



## Research paper

## The effects of Airbnb's price positioning on hotel performance

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## ABSTRACT

This study examined the relationship between the price positioning of Airbnb listings, measured in price difference between a hotel property and the nearby Airbnb listings as well as price dispersion among these Airbnb listings, and the performance of nearby hotels. An exploratory analysis using field data points collected from the Airbnb listings and their hotel counterparts in the metropolitan area of Austin, Texas between Quarter 3, 2008 (debut of Airbnb in Austin) and Quarter 2, 2011 reveals intriguing findings. The entry of Airbnb listings was penetrative to local hotels. However, the price positioning of Airbnb, manifested in higher average price as compared to nearby hotels, as well as larger price dispersion among individual listings, significantly mitigated such penetration. Important theoretical contributions and practical implications for hotels are discussed.

## 1. Introduction

“Sharing economy” builds on the ideology of making good use of underused resources among consumers (Botsman and Rogers, 2011). When underused resources are shared among peers or other consumers, additional value can be created (Koopman et al., 2015). In fact, the idea of sharing resources is not new, but today's technology makes it possible for entrepreneurs to scale up the sharing economy in a virtual marketplace (Katz, 2015). Airbnb, for example, is one of the most successful models in sharing economy. Founded in 2008, Airbnb allows travelers to connect with local residents who are willing to rent out an extra bed/bedroom or an entire house. As of December 2016, the company has recorded more than 2 million listings and entered over 34,000 cities in 191 counties (Airbnb, 2016). Meanwhile, the world's largest hotel company, Marriott and Starwood combined, only has approximately 5500 properties and 1.1 million rooms (Karmin and Hoffman, 2015).

Amid the rapid growth of Airbnb, academic researchers and professional analysts alike have weighed in a torrent of debates regarding the impact of the “room-sharing phenomenon” on the hotel industry. Table 1 highlights a few recent reports and discussions about Airbnb's impact. The findings, however, are surprisingly mixed. While several studies have reported Airbnb's considerably negative impact on the hotel industry (Corsun et al., 2016; HVS, 2015; Lane and Woodworth,

2016; Zervas et al., 2016), a similar number of studies have claimed the impact remains negligible (Alvarado et al., 2016; Haywood, 2016; Haywood et al., 2016; Wroten, 2015). Some industry professionals cast doubt on these mixed findings and challenged some of the analyses on several grounds, including conflicts of interest involving room sharing platforms in data analysis,<sup>1</sup> methodology rigor (mostly descriptive studies), and the oversight of such confounding factors as price comparison among Airbnb listings and hotels, which could cause bias in the analysis.

Referring to Marshall's classic pricing theory in economics (Ekelund & Hébert, 2013), goods with similar attributes are usually sold in similar prices in a competitive market, where the price mechanism can be used to explain the dynamic interactions between supplies and demands (e.g., how the equilibrium price may change according to the supplies and demands, and vice versa). Price is a very important variable in analyzing supplies and demands. For lodging products in particular, price, as measured in average daily rate or ADR, is perceived as a fundamental variable in hotel performance evaluations and used in the Smith Travel Research (STR) scale schemes for segmentation (STR, 2016). Furthermore, because consumers often perceive price as the most influential factor in their purchasing decision for a stay in a limited-service hotel and one of the most important influential factors for a full-service hotel stay (Tanford et al., 2012), information regarding the differences in price among hotels and nearby Airbnb listings has also

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<sup>1</sup> Industry practitioners continue to attack recent research on room sharing services by STR.Inc. One industry observer commented, “There is so much wrong here I barely know where to start. Two small hotel companies are mentioned to represent all of NY and no discussion of depressed rates. I can only assume the author has a relationship with Airbnb.” Source: <http://www.hotelnewsnow.com/Articles/64225/Right-scale-mix-equals-strong-quarter-for-China-Lodging>. For many, the data used by STR in these articles was “cooked up.” Source: [http://hotelmkt.com/index.php/content/article/hotel\\_industry\\_disputes\\_report\\_about\\_airbnbs\\_impact\\_in\\_nyc](http://hotelmkt.com/index.php/content/article/hotel_industry_disputes_report_about_airbnbs_impact_in_nyc)

**Table 1**  
A Review of Impact Studies with Mixed Findings.

Research Team	Research Sponsor	Data Source	Research Context/Data/Analysis Method	Key Findings
Winkle and Haywood (2015)	STR Inc. <sup>a</sup>	<a href="http://insideairbnb.com">insideairbnb.com</a>	Airbnb's entry to London, UK/Hotel performance data for the 12 months ending 31 August 2015 and Airbnb listing data gathered on 3 September 2015/Descriptive analysis	Airbnb significantly penetrates the London market at price points above that of average hotel units.
HVS (2015)	Hotel Association of New York City	TS Worldwide, LLC and <a href="http://airdna.com">airdna.com</a>	Airbnb's entry to New York, U.S./Hotel performance and Airbnb listing data from September 2014 through August 2015/Descriptive Analysis	Airbnb has cost New York an estimated \$451 million in lost hotel revenue over the 12 months. The total cost to New York is \$2.1 billion, including the impact on the construction industry and lost tax revenue.
Zervaset al.(2016)	Independent Researchers	STR Inc.	Airbnb's entry in Texas, US/10; 555 hosts and 13,935 listings from 2008 to August 2014/Econometric Analysis	The negative impact of Airbnb on hotel revenue is in the 8–10% range, with lower-priced hotels and those hotels not catering to business travelers being most influenced.
O'Neill and Ouyand (2016)	American Hotel & Lodging Association (AH & LA)	<a href="http://airbnb.com">airbnb.com</a>	Airbnb's entry to 12 US cities/Airbnb listing data in 12 major U.S. cities from September 2014 through September 2015/Descriptive Analysis	Nearly 30 percent (\$378 million) of Airbnb's total revenue in the market it enters came from "full-time operators," with rentals illegally available at least 360 days a year.
Wroten (2015)	STR Inc.	<a href="http://insideairbnb.com">insideairbnb.com</a>	Airbnb's entry to New York, U.S./Interviews with local hoteliers in October 2015/Content analysis	Despite the Airbnb entry, hotel occupancy, average daily rate, and revenue kept growing in the New York City.
Lane and Woodworth (2016)	CBRE Hotels <sup>b</sup>	STR.Inc. and <a href="http://airdna.com">airdna.com</a>	Airbnb's entry to U.S. markets/Compiled selective information for hundreds of U.S. markets in 2015/Descriptive analysis	New York was the number one domestic market at risk from the growth of Airbnb, followed by San Francisco, Miami, Oakland, and Oahu.
Haywood et al. (2016)	STR Inc.	Airbnb. Inc.	Airbnb's entry to Manhattan, New York/Airbnb and hotel daily data (supply, demand, revenue) from 1 December 2013–30 November 2015/Descriptive Analysis	Airbnb sales do not materially affect hotel performance in Manhattan, New York.
Alvaradoet al. (2016)	STR Inc.	Airbnb. Inc.	Airbnb's entry to boroughs of New York City/Airbnb and hotel daily data (supply, demand, revenue) from 1 December 2013–30 November 2015/Descriptive Analysis	Airbnb units in the boroughs of New York City (of the Bronx, Brooklyn, Queens and Staten Island) do not significantly affect key performance indicators of hotels.
Haywood (2016)	STR Inc.	Airbnb. Inc.	Airbnb's entry to Manhattan/New York City/Airbnb and hotel daily data (supply, demand, revenue) from 1 December 2013–30 November 2015/Descriptive Analysis	Airbnb units have little effect on the competition for business during compression nights.
Corsun et al. (2016)	Denver City Council	Survey data collected with local patrons of Vacation Rentals by Owner (VRBO) in Denver	Short-term rentals' entry to Denver, U.S./Over 400 short-term renters in 2016/Descriptive Analysis	Denver is missing out on least \$2 million in tax revenue annually from short-term rentals.

<sup>a</sup> STR, formerly known as Smith Travel Research, is an American company based in Hendersonville, Tennessee that tracks supply and demand data for multiple market sectors, including the global hotel industry. Source: <https://www.str.com/>.

<sup>b</sup> CBRE is the world's largest commercial real estate services firm, with 449 offices in more than 60 countries. Source: <http://www.cbrehotels.com/EN/aboutus/Pages/about-us.aspx>.

been used by online booking websites (e.g., [Busbud.com](https://www.busbud.com))<sup>2</sup> to assist travelers in making an informed purchasing decision. Hence, the price positioning of Airbnb listings in a market should not be ignored when analyzing Airbnb's impact to the hotel industry.

Additionally, prices of Airbnb listings are solely determined by individual hosts, whereas hotels have widely adopted the sophisticated revenue-management practices in managing ADR and room inventory. Even though Airbnb provides "smart pricing"<sup>3</sup>; guidance to hosts if there is a need to re-set or modify the listing prices in a market, it is still up to the individual hosts to decide how much they want to charge and when they want to adjust the price based on their own observations and personal judgments. Under such user-driven decision-making process, hosts of Airbnb are empowered to personalize their listings with price as well as the product's physical and service attributes; but at the same time, they are also subject to irrational decision making on the listing price due to inherent host heterogeneity. How such host-driven price decisions, as reflected on Airbnb's price positioning, would affect the competitive landscape among Airbnb listings and hotels remains unknown and less explored.

The objective of this study is to investigate the effect of Airbnb's price positioning on the performance of nearby hotels. Drawing from the economic and marketing literature, we used price difference and price dispersion to assess the impact of Airbnb's price positioning on hotel performance. By definition, price difference measures how a hotel's price compares against that of its competitors (Enz et al., 2009; Lee, 2015); and price dispersion can be referred as the variation of price points of the same product (Balaguer and Pernías, 2013; Kim et al., 2014). Studies show that hotels that maintain a higher ADR than their competitors (price difference) and those with a focused price orientation (smaller price dispersion) tend to achieve better performance in the long term (Kim et al., 2016; Noone et al., 2013). To address the objective of this study, we proposed the following research questions for empirical analysis:

(1) What is the impact of the Airbnb supply on the performance of hotel counterparts in the market?

(2) How would such impact be moderated by the price positioning, in terms of price difference and price dispersion, of Airbnb listings in each zip code?

Meanwhile, current literature suggests that hotel quality may also moderate the impact of Airbnb supply, where lower-tiered hotels are more likely to be affected by Airbnb while higher-tiered hotels are less influenced (Zervas et al., 2016). As far as a hotel's quality is concerned, consumers often draw their references from its physical and service attributes as described in the industry standard (e.g., hotel class scheme) (Kim and Canina, 2011; Xu and Li, 2016) as well as from the perceived quality expressed in online word-of-mouth (Kwok and Yu, 2013; Xie et al., 2014). Therefore, we also included the quality of hotels, in terms of the hotel class as well as average ratings of online reviews, as another moderator when examining the impact of Airbnb supply on hotels of various qualities. Hence, our third research question is:

(3) How would the impact of Airbnb supply on hotel performance be moderated by the quality attributes such as class and average review ratings of hotel counterparts in each zip code?

To answer the three research questions above, we collected a unique online observational dataset of 86 hotels on TripAdvisor.com and 63 Airbnb listings posted on Airbnb.com in of the market of Austin, Texas, over a period from Quarter 2, 2008 to Quarter 2, 2011 (12 quarters). For each of the hotel properties in Austin, we first estimated the effect of Airbnb supply on its revenue per available room (RevPAR) performance. We then estimated the moderation effects of the aggregated

price positioning of Airbnb listings in the same zip codes and the hotel's quality attributes on such effect. We controlled specific hotel characteristics that may affect the RevPAR performance in estimations. While there are studies that have reported similar negative impact to hotel performance due to Airbnb's increasing supply (e.g., Zervas et al., 2016), our investigation differs from, yet complements to these studies by examining the effects of Airbnb listings' pricing strategies on hotels' RevPAR performance. It also adds to the pricing literature with new evidence from the sharing economy and exemplifies the use of data analytics approaches to mine insights from large-scale but granular online observational data. Insights from this study add empirical evidence to the debate about Airbnb's impact to the hotel industry, as well as complement the existent preliminary studies about Airbnb with a focus on price positioning. Useful implications on proactive pricing strategies are explicitly provided for hoteliers as hotels and Airbnb will very likely coexist in the market in the long term (Budín, 2015).

## 2. Relevant literature and a proposed model

In the advent of the so-called room sharing economy, researchers have begun to examine its direct impact on the traditional lodging industry (e.g., O'Neill and Ouyand, 2016; Zervas et al., 2016). In addition, trust problems (Ert et al., 2016; Tussyadiah, 2015) as well as discrimination issues (Edelman et al., 2017) on room sharing economy platforms have also been studied. Such emerging literature provides hoteliers valuable insights about the room-sharing phenomenon; however, research in this area requires broader analysis and more immediate scholarly attention (Guttentag, 2015). Particularly, studies that are rooted in established theories and instantiated in rich field data could have the potential of bringing in a clearer picture of what the room-sharing economy really means to the traditional lodging industry. Accordingly, we draw upon Marshall's classic economic theories (Ekelund and Hébert, 2013) and the pricing literature in marketing (Balaguer and Pernías, 2013; Kim et al., 2014) to illustrate the research framework of this study. As the visual diagram in Fig. 1 shows, we first provided a detailed theoretical rationale for the main effect of citywide Airbnb supply on hotel performance in the market (Section 2.1), followed by the discussion of the effects of price difference (the ADR difference between a hotel and the nearby Airbnb listings) and price dispersion (the ADR variation among Airbnb listings) on hotel performance (Section 2.2). We then reported the theoretical and empirical evidence about the effect of quality attributes of hotels, including class and average review ratings, on hotel performance (Section 2.3). In Section 2.4, the moderation effects of Airbnb's price positioning (price difference and price dispersion) and quality attributes of hotels (hotel class and average online review ratings) on the main effect (Section 2.1) were also discussed.

### 2.1. The dynamic interactions among supply, demand, and price

According to Marshall's classic economic theory (Ekelund and Hébert, 2013), economic equilibrium is reached when supply and demand are balanced. The level of supply and demand also determines the balanced price for a product/service sold in a market. Assuming the demand remains unchanged, an increase in supply will shift the supply curve to the right and result in a lower price point in a new economic equilibrium. In the sharing-economy phenomenon, Airbnb provides travelers with additional alternatives for their accommodation needs apart from the traditional option of staying in a hotel. Hotels and the listings on Airbnb in the same market are therefore fighting for the same group of potential consumers (travelers). In other words, any new listings on Airbnb will add to the supply of available lodging options, pushing the supply curve to the right and leading to a lower price point. At the microeconomic level, a lower price point usually means lower profit or lower firm performance if the demand remains the same. Furthermore, evolutionary economists also asserted that Marshall's

<sup>2</sup> Source: <https://www.busbud.com/blog/airbnb-vs-hotel-rates/>.

<sup>3</sup> Airbnb's "Smart Pricing" option, if turned on by hosts, helps them to set the listing price to automatically adjust the daily prices based on the real time demand. Source: <https://www.airbnb.com/help/article/1168/smart-pricing-set-prices-based-on-demand>.

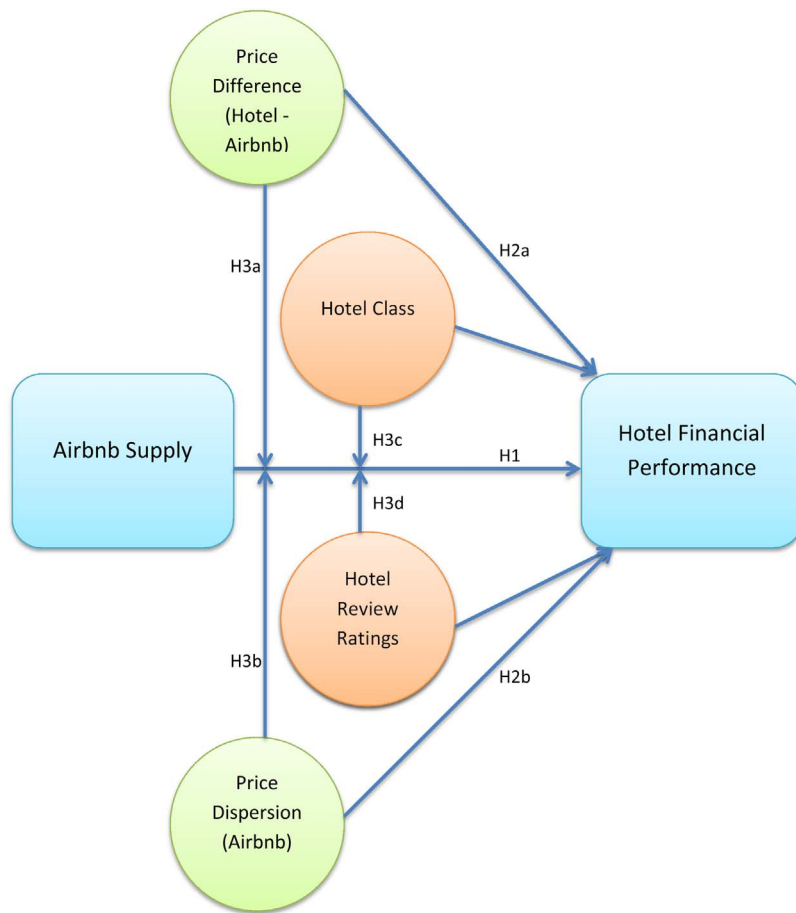


Fig. 1. The Effect of Airbnb's Price Positioning on Hotel Performance – A Proposed Model.

market equilibrium could in fact be disrupted because of emergence of new technology or new modes of business operations, which could result in a dramatic shift in the nature of goods or services provided and/or the costs of producing such products/services (Nelson, 2013). New consumers and new suppliers may also enter the market. In this case, evolutionary economists encourage new analysis for a better understanding of what is really going on in a market. The main effect of Airbnb's supply on hotel performance thus becomes a focal point of our analysis. We propose the following hypothesis for empirical testing:

**H1.** The supply of Airbnb listings negatively impacts the performance of local hotels

## 2.2. Competitive positioning with price difference and price dispersion

The price of a lodging product is usually determined by a variety of influential factors, such as location, star ratings, size of the property, and level of service provided (Sánchez-Ollero et al., 2014). Consequently, a strong correlation between a hotel's room price and the hotel's service quality is often expected (Becerra et al., 2013). For lodging products, price becomes an easily manipulated variable when responding to tough competitions because hotels are essentially fulfilling the same needs for consumers – accommodations (Choi, 1991). In fact, price competition is found particularly salient among the lodging products that are located within a ten-mile radius from one another (Lee, 2015). As a new alternative for accommodations, the listings on Airbnb are also likely to face stiff price competition with other lodging facilities in the same market.

Economists and hospitality scholars usually describe and examine the price competitions among various lodging products with two key variables: “price difference” of a hotel and its competitors (Enz et al.,

2009; Lee, 2015) and “price dispersion” of a product (Balaguer and Pernías, 2013; Kim et al., 2014). Generally, empirical evidence suggests that greater density of competitors in a market will result in lower hotel ADR and less price dispersion (Balaguer and Pernías, 2013). Additionally, hotels that consistently offer higher prices than their competitors tend to have better performance in the long term (Kim et al., 2016; Noone et al., 2013). Such competitive dynamics, however, can also be affected by a firm's strategic orientation. For instance, a hotel with a low-cost strategy (e.g., budget traveler hotels) can possibly gain better performance if it enters a market with a high percentage of high-end hotels (e.g., luxury hotels), whereas a high-end hotel can lose value if it is located close to its lower-end competitors (Canina et al., 2005). Hence, when assessing the effect of Airbnb's price penetration on hotel performance, we also used two similar variables in our analysis, including “price difference,” which is calculated as the gap between a hotel's ADR and the average price of all Airbnb listings in a particular area, as well as “price dispersion,” as measured in price variation among all Airbnb listings. Depending on Airbnb's strategic orientation in the market (e.g., low-cost or high-end alternatives for hotels), we expect these two variables may also have a significant impact on hotel performance and deserve an exploratory analysis. We propose:

**H2a.** Price difference between a hotel and nearby Airbnb listings has a significant impact on the performance of the hotel.

**H2b.** Price dispersion among nearby Airbnb listings has a significant impact on the performance of the hotel.

## 2.3. Quality reflected by hotel class and online review ratings

Lodging products are often put into different categories for comparisons and market analysis (e.g., chain scale by Smith Travel

Research). Not only do hotels of different classes have very distinct operating characteristics (O'Neill et al., 2008), but consumers may also hold very diverse attitudes towards various types of hotels. For example, consumers are found to convey discrepant important attributes among hotels of different class (Rhee and Yang, 2015). Meanwhile, the factors that influence consumer satisfaction and dissatisfaction can be very different among different types of hotels (Xu and Li, 2016). Not surprisingly, hotel class is found to significantly influence consumers' purchasing decisions on a hotel stay (Mattila, 2006) and show different impacts of online reviews on hotel performance as measured in RevPAR (Blad and Sturman, 2014; Xie et al., 2017). It is hence expected that the performance will vary among hotels of different classes. In particular, because ADR is often considered as a very important factor when determining a hotel's class categorization (Kim and Canina, 2011) and RevPAR is positively related to ADR, a positive correlation can be expected between a hotel's class category (ranging from economy hotels to luxury hotels) and the hotel's RevPAR performance.

Apart from the quality indicator of hotel class, today's consumers also heavily rely on online review websites and cyber communities as an important influential information source for travel planning (Kwok et al., 2015). On most online review platforms, consumers are allowed to rate their experience of a hotel stay in a 5-point-scale star rating system, where one star indicates most negative and five stars represent most positive (Chevalier and Mayzlin, 2006). Online ratings thus become an important reference point for consumers' decision-making (Kwok and Xie, 2016). According to a recent systematic review of contemporary literature on online reviews by Kwok et al. (2017), hotels can benefit from higher review ratings in all key performance indicators, including sales price, room sales (occupancy), and RevPAR, leading to a positive relationship between hotel online ratings and hotel performance.

#### 2.4. The moderation effects on the impact of Airbnb supply on hotel performance

In this investigation, we expect that the key influential relationship between Airbnb supply and hotel performance will be moderated by the price and quality factors discussed above. Marketing literature, for example, suggests that two substitutable products are very likely to compete with price (Choi, 1991). Because price is commonly perceived as a valid indicator of a hotel's service quality (Ye et al., 2014), lodging products that compete in a similar price range can be perceived as "highly substitutable" options for travelers, possibly offering similar levels of service in comparable facilities. On the flip side, the equilibrium room rates for individual hotels in an oligopolistic market may vary from one property to another under the condition that these hotels offer different levels of service with differentiated product attributes (Arenoe et al., 2015), indicating that a hotel may sustained higher ADRs than its competitors in price competition due to its superior service or other desirable features. Along the same lines, when there is a huge price gap between two alternative lodging options in the same neighborhood, chances are these two products are actually offering two different levels of services (e.g., a high-end hotel vs. a low-priced Airbnb listing) or they are targeting two different groups of travelers, indicating that they are not really competing for the same market segment. Hence, if Airbnb listings and traditional hotels are serving two different segments of travelers who are willing to pay for the lodging service at two distinguishable price points, the negative impact of Airbnb's supply on nearby hotels might become less significant. We propose:

**H3a.** Price difference between a hotel and nearby Airbnb listings moderates the relationship between local Airbnb supply and hotel performance, where a larger price gap will lower the negative impact of local Airbnb supply on hotel performance.

Similar to the traditional lodging products where price is highly

correlated with a hotel's service quality (Arenoe et al., 2015; Becerra et al., 2013; Ye et al., 2014), price of an Airbnb unit can also be a good indicator for the service being offered. In other words, Airbnb listings in the same price range are very likely to offer similar quality of service and facilities. When a large number of Airbnb listings enter a market in the same price range (e.g., 100 Airbnb listings, all at about \$80 a night), for instance, it creates a significant threat to hotels that are also competing in the same price range. In effect, it is as if there were a new hotel with 100 rooms that just enters the market. In another scenario when a large number of Airbnb listings enter a market with highly inconsistent price points (e.g., 100 Airbnb listings, at a price ranging from \$40 to \$200), hotels in the area only need to compete with the listings in the same price range (i.e., to compete with 10 listings at \$80 a night instead of 100). Since a hotel's price is only affected by local competitors that offer similar quality of service/facility (Balaguer and Pernías, 2013), the aggregate hotel market, as a result, may not be impacted as much because the inconsistent pricing strategy among Airbnb listings largely distracts the focused competition at the same tiers of price points. We thus introduce the following moderating effect:

**H3b.** Price dispersion among nearby Airbnb listings moderates the relationship between local Airbnb supply and hotel performance, where a larger price dispersion will lower the negative impact of local Airbnb supply on hotel performance.

Because the lodging industry offers a very complex product mix, hotel class is often treated as a contextual or a moderating factor in empirical studies (e.g., Blad and Sturman, 2014; Kang et al., 2012; Kim et al., 2013). As a result, hospitality scholars are highly recommended to examine the moderation effect of hotel class when analyzing hotels' characteristics and performance (Xie et al., 2017). In Zervas et al.'s (2016) analysis of Airbnb's impact on the lodging industry, hotels of lower classes seem to be more vulnerable to the negative effect than those of higher classes. Likewise, the moderation effect of hotel online ratings deserves additional attention because positive reviews can more effectively enhance consumers' hotel booking intentions than negative ones (Tsao et al., 2015). Consequently, we also suggest the following hypotheses for our statistical analysis:

**H3c.** Hotel class moderates the relationship between local Airbnb supply and hotel performance, where hotels in a lower-tier class will be negatively impacted more by local Airbnb supply than those in a higher-tier class

**H3d.** Hotel online ratings moderate the relationship between local Airbnb supply and hotel performance, where hotels with lower review ratings will be negatively impacted more by local Airbnb supply than those with higher review ratings.

### 3. Methodology

#### 3.1. Data and measures

To investigate the effects of Airbnb's price positioning to the performance of nearby hotels, it is necessary to construct a unique dataset that includes not only the performance records, quality information, and characteristics of hotels, but also the price information of Airbnb listings in the same market. To fulfill this requirement, we collected data from hotel properties and Airbnb listings in the metropolitan area of Austin, Texas. We chose Austin, Texas as our focal market for two reasons. Firstly, it is a major metropolitan area with a boom of vacation rentals in recent years to meet the needs of the city's visitors (Dinges and Novak, 2013). Results from Austin could serve as a reference to other markets that are experiencing or about to experience the growth of Airbnb. Secondly, emerging studies in recent years have also investigated various issues of Airbnb in the Austin market due to data transparency and availability (e.g., Zervas et al., 2016), making it of

most empirical relevance. Results in this study are comparable to and can supplement the findings of prior research.

We then developed automated Python scripts to access and parse HTML and XML pages on TripAdvisor.com for hotel-related information and Airbnb.com for listing-related information, both chronologically compiled on the webpages of two sites. Hence, we could track the number of Airbnb listings and hotels in Austin over time. For each individual hotel, we collected price, class, ratings of online reviews and other property characteristics information such as zip code, size, age, and number of amenities from TripAdvisor.com. We also collected the quarterly hotel performance records furnished by the Texas Comptroller of Public Accounts,<sup>4</sup> in their capacity as auditors of state tax collection. We collected the Internet data with respect and emphasis on academic ethics. The data collected are publicly available online and contain no human subject privacy or business confidentiality information. Similar data collection approaches have also been widely adopted in other academic work (e.g., Archak et al., 2011; Beauchamp, 2016; Büschken and Allenby, 2016).

After collecting the data, we aggregated information by hotel and quarter (i.e., unit of analysis) in each source of data and then merged them together to form a panel, in which each hotel carries a variety of property information (e.g., financial performance, price, quality, and property characteristics) as well as the corresponding count and price information of Airbnb listings over quarters. If any aforementioned information was missed for a hotel in a certain quarter, the entire observations of that hotel in that quarter were dropped to ensure the completion and integrity of analysis. The constructed data is large-scale but granular, including 1482 observations of 86 hotels distributed in 20 zip codes of Austin, Texas over a period of 12 quarters from Quarter 3 (Q3), 2008 to Quarter 2 (Q2), 2011. This sample covers all hotels in Austin during the study period as long as they reported financial performance data to the Texas Comptroller and received reviews on TripAdvisor.

Table 2 presents the definitions and summary statistics of variables, which are categorized into four dimensions: (a) hotel performance, (b) Airbnb penetration, (c) hotel quality, and (d) hotel characteristics controls. Our dependent variable is hotel performance, measured by RevPAR, which is a function of Airbnb supply (*ListingNum*), Airbnb price positioning (*PriceDiff* and *ListingPriceVar*), hotel quality (*HotelRating* and *HotelClass*), and hotel characteristics controls (*Age*, *Size*, *AmenNum*, and *HotelComp*).

Table 3 and Fig. 2 collectively present the growth of hotels and Airbnb listings from 2008 Q3 through 2011 Q2 in Austin. Airbnb listings had enjoyed a continuous and incremental growth in Austin since its launch in 2008 Q3, with a leap of 57 listings in 2011 Q1 and then a peak of 63 listings in 2011 Q2. In contrast, we observed a slow and fluctuating trend of hotel growth from 63 in 2008 Q3 to 86 in 2011 Q2. Regarding the price point, while the ADRs of hotels in Austin remained relatively stable at about \$100 during the study period, Airbnb listings in the same zip codes recorded much higher ADRs at about \$300 since 2008 Q3 and then saw a decrease to about \$200 beginning 2011 Q1. It seems the price positioning of Airbnb listings and hotels was quite different since Airbnb debuted in 2008 Q3 in the Austin market. The ADRs of Airbnb listings were approximately three times more than those of hotels in 2008 and remained twice as much in 2011.

### 3.2. Model specification

We used a blend of econometrics models to estimate the main effect of Airbnb supply on the RevPAR performance of hotels, as well as the moderation effects of Airbnb listings' price positioning and the hotel quality attributes on such main effect while controlling hotel characteristic variables. We modeled the RevPAR of a hotel *i* at time *t* as a

function of Airbnb supply, the moderation effects of Airbnb listings' price positioning and the hotel quality attributes, as well as a group of hotel characteristic controls:

$$\begin{aligned} RevPAR_{it} = & \beta ListingNum_{it-1} + \delta X_{it-1} + \gamma Z_{it-1} \\ & + \eta (ListingNum_{it-1} \times X_{it-1}) + \phi (ListingNum_{it-1} \times Z_{it-1}) + \theta HC_{it-1} + \varepsilon_{it} \end{aligned} \quad (1)$$

where we use the lagged terms of time-variant independent variables at *t-1* to represent the influence of Airbnb listings in previous period. *ListingNum<sub>it-1</sub>* represents the supply of Airbnb listings in the Austin market at time *t-1*. *X<sub>it-1</sub>* represents pricing variables of Airbnb; *PriceDiff<sub>it-1</sub>* and *ListingADRVar<sub>it-1</sub>*, *Z<sub>it-1</sub>* represents hotel quality indicators; *HotelRating<sub>it-1</sub>* and *HotelClass<sub>i</sub>*, and *HC<sub>it-1</sub>* is a vectors of hotel characteristics controls such as *Age<sub>it-1</sub>*, *Size<sub>it-1</sub>*, *AmenNum<sub>i</sub>*, and *HotelComp<sub>it-1</sub>*. The interaction terms of *ListingNum<sub>it-1</sub> × X<sub>it-1</sub>* and *ListingNum<sub>it-1</sub> × Z<sub>it-1</sub>* represent the moderation effects of Airbnb's price positioning and hotel quality attributes on the effect of Airbnb supply. Our estimation interest focused on  $\eta$  and  $\theta$ , which capture the moderation of Airbnb's price positioning and the hotel quality attributes on the effect of Airbnb supply, respectively.  $\varepsilon_{it}$  is the error term. To reduce heteroscedasticity concerns, we leveraged robust standard errors clustered at the hotel level, as suggested in Greenwood and Watta (2015). We estimated the model using STATA Version 14, a statistical software widely used for econometrics analysis (Muenchenm, 2012).

## 4. Results and discussions

Estimation results of Eq. (1) are presented in Table 4. In order to check the robustness of the estimation results, we first estimated the main model (Model 1) where both price variables (*PriceDiff* and *ListingPriceVar*) and quality attributes (*HotelClass* and *HotelRating*) were included. To understand if price variables are the main drivers of Airbnb penetration, we excluded both quality indicators in Model 2 and one of each in Model 3 and Model 4, respectively. By comparing the changes of price variables in these three models, we were able to check if the price penetration of Airbnb listings persists and remains consistent despite the quality of hotels nearby. As shown in Table 4, we firstly reported the estimations of the main model (Model 1) and then checked the robustness of the estimated results in Models 2–4.

The first column of Table 4 shows the estimated results of the main model. The coefficient of Airbnb supply is  $-0.059$  ( $p < 0.000$ ), indicating a significant penetration of Airbnb listings in the Austin market to each individual hotel. The supply of accommodation alternatives of Airbnb listings could potentially substitute the demand of the hotel and further bring down its RevPAR, supporting H1. The RevPAR performance of hotels increases along with the price difference between hotels and Airbnb listings ( $0.475$ ,  $p < 0.000$ ) and price dispersion within Airbnb listings ( $0.230$ ,  $p < 0.000$ ). A larger price gap between Airbnb listings and hotels indicates that the price positioning of these two business models is becoming more divergent from each other. A larger price dispersion of Airbnb listings indicates an increase of inconsistency of the price positioning among Airbnb listings. In other words, if a hotel is located in a zip code in which Airbnb listings that are priced significantly higher than the hotel's ADR or offer a large fluctuation in price points, the hotel will very likely to see an increase in its RevPAR performance, supporting H2a and H2b. Such results also support the agglomeration effects of a product's strategic orientation (Canina et al., 2005), in which low-cost hotels can possibly yield higher RevPAR if they are strategically located in an area with many highly priced competitors.

As the price difference between the hotel and Airbnb listings increases, however, the negative impact of Airbnb supply on hotel performance decreases significantly ( $0.003$ ,  $p < 0.000$ ), supporting a significant moderation of price difference on the impact of Airbnb supply (H3a). Similarly, in presence of an increased price dispersion among

<sup>4</sup> Source: <http://cpastar2.cpa.state.tx.us/>.

**Table 2**  
Variable Definition and Summary Statistics.

Dimension	Variable	Definition	Mean	SD	Min	Max
Hotel Performance	RevPAR	Revenue per available room (RevPAR) of a hotel in a given quarter	73.97	44.55	7.25	323.45
Airbnb Penetration	ListingNum	Number of citywide Airbnb listings in a given quarter	18.08	20.8	1	63
	ListingADRVAR	Standard deviation of the average daily rates of Airbnb listings in a hotel's zip code in a given quarter	188.05	30.06	138.84	247.12
	PriceDiff	Difference of the average daily rate between a hotel and its Airbnb counterparts in the hotel's zip code in a given quarter	-191.47	84.23	-322.12	211.85
Hotel Quality	HotelRating	Average consumer-generated review ratings on a scale of 1–5 stars, with 1 star for "terrible," 2 stars for "poor," 3 stars for "average," 4 stars for "very good," and 5 stars for "excellent" in a given quarter	3.46	1.15	1	5
	HotelClass <sup>a</sup>	Hotel scales with the value of 5 for a luxury hotel, 4 for an above average hotel with some outstanding features and a broad range of services, 3 for a full service hotel, 2 for a mid-market economy hotel, and 1 for a budget traveler hotel.	2.56	1.16	1	4.5
Hotel Characteristics Controls	Age	Number of years since the inception of a hotel in a given quarter	18.88	13.03	0	54
	Size	Number of guest rooms of a hotel in a given quarter	177.27	131.18	14	800
	AmenNum	Number of internal amenities such as indoor swimming pool, free high-speed Internet, fitness center, wheelchair access, and pets allowed of a hotel	7.65	2.88	0	13
	HotelComp	Number of nearby hotels in a hotel's zip code in a given quarter	5.63	3.60	0	13

<sup>a</sup> TripAdvisor.com provides hotel class segmentation information about each hotel being reviewed using a service segmentation scheme that classifies hotels using "Crowns" with the value of 5 for a luxury hotel, 4 for an above average hotel with some outstanding features and a broad range of services, 3 for a full service hotel, 2 for a mid-market economy hotel, and 1 for a budget traveler hotel.

**Table 3**  
Growth of Hotels and Airbnb Listings (2008Q3-2011Q1).

Quarter	Number of Hotels	Hotel ADR	Number of Listings	Airbnb ADR
2008Q3	63	\$ 120.94	1	\$ 300.00
2008Q4	53	\$ 120.26	1	\$ 300.00
2009Q1	68	\$ 101.36	4	\$ 303.33
2009Q2	64	\$ 104.53	5	\$ 289.75
2009Q3	75	\$ 101.40	6	\$ 311.80
2009Q4	75	\$ 94.77	7	\$ 289.00
2010Q1	71	\$ 99.10	10	\$ 285.81
2010Q2	82	\$ 103.21	12	\$ 311.19
2010Q3	83	\$ 100.43	14	\$ 306.87
2010Q4	87	\$ 101.49	17	\$ 287.68
2011Q1	81	\$ 104.08	57	\$ 180.64
2011Q2	86	\$ 105.06	63	\$ 178.38

or the price dispersion of Airbnb listings magnifies. Such results support the marketing literature of price competition among substitutable products (e.g., Choi, 1991) where they often compete with one another at the same price point.

We further found that the negative effect of the Airbnb supply on hotel performance did not significantly vary by the quality attributes of hotels in terms of class ( $-0.007, p = 0.655$ ) or review ratings ( $0.001, p = 0.945$ ). Thus, H3c and H3d, which state that Airbnb supply impacts the hotels in a lower class or with lower online review ratings more than those in a higher class or with higher online review ratings, are not supported. These findings suggest that Airbnb listings remain equally noticeable substitutions to hotels across all class segments (budget traveler, luxury, etc.) and perceived rating scales. It is possibly because the Airbnb listings in our sample were priced significantly higher than

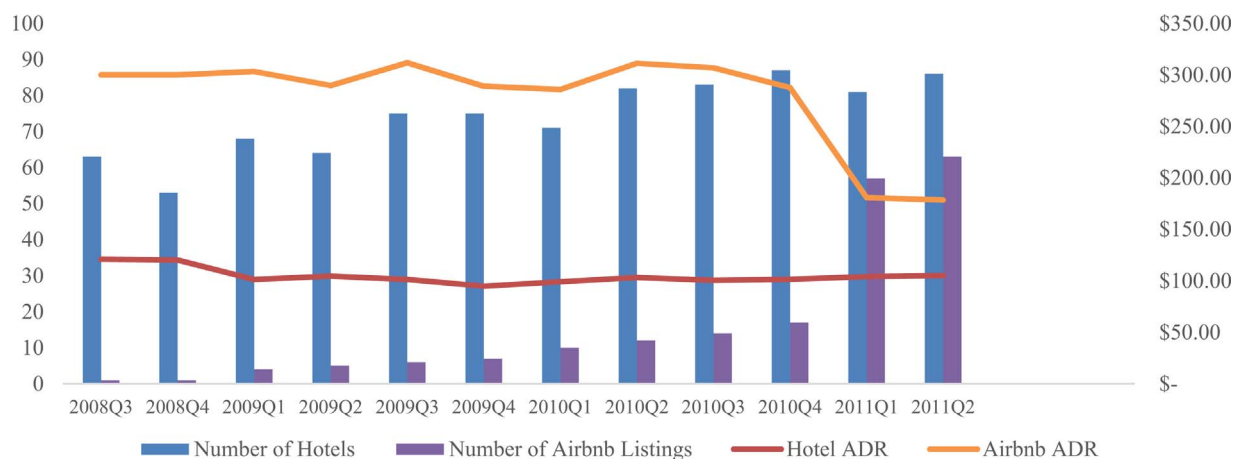


Fig. 2. Growth of Hotels and Airbnb Listings (2008Q3-2011Q1).

Airbnb listings, the negative effect of Airbnb supply on hotel performance shows a significant decline ( $0.037, p < 0.000$ ), supporting a significant moderation effect of price dispersion of Airbnb listings on the impact of Airbnb supply (H3b). These findings add additional evidence to the current debate of Airbnb's negative impact on local hotel markets with a new pricing perspective, explaining why mixed findings were reported. Our results reveal that, while the Airbnb supply generates a negative impact on hotels, such effect can be significantly mitigated as the price gap between hotels and Airbnb listings increases

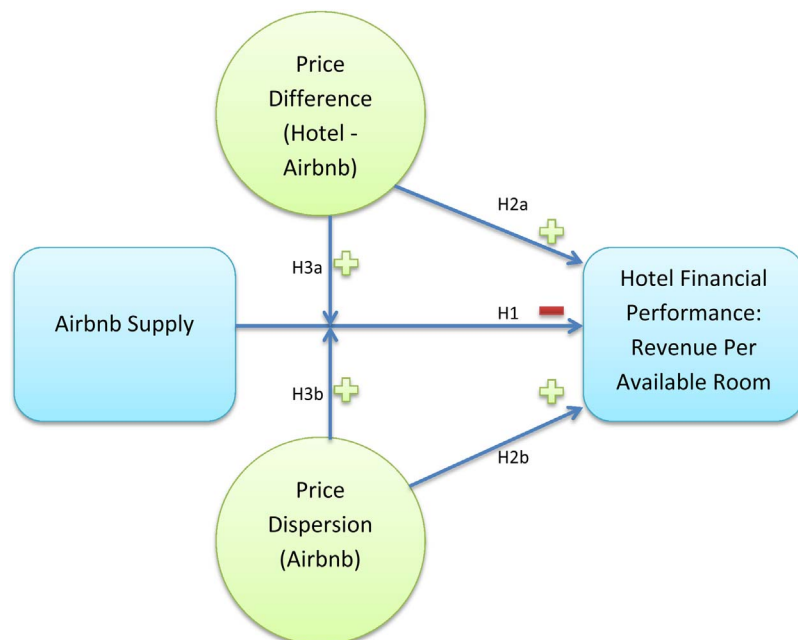
the hotels nearby, which is different from the sample reported in Zervas et al. (2016). As a result, hotels in the market, regardless of their class category or online review ratings, could all gain benefits from the agglomeration effects as suggested by Canina et al. (2005), where they could find a higher RevPAR because they are surrounded with many Airbnb listings with a high price.

The mean values of variance inflation factors (VIF) of all the models remain lower than 10, indicating the nonexistence of multi-collinearity issues in variables of these models (Allison, 1999). We also run a Wald

**Table 4**  
Estimated Effects of the Airbnb Price Positioning on Hotel Performance.

	Main Model	Robustness Checks		
	(1)	(2)	(3)	(4)
<i>ListingNum</i>	-0.059*** (0.000)	-0.047*** (0.000)	-0.059*** (0.000)	-0.051*** (0.000)
<i>PriceDiff</i>	0.475*** (0.000)	0.458*** (0.000)	0.475*** (0.000)	0.463*** (0.000)
<i>ListPriceVar</i>	0.230*** (0.000)	0.230*** (0.000)	0.230*** (0.000)	0.230*** (0.000)
<i>HotelClass</i>	0.121 (0.975)		0.103 (0.979)	
<i>HotelRating</i>	0.056 (0.921)			0.054 (0.926)
<i>ListingNum</i> × <i>PriceDiff</i>	0.003*** (0.000)	0.003*** (0.000)	0.003*** (0.000)	0.003*** (0.000)
<i>ListingNum</i> × <i>ListPriceVar</i>	0.037*** (0.000)	0.036*** (0.000)	0.037*** (0.000)	0.036*** (0.000)
<i>ListingNum</i> × <i>HotelClass</i>	-0.007 (0.655)		-0.007 (0.662)	
<i>ListingNum</i> × <i>HotelRating</i>	0.001 (0.945)			0.007 (0.768)
<i>Age</i>	0.107 (0.431)	0.114 (0.375)	0.108 (0.423)	0.112 (0.386)
<i>Size</i>	0.021* (0.087)	0.024 (0.209)	0.021* (0.087)	0.023 (0.218)
<i>AmenNum</i>	1.029 (0.123)	1.127** (0.012)	1.022 (0.119)	1.104** (0.010)
<i>HotelComp</i>	-0.472** (0.000)	-0.458*** (0.000)	-0.474*** (0.000)	-0.461*** (0.000)
Constant	97.968*** (0.000)	95.711*** (0.000)	97.988*** (0.000)	94.646*** (0.000)
Mean VIF	6.901	5.663	6.720	5.688
Wald test (chi <sup>2</sup> )	2329.02	2014.39	2257.99	2135.49
Prob > chi <sup>2</sup>	0.000	0.000	0.000	0.000
Observations	1482	1482	1482	1482
R-squared	0.801	0.352	0.505	0.630

Robust p-value in parentheses \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .



**Fig. 3.** The Effect of Airbnb’s Price Positioning on Hotel Performance – A Revised Model.

test to check whether all the coefficients in the model are different from zero. Because the values of Wald chi<sup>2</sup> are consistently significant at the 0.05 level across all the models, all of the coefficients in our models are different from zero (Davidson and MacKinnon, 2003). To check the

robustness of such findings, we tested if the estimated effects of Airbnb supply persist in models with various hotel quality indicators. As shown in Models 2–4 in Table 4, we found the estimation results of Airbnb supply and price positioning are qualitatively consistent across models



without review ratings and class information (Model 2), without review ratings but with class information (Model 3), and with review ratings but without class information (Model 4). In the end, we revised our proposed model as in Fig. 3, which highlights the significant relationships among the variables. The “plus” and “minus” marks indicate the positive and negative influential relationships.

## 5. Conclusions and implications

While preliminary literature on Airbnb has discussed its impact on the hotel industry, this study is the first consequential attempt to examine Airbnb's pricing practices as it enters the hotel market. We found that Airbnb remains an alternative to hotels for accommodation needs. However, the price positioning of Airbnb, which is largely driven by individual hosts, significantly mitigates its penetration to the hotel businesses. This is largely because of Airbnb's significant price difference as compared to its hotel counterparts, as well as the wide price dispersion within the listings themselves. Given the limited empirical evidence on room-sharing service and how it may evolve and penetrate the hospitality incumbents, this study adds important insights to the literature by revealing not only the impact of new entries, but also the effects of price positioning of Airbnb.

### 5.1. Theoretical implications

The theoretical implications of this study warrant discussion. First, because a market equilibrium can be disrupted due to an emergence of new technology or new modes of business operations, new analysis is required to better understand what is really going on in a market (Nelson, 2013). We acknowledged the fact that room-sharing websites such as Airbnb could disrupt the incumbent hotel business in a market, urging for more research effort with academic vigor to study this new phenomenon. Our investigation took a different angle from those of existing Airbnb impact studies. Our analysis was guided by the existing economic theory and marketing/pricing literature and focused on the effect of Airbnb's price positioning on hotels' RevPAR performance in the Austin market, particularly with an emphasis on the moderation effect of “price difference” and “price dispersion.” As the first attempt to examine Airbnb's host-driven pricing strategy on the RevPAR performance of hotel incumbents, new empirical evidence in a new context of sharing economy is added to the existing economic and marketing/pricing literature. At the same time, our results provide additional insight to the new lodging market where Airbnb and the incumbent hotels are competing with one another. Methodology wise, our study also exemplifies the use of technology-enabled data analytics approaches to mine insights from large-scale but granular field data.

Furthermore, as the peer-to-peer sharing platforms are expanding services from the accommodation sector to other sectors within the tourism industry, such as food and beverage businesses and tour guiding services (Lawler, 2014), this study may serve as a foundation for extending this research into other aspects of the sharing economy, such as ride sharing and crowdfunding platforms. We recognized the significant influence of a product's price in economic equilibrium, as suggested in Marshall's classic economic theory (Ekelund and Hébert, 2013) and the evolutionary economic theory (Nelson, 2013). Then, we challenged the results of those descriptive analyses about Airbnb's impact to the lodging industry by adding price-related factors into our analysis. Our findings confirmed the significant roles that “price difference” and “price dispersion” play in sharing economy. As a result, we urge that future studies about sharing economy's impact on its incumbent industry should also consider price as an important variable in their analysis. Estimations that include supply, demand, and price can

provide evidence that is more concrete to the policymakers who wish to regulate those emerging sectors.

Lastly, as pricing is perceived as one of the most difficult marketing decisions in hotel operations (Arenoe et al., 2015) and has been widely identified as a key area in hotel revenue management (Pereira, 2016), the unique perspective revealed in our findings about Airbnb listings' pricing strategies may provide some groundwork for future studies in hotel revenue management practices. As Airbnb grows its influence in a market, future studies may reassess the effectiveness of different revenue management practices, such as day and rate restrictions.

### 5.2. Practical implications

As far as this study's practical implications are concerned, our analysis brings in insights on the impact of innovators (Airbnb) on incumbents (hotels) in the increasingly competitive hospitality market driven by ever-changing technology and innovation. According to a conceptual analysis by Hill and Rothaermel (2003), even though it is a common belief that the performance of incumbent organizations will decline when a market is disrupted by radical technological innovations, such tendency may not be terminal or applicable to all incumbents, especially for firms that are flexible in adapting to new changes. We then focused on the effect of price positioning of Airbnb on the performance of nearby hotels in this study and identified some proactive strategies that hoteliers may use to respond to the threat created by Airbnb.

First, this study empirically demonstrates how Airbnb's price positioning affects the performance of nearby hotels through the lens of price difference and price dispersion. Although there are many on-going debates about Airbnb, there is limited empirical research on the economic gains (or losses) of its hotel counterparts in the same market. Our findings reconcile the debate about Airbnb's impact on local hotel properties by demonstrating a decline in hotel performance in the presence of Airbnb in the Austin market. Then, owing to Airbnb's host-driven pricing practice, the penetration of listings into the hotel markets can be mitigated by price difference and price dispersion. Finally, we have observed that many online travel agents (OTAs), such as Expedia and Kayak, recently added residential rentals to their websites since Expedia acquired HomeAway, a rival room-sharing website of Airbnb, for \$3.9 billion in 2015 (Picker, 2015). Consumers can now search residential rentals and hotel rooms in an OTA website, which can significantly change the dynamics of hotels' revenue management practices because hotels are now directly competing with residential rentals on OTAs. Hence, we urge hotels to include Airbnb listings as part of the competitive set when evaluating hotel performance in their current revenue management practices because, to our best knowledge, it is not yet a norm for hotels to include Airbnb listings in performance benchmarking despite its increasing rival power. Meanwhile, hoteliers must also work closely with OTAs because OTAs now have the business intelligence of both hotels and residential rentals.

### 5.3. Limitations

The data used in this study is not without temporal and spatial limitations. First, we investigated the price penetration of Airbnb listings to the local hotel market during its early stage of growth up until the second quarter of 2011. Although with some early empirical evidence, our findings have already indicated a significant penetration of Airbnb listings to their hotel counterparts. The enormous growth of Airbnb in Austin after 2011 also requires new insights in this research area. We acknowledge such needs but are not able to address this issue given the unavailability of data. Researchers who are interested in

extending the research inquiries about Airbnb price penetration should strive to obtain and collect data in most recent years in order to provide insights that are more contemporary. With a larger dataset, future studies may also examine whether a bigger presence of Airbnb would result in a smaller price dispersion among competitive sets. Second, we focused on Airbnb price penetration to the hotel market in Austin, Texas. Such findings may not be able to generalizable to other markets such as New York, San Francisco, Miami, Oakland, and Oahu in which Airbnb enjoys a prolific growth and strongly competes with local hotels (Lane and Woodworth, 2016). Future studies should include a broader range of data collected from these cities by using legitimate probability sampling methods.

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