies	Yes	Yes	Yes	Yes
Segment-Year dummies	Yes	Yes	Yes	Yes
Observations	221734	221734	221734	221734
R^2	0.482	0.482	0.483	0.482
No. of hotels	31491	31491	31491	31491
No. of zips (clusters)	7783	7783	7783	7783

Robust standard errors in brackets, adjusted for heteroscedasticity and clusters at hotel zip-code level.
Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2C: Fixed Effects Regression, 2000-2008, Occupancy Rate.

	(1)	(2)	(3)	(4)
Pass per hotel, 30m	0.017			
	[0.026]			
Pass per hotel, 50m		0.015		
		[0.014]		
Log(Pass per hotel, 30m)			6.16***	
			[0.70]	
Log(Pass per hotel, 50m)				3.27***
				[0.49]
Log(Rooms)	-7.77***	-7.77***	-7.81***	-7.80***
	[0.68]	[0.68]	[0.68]	[0.68]
Log(Age)	11.7***	11.7***	11.8***	11.8***
	[0.17]	[0.17]	[0.17]	[0.17]
Log(Population)	5.75**	5.75**	5.60**	5.64**
	[2.39]	[2.39]	[2.32]	[2.35]
Log(Income)	5.06***	5.06***	5.19***	5.06***
	[1.32]	[1.32]	[1.31]	[1.31]
Unempl. Rate	-2.00***	-2.00***	-1.96***	-1.98***
	[0.073]	[0.073]	[0.074]	[0.073]
Log(AE&R empl.)	-0.12***	-0.12***	-0.11***	-0.12***
	[0.039]	[0.039]	[0.039]	[0.039]
Log(F&B empl.)	-0.12*	-0.12*	-0.12*	-0.097
	[0.070]	[0.070]	[0.070]	[0.070]
Constant	31.3***	31.2***	28.0**	29.1**
	[12.1]	[12.1]	[12.0]	[12.0]
Hotel Fixed Effects	Yes	Yes	Yes	Yes
Org.form dummies	Yes	Yes	Yes	Yes
Segment-Year dummies	Yes	Yes	Yes	Yes
Observations	221734	221734	221734	221734
R^2	0.172	0.172	0.174	0.173
No. of hotels	31491	31491	31491	31491
No. of zips (clusters)	7783	7783	7783	7783

Robust standard errors in brackets, adjusted for heteroscedasticity and clusters at hotel zip-code level.
Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3A: Instrumental Variables Regression, 2000-2008, Log(RevPAR)

	(1)	(2)	(3)	(4)
Passengers, 30m	0.16^{***}			
	[0.019]			
Passengers, 50m		0.10^{***}		
		[0.014]		
Log(Passengers, 30m)			1.41^{*}	
			[0.72]	
Log(Passengers, 50m)				2.89^{*}
				[1.61]
Log(Rooms)	-0.16^{***}	-0.16^{***}	-0.18^{***}	-0.20^{***}
	[0.022]	[0.021]	[0.022]	[0.031]
Log(Age)	0.26^{***}	0.26^{***}	0.26^{***}	0.28^{***}
	[0.0099]	[0.0079]	[0.0059]	[0.013]
Log(Population)	0.50^{**}	0.48^{***}	0.26^{***}	0.21
	[0.22]	[0.16]	[0.079]	[0.13]
Log(Income)	0.48^{***}	0.46^{***}	0.56^{***}	0.53^{***}
	[0.065]	[0.058]	[0.051]	[0.081]
Unempl. Rate	-0.046^{***}	-0.049^{***}	-0.044^{***}	-0.036^{***}
	[0.0039]	[0.0034]	[0.0059]	[0.011]
Log(AE&R empl.)	0.0054	0.0011	0.00063	0.0020
	[0.0039]	[0.0034]	[0.0019]	[0.0046]
Log(F&B empl.)	0.0015	0.0088	-0.0019	0.018
	[0.0057]	[0.0074]	[0.0022]	[0.013]
Constant	-0.78	-0.70	-0.17	-1.47
	[1.07]	[0.80]	[0.68]	[1.29]
Hotel Fixed Effects	Yes	Yes	Yes	Yes
Org.form dummies	Yes	Yes	Yes	Yes
Segment-Year dummies	Yes	Yes	Yes	Yes
Observations	221734	221734	221734	221734
No. of hotels	31491	31491	31491	31491
No. of zips (clusters)	7783	7783	7783	7783

Robust standard errors in brackets, adjusted for heteroscedasticity and clusters at hotel zip-code level.
Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3B: Instrumental Variables Regression, 2000-2008, Log(Price)

	(1)	(2)	(3)	(4)
Pass per hotel, 30m	0.089***			
	[0.010]			
Pass per hotel, 50m		0.059***		
		[0.0074]		
Log(Pass per hotel, 30m)			1.01**	
			[0.44]	
Log(Pass per hotel, 50m)				2.02*
				[1.09]
Log(Rooms)	-0.012	-0.014	-0.022*	-0.036*
	[0.011]	[0.011]	[0.013]	[0.021]
Log(Age)	0.013**	0.014***	0.015***	0.023***
	[0.0054]	[0.0042]	[0.0032]	[0.0086]
Log(Population)	0.30**	0.29***	0.16***	0.13
	[0.12]	[0.088]	[0.047]	[0.091]
Log(Income)	0.39***	0.38***	0.44***	0.42***
	[0.037]	[0.033]	[0.032]	[0.055]
Unempl. Rate	-0.015***	-0.016***	-0.012***	-0.0068
	[0.0022]	[0.0018]	[0.0036]	[0.0074]
Log(AE&R empl.)	0.0038*	0.0013	0.0014	0.0024
	[0.0022]	[0.0019]	[0.0014]	[0.0031]
Log(F&B empl.)	0.0027	0.0068	0.00099	0.015*
	[0.0032]	[0.0042]	[0.0012]	[0.0088]
Constant	1.00*	1.05**	1.22***	0.32
	[0.60]	[0.44]	[0.41]	[0.88]
Hotel Fixed Effects	Yes	Yes	Yes	Yes
Org.form dummies	Yes	Yes	Yes	Yes
Segment-Year dummies	Yes	Yes	Yes	Yes
Observations	221734	221734	221734	221734
No. of hotels	31491	31491	31491	31491
No. of zips (clusters)	7783	7783	7783	7783

Robust standard errors in brackets, adjusted for heteroscedasticity and clusters at hotel zip-code level.
Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3C: Instrumental Variables Regression, 2000-2008, Occupancy Rate.

	(1)	(2)	(3)	(4)
Pass per hotel, 30m	3.63***			
	[0.58]			
Pass per hotel, 50m		2.38***		
		[0.44]		
Log(Pass per hotel, 30m)			17.5	
			[16.4]	
Log(Pass per hotel, 50m)				37.4
				[32.4]
Log(Rooms)	-7.66***	-7.75***	-7.89***	-8.17***
	[0.72]	[0.71]	[0.70]	[0.76]
Log(Age)	11.8***	11.9***	11.8***	12.0***
	[0.26]	[0.22]	[0.19]	[0.28]
Log(Population)	10.7**	10.3***	5.37**	4.72*
	[5.27]	[3.93]	[2.24]	[2.58]
Log(Income)	3.84**	3.39**	5.43***	5.03***
	[1.78]	[1.66]	[1.39]	[1.59]
Unempl. Rate	-1.84***	-1.89***	-1.88***	-1.78***
	[0.11]	[0.099]	[0.15]	[0.22]
Log(AE&R empl.)	0.045	-0.054	-0.092**	-0.072
	[0.093]	[0.081]	[0.043]	[0.077]
Log(F&B empl.)	-0.0097	0.15	-0.10	0.16
	[0.15]	[0.18]	[0.072]	[0.26]
Constant	-0.84	1.45	21.6	4.30
	[26.0]	[20.2]	[16.1]	[25.9]
Hotel Fixed Effects	Yes	Yes	Yes	Yes
Org.form dummies	Yes	Yes	Yes	Yes
Segment-Year dummies	Yes	Yes	Yes	Yes
Observations	221734	221734	221734	221734
No. of hotels	31491	31491	31491	31491
No. of zips (clusters)	7783	7783	7783	7783

Robust standard errors in brackets, adjusted for heteroscedasticity and clusters at hotel zip-code level.
Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: Instrumental Variables Regressions, 2000-2008, Interactions with Passenger Type

Panel A: Log(RevPAR)

	(1)	(2)	(3)	(4)
Pass per hotel, 50m	0.10***	0.16***	0.13***	0.16***
	[0.014]	[0.027]	[0.015]	[0.025]
Pass p.h. on compet. route		-0.056***		-0.039***
		[0.016]		[0.013]
Pass p.h. on LCC			-0.10***	-0.10***
			[0.014]	[0.015]

Panel B: Log(Price)

	(1)	(2)	(3)	(4)
Pass per hotel, 50m	0.059***	0.099***	0.070***	0.10***
	[0.0074]	[0.015]	[0.0080]	[0.014]
Pass p.h. on compet. route		-0.042***		-0.032***
		[0.0094]		[0.0075]
Pass p.h. on LCC			-0.054***	-0.057***
			[0.0077]	[0.0089]

Panel C: Occupancy Rate

	(1)	(2)	(3)	(4)
Pass per hotel, 50m	2.38***	3.00***	2.92***	3.15***
	[0.44]	[0.81]	[0.49]	[0.80]
Pass p.h. on compet. route		-0.65		-0.23
		[0.46]		[0.39]
Pass p.h. on LCC			-2.62***	-2.64***
			[0.37]	[0.40]
Observations	221734	221734	221734	221734
No. of hotels	31491	31491	31491	31491
No. of zips (clusters)	7783	7783	7783	7783

Robust standard errors in brackets, adjusted for heteroscedasticity and clusters at hotel zip-code level. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Controls from Table 2 included in all the regressions.

Table 5: Instrumental Variables Regressions, 2000-2008, by Hotel Segment

Panel A: Log(RevPAR)

	(1) Branded, High Quality	(2) Branded, Lower Quality	(3) Unbranded
Pass per hotel, 50m	0.24***	0.15***	0.27***
	[0.065]	[0.024]	[0.095]
Pass p.h. on compet route	-0.069**	-0.032**	-0.10**
	[0.028]	[0.013]	[0.048]
Pass p.h. on LCC	-0.17***	-0.088***	-0.18***
	[0.044]	[0.014]	[0.052]

Panel B: Log(Price)

	(1) Branded, High Quality	(2) Branded, Lower Quality	(3) Unbranded
Pass per hotel, 50m	0.18***	0.089***	0.19***
	[0.043]	[0.013]	[0.063]
Pass p.h. on compet route	-0.064***	-0.028***	-0.070**
	[0.019]	[0.0071]	[0.031]
Pass p.h. on LCC	-0.12***	-0.045***	-0.12***
	[0.030]	[0.0081]	[0.035]

Panel C: Occupancy Rate

	(1) Branded, High Quality	(2) Branded, Lower Quality	(3) Unbranded
Pass per hotel, 50m	2.07	3.08***	5.11*
	[1.90]	[0.83]	[2.79]
Pass p.h. on compet route	0.25	-0.18	-2.27
	[0.79]	[0.42]	[1.45]
Pass p.h. on LCC	-2.48**	-2.49***	-3.41**
	[1.05]	[0.40]	[1.38]
Observations	35513	168325	17896
No. of hotels	5526	24279	5467
No. of zips (clusters)	2322	6975	3135

Robust standard errors in brackets, adjusted for heteroscedasticity and clusters at hotel zip-code level. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Controls from Table 2 included in all the regressions.

Table 6: Tourist vs. Non-tourist destinations: IV Regressions, 2000-2008.

	Log(RevPAR)		Log(Price)		Occupancy Rate	
	Tourist	*Non-Tourist*	*Tourist*	*Non-Tourist*	*Tourist*	*Non-Tourist*
Pass per hotel, 50m	0.28***	0.15***	0.24***	0.088***	1.20	3.06***
	[0.10]	[0.025]	[0.075]	[0.013]	[3.20]	[0.84]
Pass p.h. on compet	-0.056	-0.035***	-0.064*	-0.028***	0.83	-0.24
route	[0.047]	[0.013]	[0.033]	[0.0070]	[1.23]	[0.41]
Pass p.h. on LCC	-0.19***	-0.089***	-0.14***	-0.047***	-2.32	-2.43***
	[0.068]	[0.015]	[0.049]	[0.0084]	[1.86]	[0.41]
Observations	25774	195960	25774	195960	25774	195960
No. of hotels	3838	27653	3838	27653	3838	27653
No. of zips (clusters)	1001	6784	1001	6784	1001	6784

Robust standard errors in brackets, adjusted for heteroscedasticity and clusters at hotel zip-code level. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Controls from Table 2 included in all the regressions.

Table 7: Hotel Entry Rate per County & Zip-Code, Fixed Effects Regressions, 2000-2008.

	Entry Rate(t) per County		*Entry Rate(t) per Zip-code*	
	OLS results	IV results	OLS results	IV results
Passengers, 50m(t-1)	0.0023	0.051**	0.0023	0.033***
	[0.0051]	[0.022]	[0.0021]	[0.011]
Pass on compet. route(t-1)	-0.0037	-0.030**	-0.0012	-0.014***
	[0.0058]	[0.013]	[0.0019]	[0.0049]
Pass on LCC(t-1)	-0.0057	-0.026*	-0.0087***	-0.024***
	[0.0064]	[0.016]	[0.0025]	[0.0068]
Observations	21184	21184	81441	81441
R^2	0.008		0.005	
No. of counties/zips	2749	2749	11096	11096

Robust standard errors in brackets, adjusted for heteroscedasticity and clusters at county level in Columns 1-2 and zip-code level in Columns 3-4. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Lagged values of county level controls from Table 2 (Population, Income, Unempl. rate and Employment in three related industries) included in all the regressions.

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Appendix A1: Variable Definitions

Variable	Definition
Hotel Characteristics	
RevPAR	Revenue Per Available Room (in $) – annual average of hotel monthly RevPAR values, defined as: total hotel revenues earned from all room-nights sold during a given month divided by the number of room-nights available during that month.
Occupancy Rate	Occupancy Rate (in %) – annual average of hotel monthly occupancy rates, defined as: percentage of hotel rooms sold out of hotel rooms available in a given month.
(Room) Price	Price per room (in $) - annual average of hotel monthly "Average Daily Rates", defined as: total hotel monthly room revenues divided by room-nights sold.
Age	Number of years since the year of hotel opening – defined as current year minus year of opening +1.
Rooms	Hotel size/capacity - number of rooms in a hotel in a given year.
Hotel/Quality Segments: (see Freedman & Kosová, 2012 (Table 1)).	
Branded Hotels	
Luxury/Upper Upscale	Elegant, distinctive, highest quality decor, upscale restaurants, full range of first-class amenities and customized services. Since there are very few luxury hotels, we combine luxury (e.g., Four Seasons, Fairmont, Ritz-Carlton) and Upper Upscale hotels (e.g. Marriott, Wyndham, Sheraton) into this category.
Upscale	Well-integrated decor, quality furnishings, premium guestroom amenities and facilities, high staff to guest ratio. Example: Courtyard, Residence Inn, Crowne Plaza.
Midscale w/ F&B	Nicely appointed rooms, range of facilities, good-quality amenities, some special services available, restaurants. Example: Holiday Inn, Best Western.
Midscale w/o F&B	Nicely appointed rooms, range of facilities may be limited, good-quality amenities. Example: Comfort Inn, Hampton Inn, Holiday Inn Express
Economy	Clean and comfortable, minimum of services and amenities. Example: Microtel Inn, Motel 6, Days Inn.
Unbranded Hotels	No brand affiliation or corporate support, no quality benchmark, heterogeneous quality and range of amenities and services.
Organizational/Operation Form	
Company Managed	Hotel operated by hotel company employees.

Franchise	Hotels operated by franchisees, belonging to a franchise chain.
Independent	Hotels operated by independent (mostly unaffiliated) operators (e.g., family B&B)
County/Market Characteristics:	
Population	Annual county population.
Income	Annual Median Household Income in the county.
Unemployment Rate	Annual unemployment rate in the county (in %).
Hotels in a County	The number of hotels in the county in a given year (numbers derived from STR census database).
AE&R empl.	Annual county employment in the arts, entertainment & recreation industry.
F&B empl.	Annual county employment the restaurants, food & beverage services industry.
Airline Spillover Variables:	
Passengers 30m (Passengers 50m)	Sum of all (domestic) passengers that arrived into the vicinity of 30 miles (50 miles) of a hotel's zip-code in a given year (since original airline data are quarterly, we summed quarterly data over the year).
Passengers on competitive route	Number of arriving passengers who traveled on routes served by at least two carriers
Passengers on LCC	Number of passengers who traveled on a low-cost carrier
(Used as Instrument): Connecting 1-stop routes.	Number of destinations that can be reached with 1-stop routes from the airports within 30 miles (50 miles) of a given hotel's zip-code, in a given year.

Appendix A2: First-Stage Regressions for IV Estimations in Table 4.

Col. in Tab. 4	(1)	(2)		(3)		(4)		
Instrumented Var.	Pass per hotel, 50m	Pass per hotel, 50m	Pass p.h. on Compet. Route	Pass per hotel, 50m	Pass p.h. on LCC	Pass per hotel, 50m	Pass p.h. on Compet. Route	Pass p.h. on LCC
IVs:								
Connecting 1-stop routes, 50m	0.287*** [0.024]	0.125*** [0.025]	- 0.082*** [0.017]	0.181*** [0.029]	- 0.147*** [0.129]	0.051 [0.034]	- 0.124*** [0.024]	- 0.170*** [0.015]
Connecting 1-stop routes x Compet. Route, 50m		0.301*** [0.040]	0.659*** [0.034]			0.265*** [0.036]	0.639*** [0.032]	0.045*** [0.016]
Connecting 1-stop routes x LCC, 50m				0.004* [0.0006]	0.007*** [0.0003]	0.003*** [0.0006]	0.002*** [0.0004]	0.007*** [0.0003]
Controls	YES	YES	YES	YES	YES	YES	YES	YES
F-stat for joint sign. IVs		77.9***	190.3***	88.4***	262.8***	61.9***	143.8***	191.1***
Observations	221734							
No. of hotels	31491							
No. of zips (clusters)	7783							

Robust standard errors in brackets, adjusted for heteroscedasticity and clusters at hotel zip-code level. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. *Controls* from Table 2 included in all the regressions.