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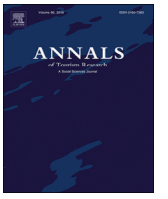

Full Length Article

Substitution between sharing accommodation and hotels: A behavioral economic demand curve analysis

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ABSTRACT

Researchers have confirmed the substitution of sharing accommodation for hotels. The existing assessments of the substitution have primarily focused on the inverse relationship between sharing accommodation supply and hotel performance, with a lack of examination based on demand curve analysis. This study utilizes behavioral economic demand models to construct alone-price/own-price demand curves for hotels and cross-price demand curves for sharing accommodation to quantify the substitutive relationship between sharing accommodation and different hotel types. Furthermore, we explore the variations in this substitutive relationship by travel companion and customer group. The analysis is dual-directional, including both the substitutability of sharing accommodation for hotels and the reverse relationship. The findings inform market competition strategies for hotels and sharing accommodation.

Introduction

Sharing accommodation has emerged as a new alternative to conventional lodging establishments. Industry managers and researchers have debated its impact, with some viewing it as a disruptive threat to hotels (Guttentag & Smith, 2017) while others seeing it as a supplement to the lodging market, offering benefits to the tourism industry and presenting a mix of both opportunities and challenges (Fang et al., 2016). Nevertheless, most researchers acknowledge the presence of a substitutive relationship between sharing accommodation and hotels given their similar functions and purposes. Moreover, sharing accommodation has been observed to compete with different hotel types to varying degrees (Zheng et al., 2023).

Prior research has predominantly evaluated the substitution of sharing accommodation for hotels by examining the adverse impacts of sharing accommodation supply on hotels' business performance (Dogru et al., 2020) with mixed conclusions being drawn. Nevertheless, scant research has looked into the substitutive relationship between these two related goods from the perspective of demand curves. In microeconomics, the substitutive relationship is characterized by an increasing demand for the substitute good as the price of the primary good rises, manifested by an upward-sloping cross-price demand curve. Therefore, there is a need for research investigating the substitutive relationship between sharing accommodation and different hotel types based on the analysis of demand curves and cross-price elasticities. Meanwhile, it would be more comprehensive to study the substitutive relationship from both directions, as the substitutability of good A for good B may not necessarily be symmetric to the substitut-

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ability of good B for good A (Nicholson & Snyder, 2017). The existing research has primarily focused on the impact of sharing accommodation on hotels while to certain extent neglecting how hotels may substitute for sharing accommodation.

In most tourism demand studies that have explored substitution based on demand curves, the substitutability of a particular good for another has been quantified through the cross-price elasticity coefficient within an econometric demand model (Song et al., 2009). However, a single coefficient is insufficient to describe the price-demand relationship, since it is either derived from one single price point or assumed to remain constant with price. Relative to traditional econometric demand models that estimate constant own-price and cross-price elasticity coefficients, the construction of complete own-price and cross-price demand curves, which account for varying elasticities, provides a more thorough understanding of demand's response to price changes. In this regard, behavioral economic demand models, featuring exponential functional forms that parameterize the change rate of elasticity along complete demand curves, offer significant advantages over traditional econometric demand models in describing demand and elasticities. This methodology enables mathematical and visual comparisons of how the shape of a demand curve changes under different scenarios.

In view of the above, this study aims to examine the substitutive relationship between sharing accommodation and different hotel types. This examination involves modeling the alone-price and own-price demand curves for hotels, along with the cross-price demand curves for sharing accommodation in relation to hotel prices, to quantify the substitutability of one for the other and providing insights into how the substitutive relationship between sharing accommodation and hotels varies across different hotel types. This study also investigates whether the substitutive relationship differs between customers with different travel companions and how it is influenced by customer characteristics.

This study is the first attempt to evaluate the dual-directional substitutive relationship between sharing accommodation and different hotel types based on demand curve analysis. In contrast to previous demand modeling research, this study employs behavioral economic demand models, among which the cross-price demand model and the multivariate own-price demand model are used in tourism research for the first time. These models serve as an innovative approach to conducting in-depth examinations of the substitution with respect to travel companions and customer groups. A unique contribution of this study lies in its provision of a standardized quantitative framework for investigating the substitutive relationship between sharing accommodation and hotels as well as its variations across customer segments and contexts.

Literature review

Sharing accommodation and hotels

Since the advent of sharing accommodation, researchers have delved into customer preferences for sharing accommodation versus hotels to understand how sharing accommodation attracts customers and influences market segmentation within the lodging industry. Prior studies have indicated that customers tend to favor sharing accommodation over hotels when looking for a relaxed vacation close to home (Lee et al., 2003) or traveling to domestic destinations (Ye et al., 2023) and when traveling with friends for extended periods (Poon & Huang, 2017). Regarding sociodemographic characteristics, males, younger individuals, experienced tourists and well-educated people are more inclined to choose to share accommodation over hotels compared to their counterparts (Jones & Guan, 2011; Miciak et al., 2001). As for personality attributes, people with higher degrees of allocentrism (Poon & Huang, 2017) and innovativeness (Wang & Jeong, 2018) tend to prefer sharing accommodation to hotels, whereas neuroticism shows a negative effect on customer preference to sharing accommodation (Ye et al., 2023). Given that customer preferences vary based on travel arrangements and personal traits, the competition between sharing accommodation and hotels is likely to differ across various customer segments.

Customers' motivations for choosing sharing accommodation are rooted in the private atmosphere, personal service, social interaction, enjoyment, home benefits and value for money (Miciak et al., 2001; So et al., 2018; Tussyadiah, 2015; Zane, 1997). It is widely recognized that sharing accommodation is consumed as an alternative to traditional hotels and is considered a disruptive innovation within the hotel market (Guttentag & Smith, 2017). Most studies have concluded that there exists an imperfect substitution between sharing accommodation and hotels. However, findings regarding how their competition fluctuates across various market segments are still debated.

One prevailing perspective suggests that sharing accommodation competes with hotels mainly on price and poses a particular threat to the market share of lower-end hotels and those catering to leisure travelers (Fang et al., 2016; Zervas et al., 2017). Hotel managers generally regard sharing accommodation as a significant competitor for small to midscale hotels but not for major hotel brands (Varma et al., 2016). Dogru et al. (2019) substantiated this argument by demonstrating that the market performance of economy hotels was most affected by the increasing sharing accommodation supply, although midscale hotels and luxury hotels were also negatively impacted. However, some researchers argue that sharing accommodation competes more directly with midscale hotels than with economy ones (Oskam & Boswijk, 2016). Guttentag and Smith (2017) further specified that customers commonly use sharing accommodation as a substitute for midscale hotels, followed by economy hotels and upscale hotels.

Another research perspective indicates a more adverse impact on the sales performance of luxury hotels due to sharing accommodation supply, compared to upper upscale hotels (Blal et al., 2018). In contrast to the assertion of a purely substitutive relationship between sharing accommodation and hotels, Ginindza and Tichaawa (2019) observed a positive correlation between the demand for sharing accommodation and hotels, suggesting a potential complementary relationship. Moreover, Henten and Windekilde (2016) proposed a scenario in which complementation and substitution exist on the supply and demand sides, respectively.

The mixed findings regarding the substitutive relationship between sharing accommodation and hotels can be attributed to different empirical contexts in research, varying types of listings and, most importantly, different measures of the substitution employed across studies. Previous research examined the substitution by validating whether sharing accommodation supply negatively impacted hotel performance using various metrics, such as revenue per available room, average daily rate and occupancy rate (Dogru et al., 2020; Sainaghi & Baggio, 2020). It has been subsequently demonstrated that the adverse impact of sharing accommodation supply on hotel revenue is primarily driven by reductions in hotel prices rather than reductions in hotel demand, although economy hotels experience declines in both price and demand (Dogru et al., 2022). This is more likely indicative of the homogeneity between sharing accommodation and hotels as lodging products than direct evidence of a substitutive relationship. In other words, the availability of sharing accommodation increases the overall market supply, leading to a lower market equilibrium price.

Instead of measuring the negative correlation between the supply of one product and the revenue of another, in microeconomics, a substitutive relationship between two related goods is defined as a positive correlation between the price of the primary good and the demand for the alternative good, as indicated by an upward-sloping cross-price demand curve. This aspect has not been thoroughly investigated to quantify the degree of substitution between sharing accommodation and different hotel types.

Measuring the substitution

An own-price demand curve is a graphical representation depicting the correlation between the price of a good and the demand for that good at different price points, whereas a cross-price demand curve illustrates how the demand for one good changes with variations in the price of a related good. The configuration of the cross-price demand curve and the magnitude of the cross-price elasticity help determine the nature of the relationship between the two goods – whether they are complements (negative cross-price elasticity), substitutes (positive cross-price elasticity) or unrelated goods (zero cross-price elasticity). A steeper cross-price demand curve means a stronger complementarity/substitutability of one good for the other. It is worth noting that the substitutability can be asymmetric, especially when the two goods are not perfect substitutes (Nicholson & Snyder, 2017).

A demand model, upon which the demand curve is based, is a mathematical representation of the relationship between demand and its determinants. Demand models have been widely applied in tourism and hospitality research with a specific emphasis on economic aspects, including demand forecasting (Song et al., 2019), determinant identification (Martins et al., 2017) and elasticity estimation (Peng et al., 2015). In the context of lodging products, prior research has primarily focused on own-price elasticities, demonstrating variations in these elasticities based on factors such as season, hotel type and hotel brand (Vives et al., 2019). Cross-price elasticity estimation has predominantly relied on destination competition (Song et al., 2011), with only a limited number of recent studies exploring the substitutive relationship between hotels and other accommodation types (Boto-García & Mayor, 2022).

To recap, the assessment of the substitution of sharing accommodation for different hotel types has centered on the adverse effect of sharing accommodation supply on hotel performance and the resulting increases in hotel own-price elasticities (Chen et al., 2022). There is a dearth of research utilizing the cross-price demand curve for sharing accommodation with hotel prices to establish a direct measurement of the substitutability of sharing accommodation for hotels. Conversely, it is also worthwhile to investigate the substitutability of hotels for sharing accommodation to validate the symmetry of the substitutive relationship between the two products.

In traditional econometric demand models used in most tourism and hospitality studies, demand elasticity is normally estimated as a constant coefficient, which may pose certain issues. On the one hand, the estimation of constant elasticity coefficients is partly due to the prevalent use of constant-elasticity demand models in a double-log functional form, driven by the simplicity of model estimation and coefficient interpretation (Song et al., 2009). However, own-price elasticity is expected to vary along most demand curves, typically increasing with price. A demand curve with constant elasticity represents a special case where the demand curve follows a power functional form (Perloff, 2018). The same applies to cross-price demand curves and cross-price elasticities. On the other hand, even when dynamic-elasticity demand models are used, researchers frequently estimate elasticity coefficients at the average price for easy interpretation, resulting in a single coefficient. This leads to a significant loss of information at all prices other than the transient average. Furthermore, comprehending the dynamics of elasticity holds substantial economic significance and is particularly crucial for pricing strategies (Alrawabdeh, 2022). Describing the relationship between price, demand and revenue hinges on constructing a complete demand curve with specified elasticity coefficients at all price levels, which enables the identification of the optimal pricing point that maximizes revenue.

Considering the above, a novel demand model is essential to parameterize the dynamics of elasticity and construct complete demand curves to comprehensively describe the relationship among relevant economic variables. This study therefore employs behavioral economic demand models to address the issues associated with constant elasticity coefficients and conducts a thorough analysis of the substitutive relationship between sharing accommodation and different hotel types.

Behavioral economic demand models

Behavioral economic demand models originate from the field of "behavioral" behavioral economics, which integrates economic principles into operant psychology to explain the reinforcement of consumption/acquisition behavior by a certain good (Hursh &

Roma, 2013). This is distinct from what most researchers in the social sciences would typically recognize as behavioral economics (the "cognitive" behavioral economics), which instead incorporates cognitive psychology into economics to explore the disparities between humans' actual decisions and the rational decisions presumed in economic theory. In this study, we focus on "behavioral" behavioral economics and its associated demand models to analyze the substitution between sharing accommodation and hotels. This approach is favored for its superior attributes over traditional econometric demand models in specifying the dynamics of elasticity and depicting complete demand curves.

In "behavioral" behavioral economics, a demand curve illustrates the degree of resource allocation that an individual would allocate to access a good as its cost increases (Kaplan et al., 2018). Unlike econometricians who often regress demand at a limited range of market price points, behavioral scholars scrutinize the complete demand curve, encompassing the range from zero price, where demand is anticipated to peak (termed as demand intensity Q_0), to the price at which demand dwindles to zero (known as the breakpoint BP). The concept of demand elasticity is reflective of the reinforcing efficacy of a good on an individual's consumption behavior. By constructing complete demand curves, researchers have unveiled the dynamics of elasticity, demonstrating that own-price elasticity increases with price and transitions from inelastic to elastic regions. The demand curve, drawn on the logarithmic coordinates, takes the form of a downward-sloping concave curve rather than the linear decrease estimated by double-log demand models. Additionally, the shape of the demand curve entails an inverted U-shaped total revenue curve, reaching its apex at the price of unit elasticity (called the optimal pricing point P_{max}). The maximum revenue point is denoted as O_{max}.

As the dynamics of elasticity demonstrate a systematic increase with price, an ideal demand model should focus on defining the change rate of elasticity. To this end, Hursh and Silberberg (2008) introduced the initial behavioral economic demand model, the exponential model, which incorporates a parameter α into the exponential term to specify the increasing rate of own-price elasticity with price. The concept of essential value (EV), inversely linked to parameter α, was devised to quantify a good's efficacy as a reinforcer to strengthen or sustain an individual's consumption despite price increases. A large parameter α indicates a higher increasing rate of elasticity with price, implying that the demand curve decays more rapidly. Thus, the reinforcing efficacy of the good is relatively weak in maintaining consumption levels against rising costs, signifying a lower essential value or lower consumer valuation. The exponential model has been validated as superior to the widely applied double-log, semi-log and linear demand functions for explaining secondary demand data (Yan et al., 2012). One of the principal advantages of essential value over point elasticity in elucidating price-demand relationships lies in its capacity to extend elasticity insights beyond a single price point to embrace the entire price spectrum. Furthermore, it offers ease of interpretation and comparability across various products and consumers.

The "behavioral" behavioral economics explores the interplay between related goods using cross-price demand curves. A positive/negative slope signifies substitution/complementation, and the degree of substitution/complementation hinges on the steepness of the slope. Moreover, the relative shift between the alone-price demand curve (assuming the related good is unavailable) and the own-price demand curve (assuming the related good is available) offers additional evidence of the relationship. Specifically, when a substitution/complementation effect stands, the presence of the substitute/complement will depress/enhance the demand for the primary good and weaken/strengthen its reinforcing efficacy or resistance to price increases. This is manifested as a greater/smaller parameter α in the own-price demand curve compared to the alone-price demand curve. The behavioral economic framework has proven highly effective in behavioral science for examining the substitutive/complementary relationships between various products, such as e-cigarettes and conventional cigarettes (Snider et al., 2017), cannabis and cigarettes (Cooper et al., 2023), and alcohol and cannabis (Pereira-Morales & Eslava-Schmalbach, 2022).

A recent development involves the creation of a multivariate behavioral economic demand model, which incorporates both own-price and cross-price variables to explain demand. In this model, parameter α remains responsible for specifying the change rate of own-price elasticity, while parameter β is introduced to define the change rate of cross-price elasticity (Hursh & Schwartz, 2023). The model provides a more comprehensive description of demand compared to the early univariate behavioral economic demand models by developing a three-dimensional demand surface rather than two-dimensional demand curves. It can be regarded as a successful amalgamation of the advantages of traditional econometric demand models in estimating coefficients for multiple demand determinants and the benefits of behavioral economic demand models in parameterizing the dynamics of elasticity along a complete demand curve. The application of this multivariate model in empirical studies has been somewhat limited, primarily centered on assessing temporal discounting in the context of substance value (Rzeszutek et al., 2023). To date, it has not been extensively tested for fitting demand data. Furthermore, the application of behavioral economic demand models in tourism and hospitality research remains scarce, as the "behavioral" behavioral economics is still a relatively new field for tourism researchers, introduced for the first time by Song and Lin (2023).

To bridge the research gaps of examining the substitutive relationship between sharing accommodation and different hotel types through the lens of demand curves and delineating complete demand curves that reveal the dynamics of elasticity, this study evaluates the dual-directional substitution between sharing accommodation and hotels using behavioral economic demand models. Alone-price, own-price and cross-price demand curves are constructed with comparable parameters to quantify the degrees of substitution.

Method

This study was conducted within the US lodging market and aimed to investigate the substitutive relationship between sharing accommodation and three main hotel types – economy, midscale and upscale hotels. Considering the multifaceted factors influencing customer preferences between sharing accommodation and hotels as discussed in Sharing accommodation and

Table 1
Participant demographics.

	Frequency	Percentage
Gender		
Female	368	54.5
Male	307	45.5
Age		
18–25 years	96	14.2
26–35 years	202	29.9
36–45 years	148	21.9
46–55 years	120	17.8
≥ 56 years	109	16.1
Annual household income		
< $40,000	161	23.9
$40,000 ~ $79,999	206	30.5
$80,000 ~ $119,999	145	21.5
$120,000 ~ $159,999	82	12.1
≥ $160,000	81	12.0
Highest level of education		
High school or lower	80	11.8
Technical/vocational training	69	10.2
Bachelor's degree	365	54.1
Postgraduate degree	161	23.9
Employment status		
Employed full-time	485	71.9
Employed part-time	57	8.4
Self-employed	45	6.7
Unemployed	23	3.4
Not in the labor force	65	9.6

hotels section, one of the most noteworthy factors is the presence of travel companions (Poon & Huang, 2017). It not only shapes customers' travel activities but also their accommodation needs. Regarding the room types of sharing accommodation, for instance, when a customer travels alone or with a partner, a private room in a shared home is often suitable, whereas groups of friends or family members traveling together tend to prefer an entire home over multiple independent rooms. Therefore, this study sought to examine whether the presence of travel companions would influence the substitutive relationship between sharing accommodation and hotels.

The research adopted a 3 (*hotel type*: economy vs. midscale vs. upscale) × 2 (*travel companions*: travel alone vs. travel with friends) between-subjects experimental design. The categorization of hotels aligned with the segments used in the North America Hotel Guest Satisfaction Index Study conducted by J.D. Power (2023). For the purposes of this study, “traveling alone” and “traveling with friends” corresponded to different room types of sharing accommodation – staying in a private room within a shared home for the former and booking an entire home for the latter. To control the influence of potential confounding variables on demand, the travel scenario was designed as a one-week domestic leisure trip to an urban city.

Hypothetical purchase task

As a typical behavioral economic gauge of demand (Kaplan et al., 2018), the hypothetical purchase task was employed to collect individual demand data by presenting participants with escalating prices ranging from zero to the breakpoint price. The hypothetical purchase task was structured into distinct versions of questionnaires, each tailored for one of the six experimental groups. Participants were randomly assigned to these groups and began by viewing representative images of their assigned hotel type and sharing accommodation, along with a travel scenario description and basic assumptions. Each questionnaire comprised two sequential scenarios. The first scenario assumed that sharing accommodation was unavailable, allowing for the measurement of alone-price demand for hotels. The second scenario considered sharing accommodation as an available option, facilitating the measurement of own-price demand for hotels and cross-price demand for sharing accommodation.

In each scenario, participants were asked to report their demand – purchase likelihood as proposed by Roma et al. (2016) and validated by numerous empirical studies (Brown et al., 2022) – for the certain hotel/sharing accommodation at various hotel/sharing accommodation prices. The notion of demand hereafter represents demand probability. To strike a balance between the precision of demand curves and the participants' workload, the questionnaire included seven price points for hotels and five price points for sharing accommodation. This resulted in seven demand questions under the alone-price scenario and 35 demand questions under the own-price/cross-price scenario. In all cases, the price started from zero, and the average market price was put as the median of the price series. The progression of prices followed a generally even logarithmic pattern. The price series for each hotel type concluded at an estimated breakpoint price, set at five times the average market price, based on findings from pilot tests. The pilot results also indicated that the maximum price for sharing accommodation should be set at two times the average

market price, beyond which the substitutability of sharing accommodation for hotels diminished. See the Supplementary Material A for the complete questionnaire.

Participants

Participants were recruited from the US via Amazon Mechanical Turk and received a compensation of $1.00 for each successfully completed "human intelligence task". We collected a total of 675 valid responses. The final participant pool comprised 54.5 % females and 45.5 % males. Participants' ages ranged from 18 to 77 years, with a mean of 40 years. Additional details regarding age, income, education and employment can be found in Table 1.

Data analysis

For each hotel type, we constructed both alone-price and own-price demand curves, as well as the cross-price demand curve for sharing accommodation in relation to the hotel price. As per Hursh and Silberberg (2008), the alone-price demand model is expressed as follows:

$$log_{10}(Q) = log_{10}(Q_0) + k\left(e^{-\alpha P} - 1\right), \tag{1}$$

where Q is hotel demand, P is hotel price, Q_0 is the demand intensity of hotel (the demand at zero hotel price), k is a predetermined span parameter to restrict the range of logarithmic demand, and parameter α is the estimated change rate of elasticity. Since we measured demand in probability, the span of demand (parameter k) was always equal to $log_{10}(Q_0)$. This model can thus be simplified as follows:

$$log_{10}(Q) = log_{10}(Q_0)e^{-\alpha P}, \tag{2}$$

which was used to fit the alone-price demand curves for hotels. Q and P are input variables, whereas Q_0 and α are estimated variables.

The cross-price demand curves for sharing accommodation, modeled with a sharing accommodation price equal to the market average ($90), were fitted following the approach of Hursh and Roma (2013):

$$log_{10}(Q) = log_{10}(Q_0) + Ie^{-\beta P_s}, \tag{3}$$

where Q is sharing accommodation demand, P_s is hotel price, Q_0 is the demand intensity of sharing accommodation (the demand at infinite hotel price), I is called the interaction constant to reflect the relationship between two related goods ($I > 0$: complementary, $I < 0$: substitutive), and parameter β specifies the change rate of cross-price elasticity. The higher the β, the stronger the substitutability of sharing accommodation for hotels. In Eq. (3), Q and P_s are input variables, whereas Q_0, I and β are estimated variables.

To account for sharing accommodation's participation in market competition, the own-price demand curves for hotels were fitted using a multivariate functional form that considered both hotel price and sharing accommodation price. Adapted from Hursh and Schwartz (2023), the demand model is defined as:

$$log_{10}(Q) = log_{10}(Q_0)e^{-\alpha P} + Ie^{-\beta P_s}, \tag{4}$$

where Q, Q_0 and P are the hotel demand, hotel demand intensity (the demand at zero hotel price and infinite sharing accommodation price) and hotel price respectively, P_s is sharing accommodation price, I is the interaction constant, parameter α is the change rate of the hotel own-price elasticity, and parameter β is the change rate of the hotel cross-price elasticity. A higher β means a stronger substitutability of hotels for sharing accommodation. Here, Q, P and P_s are input variables, whereas Q_0, I, α and β are estimated variables.

In summary, the substitutability of sharing accommodation for a particular hotel type could be identified by observing a more elastic hotel own-price demand curve compared to its alone-price demand curve, along with the parameter β on the cross-price demand curve for sharing accommodation. Conversely, the substitutability of a certain hotel type for sharing accommodation would be reflected by the parameter β on the multivariate own-price demand curve for hotels. Since the demand models necessitated log transformation, zero values in the demand data were replaced with a value of 1 (%).

The essential value was calculated as the reciprocal of parameter α. A larger essential value indicates a flatter demand curve and a greater insensitivity to price increases, suggesting a higher valuation of the hotels. Based on nonlinear least squares, an individual demand curve was fitted using pooled data of the participants from one segmented group and was regarded as the representative demand curve of this group of individuals (Kaplan, 2018). Before modeling, extra sum-of-squares F-tests were conducted to determine whether the groups under investigation exhibited different demand curves, thus confirming the segmentation structure. The null hypothesis posited that the tested groups shared the same parameter α; its rejection would indicate the need for separate estimations of the demand curve.

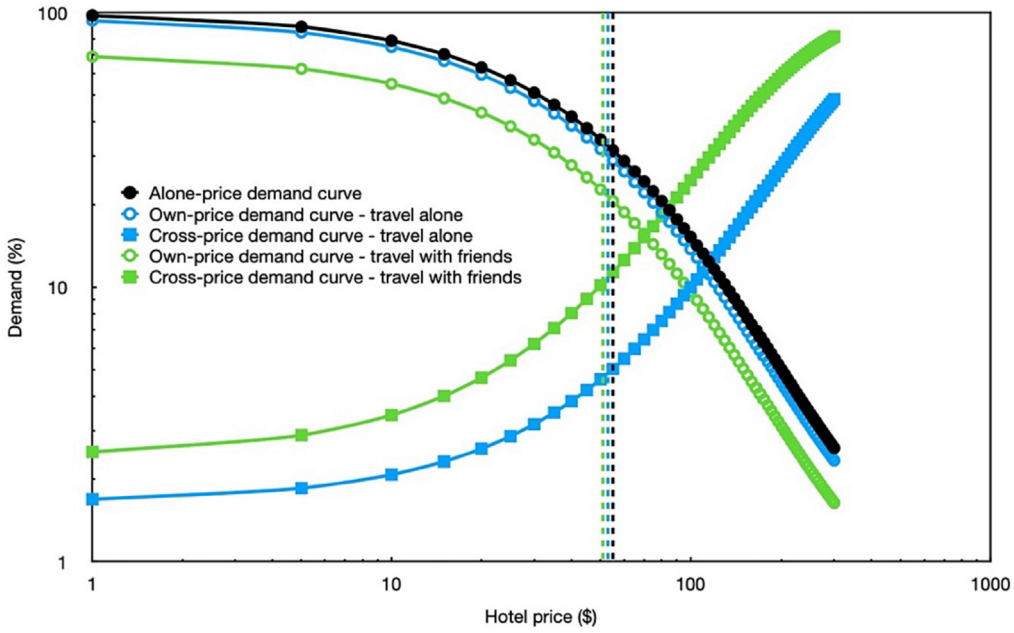

Fig. 1. Demand curves for economy hotels.

Results

Manipulation checks

After reading the scenario description, participants answered two manipulation check questions to validate the manipulation of hotel types and travel companions, respectively, on a 7-point Likert scale. For hotel types, participants assessed the cost of staying in economy/midscale/upscale hotels. And for travel companions, participants rated the extent to which they agreed with the statement "In this trip, I make decisions on my travel activities alone" if they travel as described in the given scenario. The manipulation checks were successful as intended. Participants perceived significantly different costs associated with staying in the three hotel types ($F = 161.64$, $p = 0.00$), with upscale hotels having the highest mean cost rating ($M = 5.66$), followed by midscale hotels ($M = 4.51$) and economy hotels ($M = 3.73$). Furthermore, participants under the "travel alone" scenario ($M =$

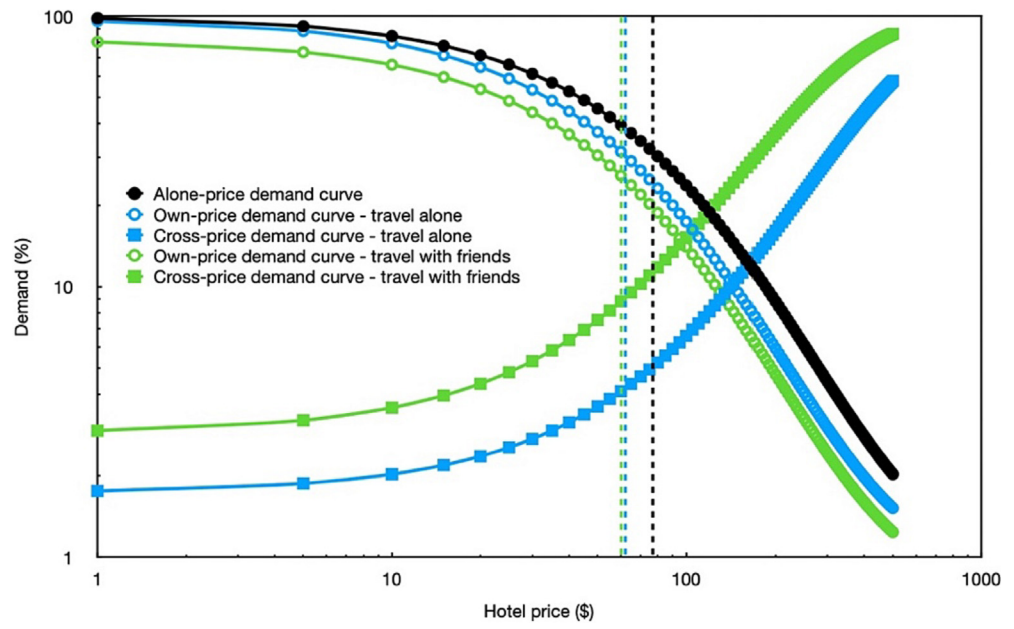

Fig. 2. Demand curves for midscale hotels.

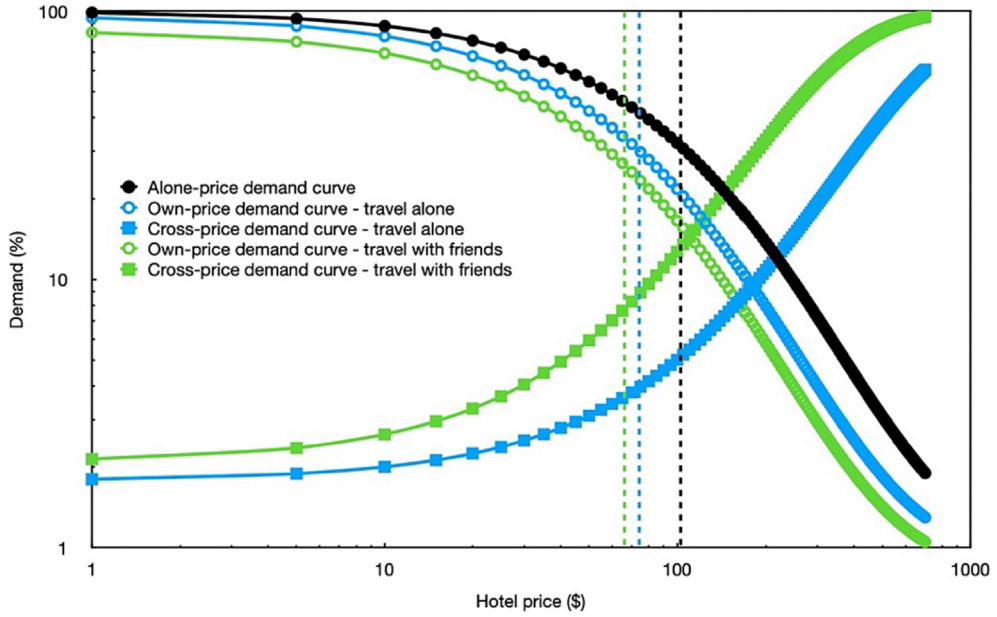

Fig. 3. . Demand curves for upscale hotels.

6.23) reported significantly higher agreement with the statement that they made decisions on travel activities alone, compared to participants under the "travel with friends" scenario ($M = 3.39$), as indicated by a t-test ($t = 24.11$, $p = 0.00$).

Substitutive relationship between sharing accommodation and hotels

The F-tests confirmed that economy, midscale and upscale hotels exhibited significantly different alone-price demand curves ($F = 157.19$, $p = 0.00$) as well as own-price demand curves ($F = 263.78$, $p = 0.00$). For each hotel type, its alone-price demand curve remained unaffected by travel companions (economy: $F = 2.16$, $p = 0.14$; midscale: $F = 1.39$, $p = 0.24$; upscale: $F = 0.01$, $p = 0.93$). However, the own-price demand curves showed significant differences between traveling alone and traveling with friends (economy: $F = 120.27$, $p = 0.00$; midscale: $F = 58.46$, $p = 0.00$; upscale: $F = 86.11$, $p = 0.00$). This suggests that the competition introduced by sharing accommodation in the lodging market, especially the offered home benefits for group travelers, made travel companions a significant factor in hotel demand.

Figs. 1 to 3 display the alone-price demand curve and own-price demand curve for each hotel type, together with the cross-price demand curve for sharing accommodation with hotel price, all on the logarithmic coordinates. In each figure, a dotted line marks the point of unit elasticity on the demand curve of the same color, denoting the optimal pricing point P_{max}. It is worth noting that the presented demand curves are different from the common demand curves on microeconomics books, since the price is plotted on the x-axis and the demand is plotted on the y-axis. This is to more intuitively describe the functional relationship between price as an independent variable and demand as a dependent variable so as to better showcase how the elasticity (the slope of the curve) increases with price along the demand curve.

Table 2
Model results: economy hotels.

	Q_0 (%)	α (10^{-3})	β (10^{-3})	I	R^2	EV	P_{max} ($)	O_{max} ($)	Indifference price ($)
Alone-price demand curve ($N = 222$)	100^{***}	5.25^{***}			0.60	191	55	17	
Travel alone ($N = 111$)									112
Own-price demand curve	100^{***}	5.47^{***}	35.33^{***}	-0.44^{***}	0.56	183	53	16	
Cross-price demand curve	100^{*}		5.78^{***}	-1.78^{***}	0.31				
Travel with friends ($N = 111$)									71
Own-price demand curve	100^{***}	5.69^{***}	18.58^{***}	-0.79^{***}	0.49	176	51	11	
Cross-price demand curve	100^{***}		9.74^{***}	-1.62^{***}	0.32				

EV: Inverse of the elasticity (decay rate) of demand curve; positively correlated with consumers' valuation of the good. P_{max}: Point of unit elasticity; the price where the expected revenue per capita maximizes. O_{max}: Maximum expected revenue per capita.

* $p < 0.05$.

*** $p < 0.001$.

Table 3
Model results: midscale hotels.

	Q_0 (%)	α (10^{-3})	β (10^{-3})	I	R^2	EV	P_{max} ($)	O_{max} ($)	Indifference price ($)
Alone-price demand curve ($N = 228$)	100***	3.75***			0.64	267	77	24	
Travel alone ($N = 116$)									144
Own-price demand curve	100***	4.71***	41.22**	−0.34***	0.62	212	62	19	
Cross-price demand curve	100**		4.00***	−1.76***	0.29				
Travel with friends ($N = 112$)									97
Own-price demand curve	100***	4.84***	21.15***	−0.57***	0.55	207	60	15	
Cross-price demand curve	100***		6.34***	−1.54***	0.27				

EV: Inverse of the elasticity (decay rate) of demand curve; positively correlated with consumers' valuation of the good. P_{max}: Point of unit elasticity; the price where the expected revenue per capita maximizes. O_{max}: Maximum expected revenue per capita.
** $p < 0.01$.
*** $p < 0.001$.

Tables 2 to 4 provide the model results, including the estimated parameters and the indifference price of the hotels where the demand for hotels matches the demand for sharing accommodation. If the hotel price goes beyond its indifference price, consumers' demand for sharing accommodation would exceed their demand for that hotel type; vice versa. The Supplementary Material C presents a comparison between the behavioral economic demand model and the double-log demand model that has been widely applied in econometric demand modeling practices, demonstrating a better goodness-of-fit and more adequate information and implications that the behavioral economic demand model can provide.

Sharing accommodation had a notable substitutability for economy hotels. The entire demand curve for economy hotels exhibited increased elasticity with the entry of sharing accommodation into the lodging market, resulting in a lower essential value of economy hotels and a reduced optimal pricing point. The increasing cross-price demand curve for sharing accommodation, specified by the negative parameter I, further confirmed that sharing accommodation served as a substitute for economy hotels. Compared to the scenario of traveling alone, the substitutability of sharing accommodation for economy hotels considerably increased when traveling with friends, as evidenced by a larger parameter β on the cross-price demand curve for sharing accommodation in the latter case. Economy hotels were deemed substitutes for sharing accommodation as well, and their substitutability for sharing accommodation decreased when traveling with friends compared to traveling alone.

The negative interaction constants indicated that sharing accommodation and midscale hotels served as substitutes for each other. The entry of sharing accommodation made the entire demand curve for midscale hotels become more elastic, characterized by a higher increasing rate of elasticity, lower essential value and a smaller optimal price. This influence was more pronounced on midscale hotels than on economy hotels. The substitutability of sharing accommodation [midscale hotels] for midscale hotels [sharing accommodation] increased [decreased] when the scenario shifted from traveling alone to traveling with friends.

Similar to the above, there was a confirmed substitutive relationship between upscale hotels and sharing accommodation, as indicated by the negative interaction constants on all demand curves. The substitutability of sharing accommodation for upscale hotels was stronger when customers traveled with friends than when traveling alone. Additionally, we observed a more noticeable impact of sharing accommodation's entry into the market on the shape of the demand curve for upscale hotels, compared to economy and midscale hotels. In other words, with sharing accommodation entering the competition, customers' valuation of upscale hotels experienced the most significant decline. Furthermore, the disparity in own-price demand curves between different travel companion situations also appeared more marked for upscale hotels than for the other hotel types.

While sharing accommodation was confirmed as a substitute for all hotel types, the degree of substitution varied. The substitutability of sharing accommodation was the strongest for economy hotels, followed by midscale hotels and upscale hotels. Furthermore, the direction of the substitutive relationship influenced the conclusions. In Table 5, we extracted parameter βs (at 10^{-3}) from the

Table 4
Model results: upscale hotels.

	Q_0 (%)	α (10^{-3})	β (10^{-3})	I	R^2	EV	P_{max} ($)	O_{max} ($)	Indifference price ($)
Alone-price demand curve ($N = 225$)	100***	2.82***			0.62	355	103	32	
Travel alone ($N = 113$)									180
Own-price demand curve	100***	3.91***	30.40**	−0.27***	0.58	256	74	22	
Cross-price demand curve	100**		2.97***	−1.75***	0.25				
Travel with friends ($N = 112$)									111
Own-price demand curve	100***	4.39***	20.82***	−0.46***	0.53	228	66	18	
Cross-price demand curve	100***		6.28***	−1.68***	0.29				

EV: Inverse of the elasticity (decay rate) of demand curve; positively correlated with consumers' valuation of the good. P_{max}: Point of unit elasticity; the price where the expected revenue per capita maximizes. O_{max}: Maximum expected revenue per capita.
** $p < 0.01$.
*** $p < 0.001$.

Table 5
Asymmetric substitution between sharing accommodation and hotels.

	Economy	Midscale	Upscale
Substitutability of sharing accommodation for hotels			
Travel alone	5.78	4.00	2.97
Travel with friends	9.74	6.34	6.28
Substitutability of hotels for sharing accommodation			
Travel alone	35.33	41.22	30.40
Travel with friends	18.58	21.15	20.82

own-price demand curves for hotels and the cross-price demand curves for sharing accommodation to examine whether the substitutability of hotels for sharing accommodation mirrored the substitutability of sharing accommodation for hotels. Since the own-price and cross-price demand curves were modeled in different functional forms, their parameters were not directly comparable. As a workaround, we analyzed the dual-directional rank orders of parameter β across hotels and found an asymmetric substitutive relationship. To reiterate, β represents the increase rate of the cross-price elasticities along the demand curve. A higher β from the own-price [cross-price] demand curve indicates that the demand for economy/midscale/upscale hotels [sharing accommodation] is more sensitive to sharing accommodation [economy/midscale/upscale hotel] price, thereby suggesting a stronger substitutability of economy/midscale/upscale hotels [sharing accommodation] for sharing accommodation [economy/midscale/upscale hotels].

The substitutability of sharing accommodation was greater for lower-end hotels. This implies that compared to midscale and upscale hotels, economy hotels would lose more customers to sharing accommodation with higher prices. When it came to hotels substituting for sharing accommodation, however, midscale hotels emerged as the strongest substitutes, defying the expectation of a symmetric relationship; and the following rank order slightly differed between traveling alone ($\beta_{economy} > \beta_{upscale}$) and traveling with friends ($\beta_{upscale} > \beta_{economy}$). This suggests that with higher sharing accommodation prices, customers tended to opt for higher-quality hotels as their accommodation substitutes, especially when traveling with friends. In fact, compared to traveling alone, the substitutability of sharing accommodation [hotels] for hotels [sharing accommodation] was consistently strengthened [weakened] when traveling with friends.

Variations in the substitutive relationship across customers

To delve into the effects of customer characteristics on the substitutive relationship, we conducted additional analyses by segmenting participants based on gender, age (≤ 40 years vs. > 40 years), annual household income (< $80,000 vs. ≥ $80,000) and preference (frequent customers of a certain hotel type vs. other customers). Tables 6 to 9 provide insights into the substitutability of sharing accommodation for hotels (βs from the cross-price demand curves) and the substitutability of hotels for sharing accommodation (βs from the own-price demand curves) within each customer group, where "Ns" denotes an insignificant parameter. Similar to Table 5, a higher β means a stronger substitutability. See the Supplementary Material B for detailed model results.

Females exhibited higher substitutability of sharing accommodation for hotels than males, except for midscale hotels. Among female customers, the substitutability of all hotel types for sharing accommodation was reduced when traveling with friends as opposed to traveling alone. A similar pattern was observed among male customers regarding the substitutability of economy hotels for sharing accommodation. However, males did not perceive midscale and upscale hotels as substitutes for sharing accommodation when traveling alone, and their hotel demand curves exhibited greater substitutability for sharing accommodation than those of females when traveling with friends. These findings suggest that females generally had a higher level of acceptance for sharing accommodation, whereas males might place a lower value on the home benefits of sharing accommodation. Furthermore, compared to females, males appeared to be more resistant to transitioning from hotels to sharing accommodation in response to increases in hotel prices. When traveling alone, their hotel preferences seemed to be primarily driven by absolute hotel prices;

Table 6
The influence of gender.

		Economy	Midscale	Upscale
Substitutability of sharing accommodation for hotels				
Travel alone	Female	6.61	4.00	4.05
	Male	4.96		2.10
Travel with friends	Female	12.01	6.34	8.86
	Male	7.18		3.04
Substitutability of hotels for sharing accommodation				
Travel alone	Female	35.33	39.41	28.86
	Male		Ns	Ns
Travel with friends	Female	18.58	20.02	20.04
	Male		23.17	21.42

Table 7
The influence of age.

		Economy	Midscale	Upscale
Substitutability of sharing accommodation for hotels				
Travel alone	≤ 40 years	6.52	4.58	4.35
	> 40 years	5.04	3.60	2.05
Travel with friends	≤ 40 years	7.34	6.34	4.09
	> 40 years	14.40		8.23
Substitutability of hotels for sharing accommodation				
Travel alone	≤ 40 years	33.11	41.22	29.74
	> 40 years	40.54		Ns
Travel with friends	≤ 40 years	22.23	21.15	20.82
	> 40 years	14.72		

and when traveling with friends, they showed a greater willingness to switch from sharing accommodation to higher-end hotels as sharing accommodation price increased.

The substitutability of sharing accommodation for hotels was stronger when traveling with friends than when traveling alone, irrespective of whether customers were younger or senior. However, younger customers displayed slightly greater resistance to transitioning from upscale hotels to sharing accommodation as the price of upscale hotels increased when traveling with friends than when traveling alone, implying that younger customers found upscale hotels more satisfactory for fulfilling their accommodation needs when traveling in a group. Senior customers, compared to their younger counterparts, were more sensitive to the influence of travel companions on their judgment. These indicate that senior customers, likely due to their extensive travel experience, showed a heightened awareness of the benefits associated with selecting an entire home in sharing accommodation when traveling with friends on a leisure trip. Nonetheless, senior customers did not consider upscale hotels as substitutes for sharing accommodation when traveling alone, meaning that they did not alter their demand for upscale hotels based on sharing accommodation prices.

High-income customers were more sensitive to the price increase in economy hotels than low-income customers and more willing to choose the sharing accommodation as an alternative, especially when traveling with friends. However, high-income customers were resistant to substitute upscale hotels for sharing accommodation despite a price increase when traveling alone. In contrast, income did not significantly affect how midscale hotels were substituted by sharing accommodation. When traveling alone, the substitutability of hotels for sharing accommodation was consistently higher among high-income customers than among low-income customers. On the contrary, in the case of traveling with friends, high-income customers presented lower substitutability of hotels (except for midscale hotels) for sharing accommodation than their low-income counterparts. The findings suggest that compared to low-income customers, high-income customers value the home benefits and social interaction offered by sharing accommodation to their travel groups to a higher degree.

Among frequent customers of a certain hotel type, the substitutability of sharing accommodation for that hotel type was more insensitive to changes in travel companions, compared to other customers. Yet this pattern did not hold true for frequent customers of upscale hotels, who, in line with other customers, consistently indicated low substitutability of sharing accommodation for upscale hotels under all circumstances. In general, frequent customers of a particular hotel type revealed demand curves with lower substitutability of sharing accommodation for those hotels and higher substitutability of the hotels for sharing accommodation than other customers did, reflecting their habit persistence in hotel choices. However, when traveling alone, frequent customers of upscale hotels did not consider upscale hotels as substitutes for sharing accommodation, while frequent customers of midscale hotels displayed greater substitutability of sharing accommodation for midscale hotels compared to other customers. These observations underscore the diverse influences of consumption preferences on demand curves across different hotel

Table 8
The influence of income.

		Economy	Midscale	Upscale
Substitutability of sharing accommodation for hotels				
Travel alone	< $80,000	4.65	4.00	3.32
	≥ $80,000	7.80		2.63
Travel with friends	< $80,000	8.35	6.34	3.69
	≥ $80,000	12.24		9.38
Substitutability of hotels for sharing accommodation				
Travel alone	< $80,000	32.77	39.27	29.20
	≥ $80,000	38.32	49.12	31.26
Travel with friends	< $80,000	19.68	20.54	22.12
	≥ $80,000	17.43	21.35	19.17

Table 9
The influence of preference.

		Economy	Midscale	Upscale
Substitutability of sharing accommodation for hotels				
Travel alone	Frequent customers	5.78	5.00	2.97
	Other customers		3.16	
Travel with friends	Frequent customers	7.86	6.34	6.28
	Other customers	10.86		
Substitutability of hotels for sharing accommodation				
Travel alone	Frequent customers	39.77	36.20	Ns
	Other customers	32.22	Ns	31.58
Travel with friends	Frequent customers	18.58	23.38	21.74
	Other customers		20.36	21.04

types. The rich experience of staying in low-end hotels led to more conservative and stable demand for those hotels, while greater experience in high-end hotels reinforced the behavior that sharing accommodation and high-end hotels were consumed independently.

Conclusions

The thriving sharing accommodation market has enriched the lodging industry with unique products and services, igniting a fervent debate about the impact of sharing accommodation on hotel businesses. While prior research has produced varied conclusions, we have recognized a lack of demand-curve delineation regarding whether sharing accommodation and hotels act as substitutes or complements and to what extent. The principal objective of this study was to conduct a systematic examination of the substitutive relationship between sharing accommodation and hotels, with a particular focus on discerning variations in the degree of substitution across different hotel types. We delved deeper into understanding the influences of travel companions and customer groups on the substitutive relationship to provide valuable insights into the competition dynamics and offer more targeted guidance for business strategies.

Discussion on key findings

In line with the pricing structure, customers place the highest value on upscale hotels, followed by midscale and economy hotels. It has been confirmed that all hotel types have significant substitutive relationships with sharing accommodation, albeit to varying extents. The substitutability of sharing accommodation is the greatest for economy hotels and decreases sequentially for midscale and upscale hotels. The result corroborates many existing conclusions (Dogru et al., 2019; Zervas et al., 2017) but diverges from certain studies positing that midscale hotels experience the highest level of substitution by sharing accommodation (Guttentag & Smith, 2017). The variance can be attributed to the inconsistent measurements of substitution in previous research. Leveraging demand curves and the dynamics of own-price and cross-price elasticities, this study establishes a new framework for examining the substitutive relationship between sharing accommodation and hotels. The comparison between the alone-price and own-price demand curves for hotels offers additional evidence of the substitution of sharing accommodation for hotels. Specifically, the demand curves for hotels become overall more elastic with lower essential values and optimal pricing points upon the entry of sharing accommodation into the market. This shift is particularly pronounced for higher-end hotels. These findings align with prior research pointing that sharing accommodation exerts significant downward pressure on hotel prices (Dogru et al., 2022) and elevates the price elasticity of the hotel industry (Chen et al., 2022).

Moreover, this study represents the first effort to confirm that the substitutive relationship between sharing accommodation and hotels is asymmetric. Previous research predominantly emphasized the threats that sharing accommodation poses to hotel businesses while relatively overlooking the substitution of hotels for sharing accommodation. Our results reveal that, although the substitutability of sharing accommodation for hotels decreases as hotels ascend from low-end to high-end categories, midscale hotels present the greatest substitutability for sharing accommodation. The order of substitutability between economy and upscale hotels for sharing accommodation varies based on whether travel companions are present. Economy hotels exhibit greater substitutability than upscale hotels for sharing accommodation when traveling alone, whereas the opposite holds when traveling with friends. In other words, the demand for upscale hotels benefits more from the increase in sharing accommodation prices when traveling with friends than when traveling alone. This phenomenon reflects group travelers' requirements for higher-quality hotels in lieu of sharing accommodation.

Compared to solo travel, the attractiveness of sharing accommodation – a sense of community (Tussyadiah, 2015), enjoyment, home benefits (So et al., 2018), novelty and social interaction (Chi et al., 2021) – is significantly amplified when traveling with friends. Consequently, there is generally higher [lower] substitutability of sharing accommodation [all hotel types] for all hotel types [sharing accommodation] when traveling with friends than when traveling alone. It has been proved that entire homes

have a more negative impact on hotel revenue than private or shared rooms (Dogru et al., 2020), and that travelers prefer sharing accommodation over hotels when accompanied by friends (Poon & Huang, 2017). These findings indirectly testify the observed variations in the substitutive relationship between sharing accommodation and hotels in different travel companion situations.

By further investigating how the substitutive relationship varies across customer groups, we uncover customers' divergent accommodation needs under different circumstances. When traveling alone, cost considerations take precedence over the living environment. Customers typically opt for economy hotels as an alternative to sharing accommodation, whereas higher-end hotels are not perceived as substitutes for sharing accommodation by certain customer groups. When traveling with friends, however, customers place a higher emphasis on the ambience and environment of their accommodation. Therefore, higher-end hotels substitute for sharing accommodation to a larger degree. This underscores customers' increased demands for the quality of hotel services and facilities to compensate sharing accommodation's home benefits. As a result, the competition between sharing accommodation and higher-end hotels intensifies when catering to group travelers as opposed to solo travelers.

Implications

This study addresses the research void in using demand curve analysis to assess the substitutive relationship between sharing accommodation and different hotel types. The behavioral economic demand models, serving as a better alternative to traditional econometric demand models, enable us to fit complete demand curves and parameterize the change rate of elasticity over the full price range. The degree of substitution is therefore comprehensively quantified based on the entire demand curve, in contrast to the prevailing practice in econometric demand modeling studies relying on single elasticity coefficients (Gunter & Önder, 2018). Furthermore, by employing the multivariate behavioral economic demand model, this study advances the fitting of hotel demand curves from a two-dimensional to three-dimensional construction. This study is the first application of the multivariate behavioral economic demand model to fit demand data in both tourism and behavioral economics research. Beyond clarifying the fluctuating substitutability of sharing accommodation for different hotel types, this study contributes to the limited literature on the substitutability of hotels for sharing accommodation and points out the asymmetric substitutive relationship between sharing accommodation and hotels. It also uncovers the influences of travel companions and customer characteristics, providing novel insights into the substitutive relationship and its variability across contexts.

From a practical perspective, these findings offer critical insights for both sharing accommodation and hotel businesses regarding market competition strategies. The substitutability of sharing accommodation for different hotel types highlights that the demand for sharing accommodation is most sensitive to the price of economy hotels. Therefore, a potential strategy for economy hotels to compete with sharing accommodation and retain their customers could involve reducing prices. On the flip side, the substitutability of each hotel type for sharing accommodation suggests that midscale hotels are the primary alternative for customers if sharing accommodation prices increase. Hence, sharing accommodation could consider lowering prices to attract more customers from midscale hotels than from other hotels.

Importantly, industry managers should recognize that the competition between sharing accommodation and hotels is dynamic and varies across customer segments and contexts. For example, upscale hotels should be vigilant about price competition from sharing accommodation, which may lure away their group customers traveling with friends. While females generally have a higher acceptance of sharing accommodation than males, they are also more price-sensitive in both hotels and sharing accommodation, a customer segment sensitive to relative pricing changes. In contrast, males tend to be less responsive to price fluctuations, implying relatively stable competition to attract male customers. However, a reduction in sharing accommodation prices when traveling with friends could motivate male customers to switch from hotels to sharing accommodation. Furthermore, independent senior customers are likely to exhibit loyalty to hotels, whereas senior customers in groups may become a reliable customer source for sharing accommodation. Hotels may find it harder to lose their frequent customers compared to other customers when increasing their own prices. Given these considerations, managers of different lodging establishments are encouraged to develop customized market competition strategies that account for their customer structure and the dual-directional substitutive relationship with other competitors.

Limitations and future research

This study focused on three hotel types to maintain a manageable research scope, but we believe that conducting investigations into other hotel types (e.g., luxury hotels) and their substitutive relationship with sharing accommodation would further enhance our understanding of the lodging industry and its competitive landscape. Furthermore, real travel situations encompass various forms of travel companions beyond traveling alone or with friends, so future research should explore how sharing accommodation and hotels substitute for each other when customers travel with family, a partner or other companions.

Purpose of travel also influences customers' accommodation demand. Due to the limited length of this study, we control the purpose of travel to leisure trips only. Nonetheless, figuring out how the substitutive relationship between sharing accommodation and hotels varies between leisure trips and business trips is also a research direction that is worth exploring. Another noteworthy consideration is the analysis of shared rooms and their substitutive relationship with hotels. Additionally, it would be valuable to investigate how the degrees of substitution between sharing accommodation and hotels vary between domestic and outbound tourists. Finally, this study used experiments to collect hypothetical purchase data given the lack of secondary data sources with sufficient price points and individual consumer information. Yet we encourage future researchers to apply eligible secondary data to model actual consumer demand and its possible trends over time.

CRediT authorship contribution statement

Gabrielle Lin: Conceptualization, Formal analysis, Methodology, Software, Visualization, Writing – original draft. **Jason Li Chen:** Conceptualization, Supervision, Validation, Writing – review & editing. **Gang Li:** Conceptualization, Supervision, Validation, Writing – review & editing. **Haiyan Song:** Conceptualization, Supervision, Validation, Writing – review & editing.

Declaration of competing interest

None.

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Appendix A. Supplementary data

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