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Multi-unit ownership and market power: A study of the lodging industry in Texas

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Abstract

As franchisees in the retail and service industries become experienced and acquire local market knowledge, they are likely to own multiple franchised units. Given non- (or weak) exclusive clauses in franchising contracts or industry norms, some of these multi-unit owners are affiliated with multiple franchisors. Agency and transaction cost theories, the classic theoretical framework to analyze franchising, cannot explain this type of multi-franchisor affiliation because this type of ownership would create incentive problems across franchisors. Conversely, this paper investigates whether this type of the multi-unit ownership can be explained by the exercise of market power by these franchisees. We test this hypothesis in geographically clustered markets (hotels near the interstate highway exits), where multi-unit ownership is common. We first show that multi-unit owners affiliated with multiple franchisors charge higher prices than other franchisors. Then, in our main analysis, we show that one explanation for this pattern is the existence of market power: Without multi-unit ownership, prices at these hotels would decrease by 9%, on average (and market-level volume sales would increase by 7.52%). These results help explain why franchisors might be willing to engage in franchising contracts with franchisees that operate units associated with different franchisors.

1 | INTRODUCTION

Franchising is a widely used business governance format in the U.S. retail and service industries. In a franchising contract, franchisees sell franchisors' products or use their brand names (trademarks) at a given location for a certain period time. In return, franchisors receive an initial installment (franchise fee) in addition to sales-based fees (royalties). With initial and ongoing support from franchisors, franchisees can take advantage of established management skills or national/regional marketing campaigns that are not possible for individual franchisees to achieve otherwise. As franchisees become experienced and more efficient in the operation in their local markets, some franchisees tend to expand their business by owning additional units; this is known as *multi-unit franchising*. Multi-unit franchisees are not rare, although the majority of franchisees remain single unit owners. Various studies in franchising show the prevalence of multi-unit franchising. Kalnins and Lafontaine (2004) indicate that among franchised units of the seven major fast food chains in Texas in 1995, 49% of franchisees operated more than one unit; these owners accounted for 84% of total franchised units in the fast food chains. It has been argued that this type of ownership is due to weak exclusive clauses in franchising contracts (Blair & Lafontaine, 2005; Wilson, 2011).

In many cases, these multiple units are associated to the same franchisor; we will henceforth refer to this type of owners as *multi-unit franchisees*. In other cases, some franchisees own units that are affiliated with multiple franchisors; in this paper, we will refer to these

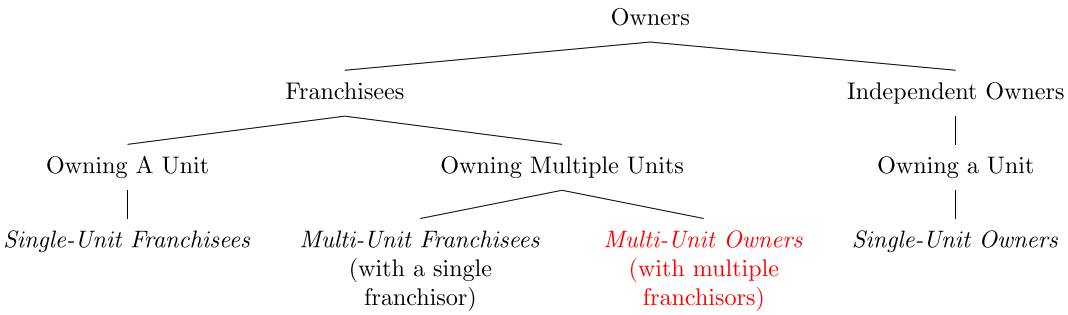

FIGURE 1 Ownership types in franchising [Color figure can be viewed at wileyonlinelibrary.com]

owners as *multi-unit owners*. Figure 1 summarizes the types of ownership in the context of franchising, in particular as they pertain to this paper. Franchisees can operate either one unit or multiple units. If franchisees own a single unit, they are referred to as *single-unit franchisees* or *single-unit owners* in this paper. Franchisees that own more than one unit are divided into either *multi-unit franchisees* or *multi-unit owners* (the red colored node in Figure 1), as explained above. The focus of this paper will be on multi-unit owners as this is the most prevalent type of non-single ownership in our data.[1]

Traditional theories of franchising, which are based on transaction costs and agency-based frameworks, cannot explain the emergence and prevalence of multi-unit owners. Agency-based frameworks suggest franchising is beneficial since the costs of the separation between owners (franchisors) and operators (franchisees) are minimized: As residual claimers, franchisees have an economic incentive to invest more effort than managers hired by franchisors. As franchisees add more units to their operation, however, this advantage would disappear since the franchisees might start to manage multiple units by hiring managers, defeating the purpose of reducing agency problems. In addition, if multi-unit owners are affiliated with multiple franchisors, the costs for franchisors to monitor and control these franchisees would be higher.

The transaction-cost perspective provides reasonable arguments for multi-unit franchising but not for multi-unit owners. In multi-unit franchising, franchisors can reduce transaction costs, such as monitoring or training, by using multi-unit franchisees since these franchisees are usually more experienced in local retailing and tend to invest more resources (effort, monetary) than single-unit owners. However, it is not clear that franchisors can reduce such transaction costs if franchisees have franchising contracts with multiple franchisors.

Rather than relying on the classic literature that explains franchising structurally, this paper explores whether a framework of market power helps explain why franchisees are affiliated with multiple franchisors. Specifically, we empirically test whether multi-unit owners charge higher prices and if market power explains this pattern. The lodging industry is suited for these empirical questions for several reasons. First, in the lodging industry, franchising is one of the widely used business formats, and multi-unit operation is prevalent (Kalnins, 2006). Hotel chains with multiple brands tend to operate multiple hotels in small geographic areas where consumer demand is high such as central business districts and tourist destinations. At the same time, when multi-unit owners are observed, they are likely to confine the operation of their units in the same small geographic area.

We use data on hotels and motels near interstate highway exits in Texas, where hotels tend to be closely located near exits, thereby creating distinct and well-defined clusters (markets) away from other (large and more difficult to define) geographic markets. In these clusters, as opposed to metropolitan areas, franchisees tend to have strong control over their operational and pricing decisions. This results from franchisees being distant from the national/regional headquarters of the franchisors (Cochet et al., 2008; Perryman & Combs, 2012). Another reason for this increased control by franchisees is that franchisors of economy and mid-scale hotel brands (typically found near highway exits) are, as a general rule, more likely to provide discretion over management and pricing to franchisees vis-à-vis franchisors of upscale and luxury hotels (Turner et al., 2016). Finally, multi-unit owners (the object of our study) appear to be a feature of isolated markets. In Texas, for example, none of the 1,521 hotels in the metropolitan area of Houston are operated by multi-unit owners, whereas 50 out of 763 hotels (5.24%) in isolated markets are.

Given these conditions, this paper purposefully focuses on markets where franchisees have (greater) control over pricing and management, a feature that motivates and is captured by the structural model that we use in this paper. In order to analyze the behavior of franchisees, it is required to precisely identify the owners (franchisees) of individual hotels in the markets. To determine franchisees' identities, we use each hotel's tax identification number registered in hotel occupancy tax fillings at the Texas Comptroller's Office.

To show whether multi-unit owners charge higher prices, we rely on reduced-form methods, including difference-in-difference (DiD) and instrumental variable (IV) methods. Then, to measure market power of hotels in these markets, we follow the approach of Berry et al. (1995). The approach consists of first estimating a random coefficients logit model demand model. Then, with the estimated demand parameters, marginal costs are recovered under the assumption that hotels optimize their pricing decisions by maximizing the joint profits

[1]In our data set, out of 240 franchised hotels operated in a "multi" fashion, only two hotels are owned by a multi-unit franchisee. More generally, multi-unit franchisees and multi-unit owners are not mutually exclusive sets. For example, a multi-unit franchisee can also be a multi-unit owner by associating with more than one franchisor (and vice-versa).

across all owned units (we call this the "pre" scenario). Finally, to gauge whether multi-unit ownership is responsible for higher prices, we conduct a counterfactual analysis in which all multi-unit owners maximize their profits as if they were single-unit owners (the "post" scenario). Comparison between the pre- and post-scenarios allows testing whether multi-unit owners exercise market power. The results show that market power is a mechanism that explains why multi-unit owners charge higher prices. A by-product of this result is that in the absence of multi-unit ownership, rooms sold would increase and so would consumer welfare.

As far as we know, this paper is the first to analyze the effects of multi-unit ownership (red text in Figure 1) using a structural approach. Studies in the franchising literature have heavily focused on multi-unit franchisees, even though there is evidence that franchisees associated with multiple franchisors are common in various industries, such as hotel and restaurant (Blair & Lafontaine, 2005). Using data on taxpayer information from hotel occupancy tax receipts, we separate upstream (franchisors) and downstream (franchisees) firms and then analyze the effects of the behavior of the downstream firms. Moreover, for reasons that we stated earlier, we limit the sample of this paper to hotels and motels near the interstate highway exits in Texas. Another benefit of choosing these remote markets is that it allows for a straightforward definition of markets, thereby circumventing the possibilities of cross-market competition (i.e., a hotel in a highway exits is unlikely to compete with other hotels at other, distant, exits.).

The rest of the paper proceeds as follows: Section 2 reviews the relevant literature. Section 3 discusses the multi-unit ownership in franchising and the characteristics of the U.S. hotel industry in the current study. Section 4 presents the models of demand estimation and counterfactual analysis. Section 5 summarizes the data and estimation strategies. Section 6 covers the results of the demand estimation and the counterfactual analysis. Section 7 concludes.

2 | LITERATURE REVIEW

Most studies in the literature have viewed franchising as representing a type of organization that lies somewhere between vertical separation and vertical integration (e.g., Blair & Lafontaine, 2005; Dahlstrom & Nygaard, 1999; Lafontaine, 1992). These studies have examined issues that arise in the interaction between upstream and downstream firms as they relate to conflicts, incentive alignment, control, or monitoring. To analyze these issues, the usual approach has been to use classical frameworks of transaction costs (e.g., Dahlstrom & Nygaard, 1999) and agency cost theories (e.g., Kidwell et al., 2007). In addition, the majority of empirical studies in economics and management focus on franchisors' decisions—double distribution channels (corporate owning and franchising) and optimal franchising proportions—while only a handful of studies analyze the decisions of local owners or franchisees. The majority of these latter studies analyze, from the viewpoint of franchisees, the trade-offs between being an independent and a franchised unit (e.g., Chaudey & Fadairo, 2008; Kosová et al., 2011; Kosová et al., 2013; Mazzeo, 2004).

Rather than relying on these theoretical frameworks, this paper focuses on cases in which franchisees have more discretion in day-to-day operations and management, with less control from franchisors. As such, these cases are considered to be closer to vertical separation.

The findings of this paper are consistent with the literature on multi-unit franchising (Kalnins & Lafontaine, 2004; Thomadsen, 2005), entry/exit (Davis, 2006a; Kalnins, 2004b; Mazzeo, 2002b), and brand proliferation (Wilson, 2011). Using Texas fast food chains as a case study, Kalnins and Lafontaine (2004) show that units owned by multi-unit franchisees are close to each other, or are located in demographically similar markets. This enables multi-unit franchisees to transfer local knowledge and experience across their units. Thomadsen (2005) simulates mergers between units of fast food chains in small geographic markets. His results show that simulated mergers increase prices, similar to my results. His analysis, however, focuses on multi-unit franchisees, not on multi-unit owners (as in this paper).

In the literature on encroachment and entry/exit, Kalnins (2004b) finds empirical evidence for why franchisees have contracts with different franchisors. He shows that cannibalization effects (revenue reduction by entry of firms with the same brands) are greater than business-stealing effects (revenue reduction by entry of firms with different brands) in the Texas hotel industry, supporting the notion that franchisees associated with different franchisors generate positive benefits. However, Kalnins, without considering the role of the hotel owners, assumes that hotel franchisors, or more generally multi-brand firms, make the entry/exit decisions. Conversely, in this paper, we use detailed information on the identity of individual hotels to apply a structural approach to multi-unit owners.

Similar to Kalnins (2004b), Wilson (2011) analyzes the effect of brand proliferation of hotel chains from the viewpoint of franchisors. Wilson finds that revenue reductions due to new entrants do occur, but the magnitude of these reductions is smaller if the entry is made by different branded hotels under the same hotel chain, or by branded hotels under different chains. He also examines the effect of multi-unit franchising by using a reduced-form model, but the results are insignificant, which might be driven by insufficient data. We circumvent these issues by incorporating several data sets and by employing a structural approach.

Even though multi-unit franchising is prevalent in many industries, few studies have empirically analyzed its effects. Kalnins and Mayer (2004) employ survival analysis to franchised units of fast food chains in Texas. They find that multi-unit franchising lowers failure rates if owners accumulate local knowledge and experience and can transfer that knowledge to the operation/management of their units. Moreover, Kalnins and Lafontaine (2004) argue that multi-unit franchising utilizes local specific knowledge of well-performing franchisees and reduces free-riding issues between franchisees (i.e., franchisees in the same market have low incentives to invest brand-promotion efforts). Moreover, with multi-unit franchising occurring in the same market, franchisors can fend off criticism from

incumbent franchisees when new franchised units are added since the owners of these units are the same.

Kalnins (2004a) and Thomadsen (2005) show new units under multi-unit franchisees tend to be located close to existing units or in demographically similar markets. While these studies focus on knowledge transfer between units under the same ownership, in this paper, we focus on how multi-unit owners compete, providing a different view on the motivation for multiple ownership. One exception is Kalnins (2004a), who analyzes multi-market contacts between franchisees in fast food chains in Texas, rather than between franchisors. Since multi-unit franchisees have contact with other franchisees within and across franchisors, this creates possible conditions of mutual forbearance. Kalnins finds that in markets with high uncertainty, franchisors tend to assign new units to franchisees with higher levels of multi-market contacts. This effect of multi-market contact requires an analysis of multiple markets, which is beyond the (within) market competition approach of this paper.

Studies in entry and exit (or encroachment) examine the effects of inter- and intra-firm competition on firm turnover (Davis, 2006b; Kalnins, 2004b; Mazzeo, 2002a). Even though these issues are similar to what we study in this paper, there is little consideration on the ownership structure at the local market level. Without considering ownership, it is hard to analyze competition unless firms are perfectly separated in a vertical structure.

3 | THE U.S. LODGING INDUSTRY AND MULTI-UNIT OWNERSHIP

The U.S. lodging industry provides vertically and horizontally differentiated products. Although there are different ways to measure hotel quality at the brand or property levels, most hotels are rated by popular hotel rating systems (*AAA*, *TripAdvisor*, or major online travel agencies). These provide relatively consistent measures of product quality that consumers trust and can easily access before consumption. Major hotel chains also provide a range of hotel brands with different levels of quality. In some geographic areas, a hotel chain provides multiple hotels with different qualities, resulting in higher market concentration than if the hotels were owned by different chains (Kalnins, 2004b; Mazzeo, 2002a; Wilson, 2011).

In addition to vertical differentiation, hotels are differentiated by location, even within a geographic area (like cities). Depending on travel distances to tourist destinations or other preferred places, consumers may consider the same brand hotels to be different products. Also, hotels of the same brand can be perceived differently if they offer different sets of amenities or services. Variations in these sets of amenities and services differentiate one hotel from the others, even within the same geographic area. Thus, hotels in metropolitan areas typically face only a limited set of competitors. For example, Kalnins (2006) shows that, on average, hotel managers recognize only four to five competitors in their markets. Thus, hotels face limited competition, thereby marking markets more likely to be oligopolies.

Agglomeration is a widely observed market phenomenon. Hotels tend to locate close to other competing hotels since consumer demand is high for certain desired destinations within a city. In these areas, hotels try to differentiate from other competitors, vertically or horizontally. Mazzeo (2002b) supports this notion for vertical differentiation of hotels and motels near highway exits in the United States. In addition, Kalnins (2004b) shows that if hotels face competition from other hotels that exhibit different product qualities, their revenues or profits are higher than if the competition comes from hotels of similar qualities.

Most branded hotels are under vertical contracts with their franchisors. As mentioned earlier, franchising, one of the most popular forms of the vertical contracts, allows franchisees to use brand names, management formats, or centralized reservations systems, while paying to franchisors initial franchise and royalty rates.[2] The average length of a franchising contract in the lodging industry is about 20 years, which is longer than in other industries. Most franchisors have established their own centralized reservation systems and management standards to control the quality of products and services.

Franchising contracts are more prevalent among low- or mid-quality hotels since operations at these hotels are more standardized. Conversely, management contracts, another form of vertical contract, are more widely used by upscale hotels. Management contracts allow franchisees limited control over day-to-day hotel operations. On the other hand, franchisors, as operators of the hotels, supervise all operations. This is tightly related to the complexity of operating upscale hotels and the difficulties of maintaining the service standards required by hotel chains.

Since this paper analyzes hotels near interstate highway exits, hotels have at most a three-star rating out of the maximum of five given by the standard *TripAdvisor*'s rating system. This is largely because demand for hotels near interstate highway exits is likley different than that observed in large cities, and, also, likley not large enough to accommodate four to five star hotels. Thus, most branded hotels in these locations are likely to be under franchising contracts. Under franchising contracts, local hotel owners become residual claimants of revenues after paying the franchising and royalty rates to franchisors. Franchisees in these markets also have more control over their business, including pricing policies, while following the business standards set by the franchisors.

It is common in markets with high demand that a single hotel chain operates hotels under different brands to attract different types of travelers. This might create some conflicts between franchisors and franchisees, such as cannibalization effects (Kalnins, 2004b) and free-riding over other franchisees (Wilson, 2011).[3]

To prevent these conflicts, most franchising contracts include exclusive clauses which prevent either franchisees or franchisors

[2]Franchise fees are a one-time lump sum payment due to franchisors when franchising contracts are signed. Royalty rates, an ongoing payment to franchisors, are generally a combination of fixed and variable terms; the variable terms are normally based on volume sales.

[3]Franchisees have less incentive to sustain the franchisors' quality standard if they can benefit from efforts by other nearby franchisees.

from engaging in any actions against their counter parties. Exclusive territory clauses grant franchisees the right to be the sole provider in a certain geographic area. Non-compete clauses, another type of exclusivity clause frequently included in franchising contracts, prevent franchisees from engaging in similar (competing) businesses during and after the franchising contracts. However, these clauses are negotiable or not strictly enforced in many cases (especially in the hotel industry). For example, if the franchised hotels locate in high demand markets, these clauses might be loosened, allowing other franchisees to enter the market with the same or a different brand name. If the franchisees are experienced and have accumulated local knowledge in a certain area, adding additional units by these franchisees would be beneficial for both franchisees and franchisors (multi-unit franchising).

Multi-unit franchising has become more popular in service industries, especially in the restaurant industry (Blair & Lafontaine, 2005); in the hotel industry, multi-unit franchising also occurs, but there is a larger tendency for owners to own single units due to financial constraints (Wilson, 2011). In general, franchisees tend to own both land and physical properties, including the building and equipment in rooms. These high initial costs may deter current hotel owners from adding new units (hotels). However, as management of the low- or medium- quality hotels across hotel chains has become more standardized, it is increasingly more common to see local hotel owners add additional units in the same market or geographically close markets. For example, this paper finds that 240 hotels out of 5,186 hotels located near the interstate highway exits in Texas were owned by franchisees with more than one unit. While this figure suggests that multi-unit franchising might not be widespread, my estimates suggest their economic effect is not negligible.

4 | MODEL

4.1 | Reduced form regressions

Our reduced form exercises are aimed at determining whether multi-unit owners charge higher prices. We first explore the relationship between prices and multi-unit ownership using a standard ordinary least squares (OLS) regression of prices on multi-ownership status (see Section 6.1 for details). This regression, however, provides only suggestive evidence of the relationship since multi-onwership status is an endogenous variable. To deal with this endogeneity issue, we also consider DiD regressions as well as an IV approach. We detail these regressions in Section 6.2.

4.2 | Structural model

As stated before, the structural model is designed to (a) measure market power and (b) determine whether such market power is a driver of higher prices for multi-unit hotels. In the sections below, we details the different components and steps in the modeling.

4.2.1 | Demand

To estimate demand, we use a random coefficients logit model, which allows for flexible substitution patterns by accounting for consumer heterogeneity in preferences over product characteristics (Berry, 1994; Berry et al., 1995; Nevo, 2000).

The indirect utility of consumer i purchasing product j at market t is

$$u_{ijt} = \alpha_i p_{jt} + X_{jt}\beta_i + \xi_{jt} + \epsilon_{jt}, \quad (1)$$

where p_{jt} is the price of product j in market t, X_{jt} represents observed product characteristics, including the distance to the highway exit, the number of activities, the number of room types, and the number of services provided for business travelers.[4] ξ_{jt} is an unobserved product characteristic, and ϵ_{ijt} is a random shock that is assumed to follow a type I extreme value distribution.

To control the characteristics of local markets, location fixed effects (highway exits) are included. In Equation (1), we assume that the coefficients of price and product characteristics (α_i and β_i) have normal distributions with an average preference, α and β, respectively, and idiosyncratic terms: $\sigma_p v_i^p$ and $\sigma_k v_i^k$. Term σ measures the standard deviation in consumer preference, and v_i represents the idiosyncratic preference. Thus, the coefficients of prices and product characteristics are rewritten as as follows: $\alpha_i = \alpha + \sigma_p v_i^p$ and $\beta_i = \beta + \sigma_k v_i^k$.

The utility of the outside option is

$$u_{i0t} = \xi_0 + \sigma_0 v_i^0 + \epsilon_{iot},$$

where the utility from the outside option is normalized to zero. This completes the specification of the utility function.

Given the assumptions of the random coefficients, the utility function can be divided into two parts: the mean utility and the deviation from the mean as follows:

$$u_{ijt} = \delta_{jt}(X_{jt}, p_{jt}, \xi_{jt}; \theta_1) + \mu_{ijt}(x_{jt}, p_{jt}, v_i; \theta_2) + \epsilon_{ijt}, \quad (2)$$

$$\delta_{jt} = \alpha p_{jt} + X_{jt}\beta + \xi_{jt},\ \mu_{ijt} = p_{jt}\sigma_i^p v_i^p + x_{jt}\sigma^k v_i^k, \quad (3)$$

where $\theta_1 = [\alpha, \beta]$ and $\theta_2 = [\sigma^p, \sigma^k]$. Based on the framework of McFadden (1989), the choice probability of individual i choosing j in market t is the following (under assumed distribution for ϵ_{ijt}):

$$s_{ijt} = \frac{\exp(\delta_{jt} + \mu_{jt})}{1 + \sum_{l=1}^{j} \exp(\delta_{lt} + \mu_{lt})}.$$

Aggregating the probability of the individual consumer probabilities, market share can be written as follows:

[4] Hotel rating and hotel age were tested, but they showed high correlation with other product attributes. Thus, these variables are not included in the final specification.

$$s_{jt}(\delta,\theta)=\int s_{ijt}dF(v)=\int\frac{\exp(\delta_{jt}+\mu_{jt})}{1+\sum_{l=1}^{j}\exp(\delta_{lt}+\mu_{lt})}dF(v). \quad (4)$$

There is no closed from solution for the integral in Equation (4), so this is numerically approximated. This paper uses Halton draws (5,000) for numerical approximation, which creates a lower simulation error (Brunner et al., 2017; Reynaert & Verboven, 2014). Estimated market shares can be obtained as follows:

$$s_{jt}=\frac{1}{NS}\sum_{i=1}^{NS}\frac{\exp(\delta_{jt}+\mu_{jt})}{1+\sum_{l=1}^{j}\exp(\delta_{lt}+\mu_{lt})}. \quad (5)$$

4.2.2 | Supply

We assume that firms play a Bertrand–Nash game by setting prices of their products to maximize profits. The focus of this study is whether franchisees can exercise market power by owning multiple units. Even though it would be interesting to analyze the effect of multi-unit franchisees and multi-unit owners separately, our data only allow us to focus on multi-unit owners.[5] Thus, the results of the paper relate to the multi-unit franchising subcase in which franchisees operate units associated with multiple franchisors (i.e., multi-unit owners).

As explained earlier, we focus on franchisees in markets where franchisors have less control over their franchisees. Since in our setup franchisees have control over their decisions, we use the term *firms* to refer to franchisees. If firms (franchisees) own multiple units (hotels), optimal pricing behavior implies a joint maximization of across owned units. For single-unit firms, on the other hand, pricing and profit maximization are done over a single hotel. The profit function is as follows:

$$\max_{p_{jt},j\in F_f}\pi_f=\sum_{j\in F_f}(p_{jt}-mc_{jt})M_t s_{jt}(p)-C_f, \quad (6)$$

where firm f has product j in F_f (a set of products of firm f), mc_{jt} is the marginal cost, $s_j(p)$ is the market share of product j, M_t is the market size, and C_f is the fixed cost of firm f.

From the profit function, the first-order condition is derived and can be written in matrix form as follows:

$$p-mc=[\Omega^{pre}]^{-1}s(p), \quad (7)$$

where

$$\Omega^{pre}_{j,h}=\begin{cases}-\partial s_j/\partial p_k & \text{if } j,k\in F_f\\ 0 & \text{otherwise.}\end{cases}$$

The ownership structure matrix, Ω captures the existence of multi-unit firms in the market. From Equation (7), the marginal costs are estimated as $\widehat{mc}=p-\Omega^{pre}\cdot s(p)$. These marginal costs rely on demand estimates and the Bertrand–Nash assumption of the supply side. If the demand estimates or the assumptions of the supply side change, marginal costs would change accordingly. For the counterfactual analysis, we assume that marginal costs are constant. Later in the paper, we relax this assumption to check the robustness of the counterfactual analysis.

We conduct the counterfactual analysis using the demand estimates and the estimated marginal costs. New equilibrium prices under a counterfactual scenario (the *post-scenario*), in which all firms own single units, are estimated as follows:

$$p^*=\widehat{mc}+[\Omega^{post}]^{-1}s(p^*), \quad (8)$$

where $\widehat{mc}$ represents the marginal costs estimated under the multi-unit ownership.

To obtain the equilibrium prices in this post-scenario, we make two assumptions. First, the cost structure is the same across pre- and the post-scenarios. As mentioned in Nevo's (2000) merger simulation analysis, multiple-brand firms (or merged ones) could enjoy a cost efficiency. To allow for this possibility and to check for the robustness of the baseline post-scenario, different assumptions on marginal costs are also considered in a robustness checks section. Second, to obtain Ω^{pre} and Ω^{post}, we use the same demand estimates, even though firms may change their product characteristics and consumers may have their preferences (both observed and unobserved ones) across scenarios. We do not deal with this limitation, but note that both of these changes are likely to occur in the medium and long run; as such, our counterfactual simulation reflects the effects of multi-unit franchising as they pertain to franchisees' short-run pricing decisions.

4.2.3 | Consumer welfare

We use the compensating variation (CV) to capture the change in consumer welfare, which is calculated as follows:

$$CV_i=\frac{\ln\left[\sum_{j=0}^{J}\exp(V_{ij}^{post})\right]-\ln\left[\sum_{j=0}^{J}\exp(V_{ij}^{pre})\right]}{\alpha_i}, \quad (9)$$

where $V_{ij}=\alpha_i p_j+X_j\beta_i+\xi_j$. When calculating V_{pre} and V_{post}, the price (p^{pre} and p^{post}) varies, while other components, including ξ_j, remain unaltered. The average CV at the market level is given by:

$$CV_t=M_t\int CV_i dP_v(V)=M_t\cdot\frac{1}{ns}\sum_{i}^{ns}CV_i, \quad (10)$$

where P_v is the distribution function of v. M_t is the market size at market t. Market size is the number of rooms sold in the market plus the number of consumers opting for the outside good. Since prices and market shares are determined on a daily basis, to capture the annual level of consumer welfare, CV is converted to the annual level by multiplying by 365. The results concerning the counterfactual analysis

[5] In the data set of this paper, there is only one multi-unit franchisee.

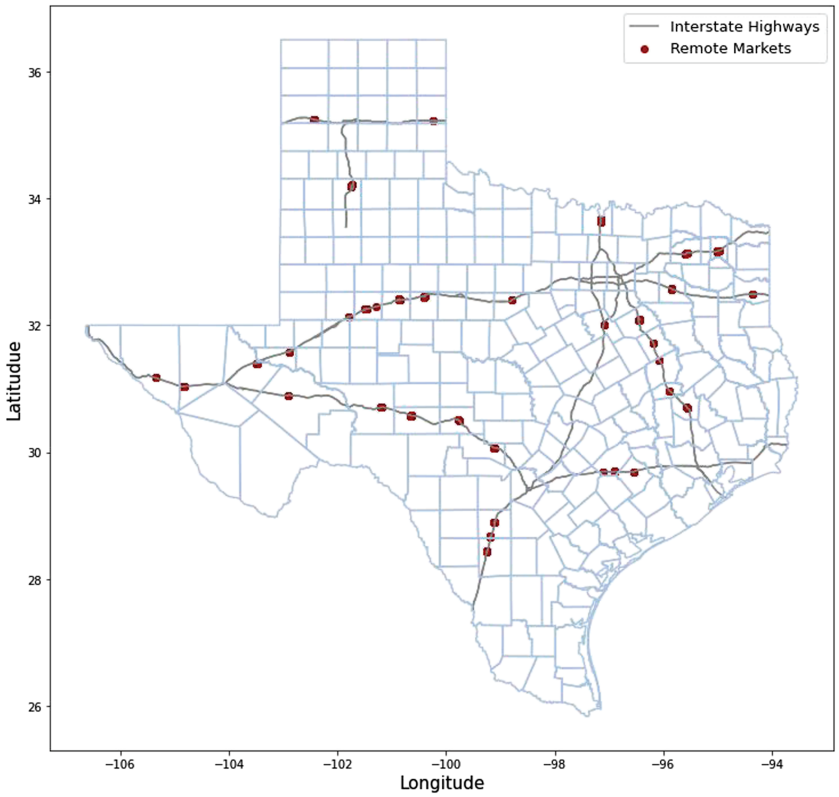

FIGURE 2 Remote market near interstate highways in Texas [Color figure can be viewed at wileyonlinelibrary.com]

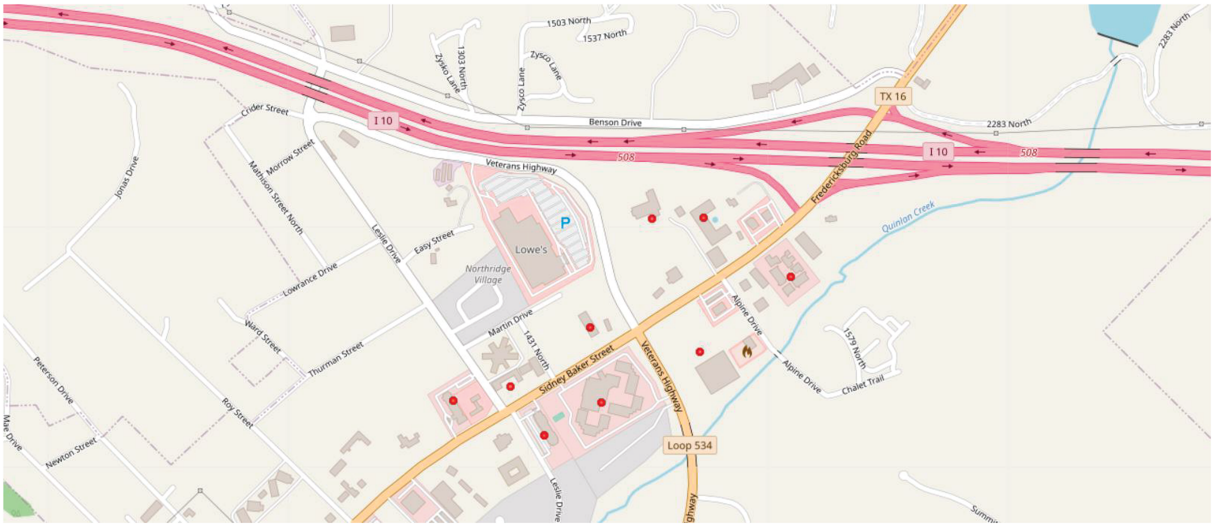

FIGURE 3 Hotels in a remote market near I-10: Kerrville in Texas [Color figure can be viewed at wileyonlinelibrary.com]

(including the CV calculation) are based on the subsample of 116 markets where with multi-unit owners are present.

5 | DATA AND ESTIMATION

5.1 | Data

Data for this paper comes from three sources. First, prices, quantities (rooms sold), capacity (total number of rooms), and chain affiliation comes from the *Texas Hotel Performance Fact book* provided by Source Strategic, Inc, a Texas-based consulting firm. Second, taxpayer identification numbers, which are used to identify hotel owners, are collected from *Hotel Occupancy Tax* provided by the Texas Comptroller's Office. Third, amenities and services at hotels are collected from from *TripAdvisor*.

The market definition used in this paper is purposefully narrow: A market is composed of hotels located within a half-mile radius from an interstate exit in Texas (See Figures 2 and 3).[6] If hotels in one exit are close to other exits, or if hotels are located in metropolitan areas,

[6]The following interstate highways are included: I-10, I-20, I-27, I-30, I-35, I-45, and I-40.

TABLE 1 Descriptive statistics of key variables

	Mean	SD	Min.	25%.	Median	75%	Max.
Price ($100s)	0.681	0.329	0.134	0.436	0.615	0.857	2.736
Market shares (rooms sold)	0.182	0.152	0.011	0.077	0.135	0.233	0.973
Distance to exit	0.276	0.112	0.026	0.186	0.282	0.356	0.499
No. of activities/10	0.267	0.117	0.100	0.200	0.300	0.400	0.500
No. of room types/10	0.384	0.141	0.100	0.300	0.400	0.500	0.700
No. of service for business/10	0.201	0.087	0.100	0.100	0.200	0.300	0.300
No. of Obs.	5186						
No. of markets	1595						

they are excluded from the analysis. A consequence of this choice is that hotels included in the analysis are located in remote areas and that markets are narrow (vis-à-vis hotel markets in metropolitan areas).[7] Even though this sample might not be representative of all multi-unit owners in Texas, using this restricted definition of markets creates major advantages. First, with this definition, the study minimizes the possibility of cross-market competition.

Second, selecting these remote and isolated markets is consistent with the assumption that franchisees have more control over their pricing policies than franchisors. Since these hotels are far from the national/regional headquarters of their franchisors or other hotels under the same brand, franchisors face high controlling or monitoring costs. Thus, franchisors tend to engage in franchising contracts that do not require high levels of oversight of the franchisee. As already indicated, most branded hotels and motels in these markets are of medium or low quality, which typically operate under a franchising contract (rather than management contracts). Given these characteristics of the sample, the assumption of franchisees having control over their pricing does not seem unreasonable (Cochet et al., 2008; Perryman & Combs, 2012). Third, as explained earlier, multi-unit ownership is much more prevalent in these isolated markets than in metropolitan areas (see also Kalinis & Lafontaine, 2004).

This paper uses quarterly data set from 2008 to 2014 and defines a market as an exit-quarter pair. The resulting sample contains 5,186 hotels in 1,595 markets. In this sample, 240 hotels can be identified as being owned by multi-unit owners. These multi-unit owners exist in 116 of the identified markets.[8]

To estimate demand parameters, the market share of the outside goods needs to be specified. The most common way of defining outside options is to use demographic information from the geographic area, such as the population of the market (Berry et al., 1995; Nevo, 2000). However, this approach is not reasonable in this industry since most consumers staying at hotels are not residents of local area. Instead, this paper uses unsold rooms in the markets to determine the share of consumers choosing the outside option. Table 1 reports descriptive statistics.[9]

[7]See Table A1 for the distribution of multi-unit owners in different market definitions.
[8]Details of descriptive statistics of these markets are summarized in Table A2. The characteristics of the remote markets are presented in Tables A3 and A4
[9]Details of variables can be found in Appendix B1.

5.2 | Estimation

Following Berry et al. (1995), we estimate the demand parameters as outlined in Section 4. Similar to Nevo (2000), we include fixed effects of highway exits and hotel chains which accounts for a portion of unobserved product characteristics associated with the markets and hotel chains. To avoid the high-dimensional fixed effect issue, the fixed effect absorption approach is used (Correia, 2016; Luoa et al., 2017). The error term (ξ_{jt}) captures the unobserved product-specific deviation from the mean valuation of the unobserved product characteristics. This deviation is assumed to be correlated with prices. To deal with this price endogeneity, we employ a nonlinear generalized method of moment (GMM) estimation. Given the initial guess of the unknown parameters, the resulting error term is calculated and then interacted with a set of the instruments to form the following the population moment condition:

$$E[\xi \cdot Z] = 0, \tag{11}$$

where Z is a set of instruments which are discussed below. In order to construct the sample moment conditions of the GMM objective function, the mean utility δ is needed. To obtain δ, the contraction mapping approach is used. This approach retrieves δ by equating the estimated market shares with the observed market shares given a value of parameters:

$$s_{jt}^{pred}(x, p_{jt}, \delta_{jt}, \theta_2) = s_{jt}^{obs}, \tag{12}$$

where s^{pred} and s^{obs} are the predicted and observed market shares, respectively. Unlike the logit and nested logit models, random coefficients models do not have a closed form solution for δ. This is numerically solved; specifically, δ is retrieved using the following fixed point iteration:

$$\delta_{jt}^{k+1} = \delta_{jt}^{k} + \ln s_{jt}^{obs} - \ln s_{jt}^{pred}(x.p, \delta_{jt}^{k}; \theta_2), \tag{13}$$

where δ^k is δ at the k th iteration. In this paper, the criteria for convergence are set at $\delta^{k+1} - \delta^k < 10^{-8}$. Given the estimated δ obtained upon convergence, θ_1 is estimated via IV regression.Given this, ξ are obtained:

$$\xi_{jt} = \delta_{jt} - (\alpha p_{jt} + X_{jt}\beta).$$

Once ξ is obtained, θ_2 is estimated by using the following GMM objective function:

$$Q(\theta_2) = \xi(\theta)' Z W^{-1} Z' \xi(\theta), \quad (14)$$

where $W = 1/n \sum \xi(\theta_1)\xi(\theta_1)^{-1} Z'Z$ is the weighting matrix. This paper uses the continuously updating weighting matrix, which provides more efficient estimates (Baum et al., 2007; Hansen et al., 1996). The GMM convergence tolerance is 1^{-8}. Since the computation burden is high in the contraction mapping, to speed converge, we use the squared polynomial extrapolation method (SQUAREM) (Reynaerts et al., 2012). SQUAREM speeds up the fixed point iteration and produces more robust convergence results.

We use the optimal instrument approach to obtain efficient demand estimates, especially nonlinear ones. Reynaert and Verboven (2014) show how using the optimal instrument approach adds additional moment conditions. These additional conditions increase the consistency and efficiency of parameter estimates. To implement this procedure, we first estimate demand parameters without optimal instruments. With these estimates, optimal instruments are formed as the expected Jacobian of the moment condition: $E(D_j(z_t)|z_t)\Phi^{-1}$ where Φ is an identity matrix since only demand side enters the estimation.[10] Second, we estimate the demand parameters with both these obtained optimal instruments as well as the initial instruments.

Even though the optimal instrument approach is used, one must still find valid instruments to deal with price endogeneity. Valid instruments should be correlated with price, but not correlated with unobserved product characteristics. BLP-type instruments (Berry et al., 1995), which are based on the similarity of products are one option. Another option are Hausman-type instruments (Hausman, 1996), which capture common components of costs of the same brands across markets. However, these instruments would be inapplicable here as a large number of markets in the data set have only one or two hotels. In addition, hotel prices are largely determined by local demand and local hotel attributes, rather than by common costs shared by hotels of the same brand.

Thus, within a brand, variation in prices is high across markets. Instead, we use the approach of Berry and Jia (2010), who employ the characteristics of the market as instruments; These instruments are meant to measure competition when firms face capacity constraints and entry is not exogenous. We tested the number of restaurants as well as the number of gas stations as possible instruments, but this did not resolve the endogeneity issue. Instead, we employ instruments that capture competition and costs. To measure competition, we use the distance to the closest rival within the same exit, as well as the sum of the rooms of rival hotels. To measure costs, we use the number of rooms. In addition, interaction terms between the above variables are included whenever such interactions do not give rise to collinearity issues.[11]

TABLE 2 Multi-unit ownership (all markets)

Ownership type	Markets	Hotels
Single-unit (franchisee or independent owner)	1,479	4,946
Multi-unit (with a franchisor or franchisors)[a]	116	240
Total	1,595	5,186

[a]Recall that only two hotels in the sample are owned by multi-unit owners.

TABLE 3 Hotel characteristics in markets with multi-unit ownership

		Single-unit	Multi-unit
Mean price ($)		**81.68**	**84.62**
Standard deviation of prices		**38.33**	**37.50**
No. of hotels (units)			
Rating[a]	1	5	3
	2	104	69
	2.5	214	168
	3	32	0
Total		355	240

[a]Hotel ratings collected from *TripAdvisor* are originally provided by *Expedia*, an online travel agency. See the following website for details of its rating system (https://www.expedia.com/Hotel-Star-Rating-Information).

6 | RESULTS

6.1 | Multi-unit ownership and prices

This section includes a descriptive analysis of single- versus multi-unit units and a reduced-form analysis on the relationship between prices and multi-unit ownership. The reduced form analysis is intended to confirm that multi-unit ownership is associated with higher prices—a pattern that we use to motivate the subsequent structural model and counterfactual analyses.

Prior to presenting this reduced-form results, we first summarize the characteristics of markets with and without multi-unit ownership, which is shown in Tables 2 and 3. As it can be seen, out of 1,595 markets, 116 markets have multi-unit owners (240 hotels).

The reduced form models include several indicator variables: (1) multi-unit ownership, (2) same brand, and (3) same chain. The multi-unit ownership (multi-owner) indicator variable is equal to one if the hotel owner also owns other units under a different franchisor. If, within a market, a branded hotel faces competition from the same branded hotels, the value of the same brand indicator is equal to one (zero otherwise). Third, if a branded hotel faces competition from other branded hotels with different brand name but under the same

[10]In cases where demand and supply are jointly estimated, optimal instruments are defined as $E(D_j(z_t)\Phi^{-1}|z_t)$, where Φ is a covariance matrix of error terms (ξ,ω).

[11]The results of the first stage estimation, can be found in Table A5.

hotel chain (franchisor), the value of the same chain variable is equal to one.

In addition to these variables, some models include the market concentration index (Herfindahl–Hirschman index [HHI]) and the interaction term of HHI and multi-owner. The HHI is calculated by assuming that hotels belonging to a single franchisee are one entity. These models explore whether concentration in the presence of multi-unit ownership is associated with prices.

In Table 4, Column 1 shows the reduced-form results of the role that multi-unit ownership plays one price. The coefficient is significant and positive, suggesting that multi-unit owners, as hypothesized, may charge higher prices than single-unit owners. The presence of other same brand franchisees in the market (Column 2) has a negative coefficient; the same is true for the presence of other same chain franchisees in the market (Column 3). These last two results provide suggestive evidence for same brand and same chain cannibalization effects.

Market concentration is positively associated with prices (Column 4). Further, the effect of multi-unit ownership grows with larger levels of concentration (Column 5).

6.2 | Causal inference: Multi-unit ownership and prices

The results in Table 4 are only suggestive because multi-unit ownership and multiple hotels under the same brand or the same chain are, for example, likely to be observed in markets with high demand; this, in turn, may be associated with higher prices. We deal with this endogeneity concern in two ways: a DiD regression and an IV approach.

6.2.1 | DiD regression

In our data, we observe several instances when a hotel goes from being owned by a franchisee that is not a multi-unit owner to being operated by a multi-unit owner. We take advantage of these events to generate more credible causal inference regarding the effects of multi-unit ownership on prices. We create two indicator variables. First, the variable *Post* is equal to one in a market for those quarters when a hotel (in such market) was operated by a multi-unit franchisor and equal to zero for quarters preceding the shift to multi-unit

TABLE 4 Regression of price on multi-unit ownership

Dep. Var.: Price ($100)	(1)	(2)	(3)	(4)	(5)
Multi-owner	0.127***				0.025
	(0.018)				(0.022)
Same brand		−0.124***			
		(0.013)			
Same chain			−0.061***		
			(0.010)		
HHI				0.145***	
				(0.004)	
Multi-owner *** HHI					0.075***
					(0.009)
Rating	1.401***	1.403***	1.424***	1.334***	1.404***
	(0.080)	(0.079)	(0.080)	(0.072)	(0.079)
Distance to exit	−0.056	−0.075***	−0.065***	−0.036	−0.065***
	(0.036)	(0.036)	(0.036)	(0.033)	(0.036)
No. of activities	0.718***	0.695***	0.678***	0.636***	0.703***
	(0.047)	(0.047)	(0.047)	(0.042)	(0.047)
No. of room types	−0.035	−0.049	−0.044	0.026	−0.046
	(0.035)	(0.035)	(0.035)	(0.032)	(0.035)
No. of service bus.	0.754***	0.738***	0.762***	0.805***	0.763***
	(0.060)	(0.060)	(0.060)	(0.054)	(0.060)
Constant	0.119***	0.153***	0.137***	−0.072***	0.127***
	(0.029)	(0.029)	(0.029)	(0.027)	(0.029)
Fixed effects	City, time	City, time	City, time	City, time	City, time
Observations	5,186	5,186	5,186	5,186	5,186
Adjusted R^2	0.52	0.523	0.519	0.608	0.526

*$p < 0.1$. **$p < 0.05$. ***$p < 0.01$.

TABLE 5 DiD regression: Effect of multi-unit ownership on prices

Dep. Var.: Price ($100)	(1)	(2)
MUO	−0.157***	−0.200***
	(0.033)	(0.033)
Post	0.237***	0.182***
	(0.022)	(0.030)
MUO × *Post*	0.174***	0.201***
	(0.037)	(0.037)
Rating	1.373***	1.452***
	(0.082)	(0.086)
Distance to exit	−0.066***	−0.097***
	(0.037)	(0.039)
No. of activities	0.709***	0.525***
	(0.049)	(0.050)
No. of room types	−0.031	−0.005
	(0.036)	(0.038)
No. of service bus	0.784***	1.026***
	(0.062)	(0.066)
Constant.	0.157***	−0.009
	(0.022)	(0.020)
Fixed effects	City, time	Exit number, Time
Observations	5,186	5,186
Adjusted R^2	0.496	0.526

*p < 0.1. **p < 0.05. ***p < 0.01.

TABLE 6 IV regression: Effect of multi-unit ownership on prices

Dep. Var.:	Multi-owner	Price ($100)
Multi $\widehat{-owner}$		0.271***
		(0.066)
Age	0.766***	
	(0.098)	
Rating	16.207***	1.346***
	(2.444)	(0.218)
Distance to exit	−3.188***	−0.033
	(0.656)	(0.083)
No. of activities	−9.591***	0.773***
	(1.124)	(0.116)
No. of room types	−5.190	−0.009
	(0.817)	(0.089)
No. of service bus	11.958***	0.705***
	(1.800)	(0.149)
Constant.	−9.376	0.114***
	(5,789)	(0.067)
Fixed effects	City, time	City, time
Log-likelihood	−329.70***	
Adjusted R^2		0.561

*p < 0.1. **p < 0.05. ***p < 0.01.

ownership. Second, the variable *MUO* is equal to one for those hotels that are operated by a multi-unit owner and zero otherwise; thus, our identification comes from the fact that some hotels change their *MUO* status in our sample.

The variable *Post* captures market-specific shocks that could have been observed in tandem with the transition to *MUO* by one of the hotels. On the other hand, the variable *MUO* is a hotel-specific variable, intended to capture hotel-specific characteristics (e.g., managerial quality). The interaction term *MUO* x *Post* is the DiD coefficient of interest. For completeness, the regression also includes other control variables.

Results are displayed in Table 5. We report two regressions. Specification 1 includes city fixed effects, whereas Specification 2 includes a richer set of fixed effects: highway exits. The DiD coefficient indicates that multi-unit ownership increases prices between 17.4% and 20.1%, in line with results in Table 4.

6.2.2 | IV approach

The endogeneity problem in our application can also be thought of as a self-selection issue: Hotels become operated by multi-unit owners for specific reasons. To correct for selection bias, we adopt an IV procedure. In the first stage, we estimate a regression with multi-unit ownership status as the dependent variable and include a battery of exogenous variables as regressors, including an IV. Our IV consists of a proxy for managerial experience: The number of years that a franchisor has been operating at least one hotel in Texas.[12] To accommodate for the dichotomous nature of the dependent variable, we implement this first stage with a probit model.

In the second stage, we run an OLS regression for price using the predicted value of the first stage (as well as other explanatory variables) as regressors.[13] Table 6 shows the results of the two-stage estimation. The first column displays results from the first-stage regression, and it shows that our proxy for managerial experience *age* is statistically significant and carries the expected sign thereby adding support to our exclusion restriction. The second stage regression (second column) confirms our prior finding that multi-unit ownership results in higher prices and that the magnitude is similar in magnitude to that reported in Tables 4 and 5.

The structural approach, which we detail next, tests our central hypothesis: whether greater market power is a reason why hotels under multi-unit ownership charge higher prices.

[12]The identity of hotel owners is obtained from the Texas Comptroller's Office (see Section 5.1).

[13]We bootstrap standard errors to account for the two-stage nature of the estimation procedure.

TABLE 7 Results of demand estimation

Variable	Coefficient	Std. Err.	*p* value
Mean (α,β)			
Price ($100)	−9.982	1.558	0.000
Distance to exit	−1.193	0.461	0.010
No. of activities	3.249	0.807	0.000
No. of room types	0.738	0.443	0.096
No. of service for business	3.469	0.959	0.000
Standard deviation (σ)			
Price ($100)	3.331	0.847	0.000
Fixed effects: Location, chain			
GMM object value: 0.000011			

6.3 | Demand estimates

This section reports demand estimates using the model discussed in Section 4.2.1. The section also reports key measures that are derived from these estimates, including price elasticities of demand, marginal costs, and markups.

Table 7 summarizes demand estimation results of the model that uses the optimal instruments. The top panel reports the means of the demand parameters (α,β). The bottom panel shows the standard deviations (σ s) of the price variable.[14] These standard deviations capture heterogeneity in consumer preferences.

All means of taste parameters (β s) are significant, except the one for the number of room types provided by hotels. All these coefficients have the expected signs. Consumers, on average, prefer to stay close to highway exits. As hotels add more amenities and activities, such as bar, restaurant, and pool, consumer utility increases on average. As expected, consumers favor more room type options, while providing amenities targeted at business travelers at hotels—basic office equipment, meeting rooms and conference facilities—also increases consumer utility.

The mean price coefficient (α) is statically significant with a negative sign. The standard deviation of this coefficient (σ), which is significant, measures the consumer heterogeneity in their willingness to pay for hotel rooms. The inclusion of this heterogeneity allows the estimation of more flexible and reasonable substitution patterns.

To check the economic plausibility of the demand estimates, we calculate the following estimates: own price elasticities of demand, marginal costs, and markups. Figure 4 shows the distribution of the own-price elasticities (mean: −4.289; S.D.: 2.081). Even though there are instances where demand is estimated to be price-inelastic, these results are by and large reasonable.[15]

Table 8 and Figures 5 and 6 show, respectively, the descriptive statistics and the distribution of marginal costs and markups. Both marginal costs and markups appear to be within reasonable ranges, thereby validating the demand estimation procedure.

[14]Different sets of random coefficients were tested; the table reports the preferred specification.

[15]These "inelastic" markets appear to be related to highly concentrated markets.

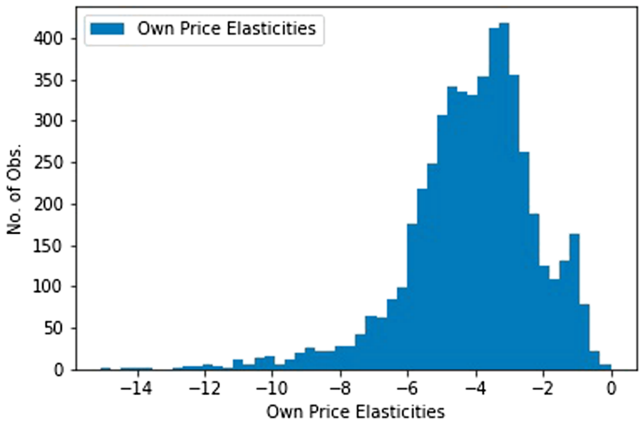

FIGURE 4 Distribution of own price elasticities [Color figure can be viewed at wileyonlinelibrary.com]

TABLE 8 Descriptive statistics of marginal costs and markups

	Mean	Std.	25%	50%	75%
Marginal costs ($)	50.61	31.41	27.93	44.75	66.23
Markups ($)	17.64	9.67	12.19	14.97	18.86

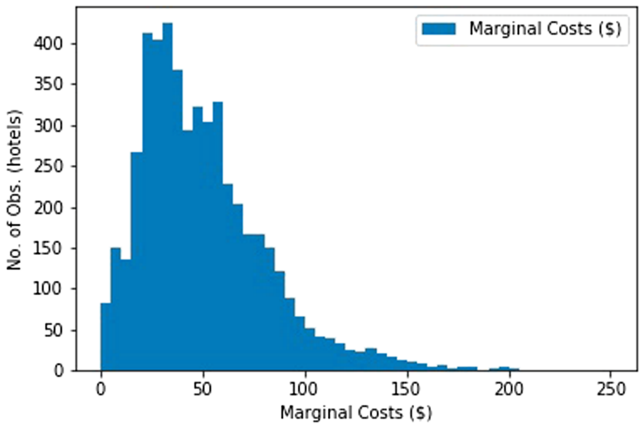

FIGURE 5 Marginal costs [Color figure can be viewed at wileyonlinelibrary.com]

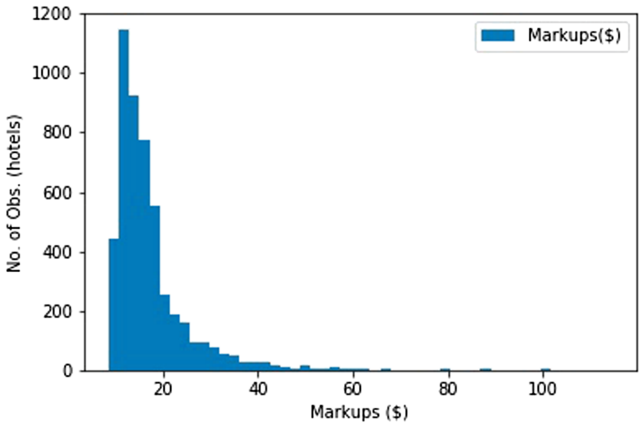

FIGURE 6 Markups [Color figure can be viewed at wileyonlinelibrary.com]

6.4 | Counterfactual analysis

6.4.1 | Changes in prices and market shares

The purpose of the counterfactual analysis is to examine whether multi-unit ownership is associated with more market power and thus higher prices. To perform this analysis, we create two different scenarios related to changes in ownership structures: (1) pre-scenario and (2) post-scenario. The pre-scenario reflects the status quo (a mix of single- and multi-unit owners), whereas in the post-scenario, all firms are assumed to be single-unit profit maximizers. Under the post-scenario, we estimate equilibrium prices by using demand estimates and the modified singe-unit ownership structure.

By comparing the estimated prices under the post-scenario with the observed prices, we empirically measure the increase in prices from multi-unit ownership that is driven by market power. As mentioned earlier, in this baseline counterfactual exercise, we assume that marginal costs, which are recovered under the pre-scenario, are constant under the post-scenario. Later, we relax, and study the consequence of modifying, this baseline assumption.

Table 9 shows that prices, on average, decrease if all firms were single-unit owners (the post-scenario). The magnitude of the price decrease is higher for multi-unit owners, while single-unit owners do not change their prices significantly. This results confirms that multi-unit owners, ceteris paribus, are able to charge higher prices because of joint profit maximization. Put differently, the estimates provide empirical support for the hypothesis that multi-unit owners exercise market power. As a result of the price reductions observed in the counterfactual exercise, multi-unit owners would increase their market share in a world in which they were asked to stop from engaging in multi-unit ownership.

TABLE 9 Changes in prices and market share in counterfactual analysis

Variable	Ownership (pre-scenario)	Pre[a]	Post[b]	$\frac{\text{Post}-\text{Pre}}{\text{Pre}}$
Price($)	All	82.86	79.62	−3.91%
	Multi	84.62	77.01	−8.99%
	Single	81.68	81.39	−0.36%
Share(%)	All	12.5	13.44	7.52%
	Multi	16.46	20.78	26.25%
	Single	9.82	8.48	−13.65%

[a]Both single and multi-unit owners.
[b]Single-unit owners.

6.4.2 | Robustness checks of price changes under post-scenario

In this section, the constant marginal cost assumption is relaxed. Since multi-unit owners are likely to be more efficient than single-unit owners, probing this assumption seems to be relevant. To relax this assumption, we adjust the marginal costs of multi-unit owners obtained under the pre-scenario upwards, while keeping marginal costs of single unit owners stay constant. In particular, we scale up the recovered marginal costs of multi-unit owners by a series of factors (ranging from 5% to 10%) as depicted in Table 10. Figures 7 and 10 show how marginal costs vary under the different marginal costs assumptions. With these new series of marginal costs, we then proceed to re-estimate equilibrium prices in the post-scenario (once for each upward scaling factor considered).

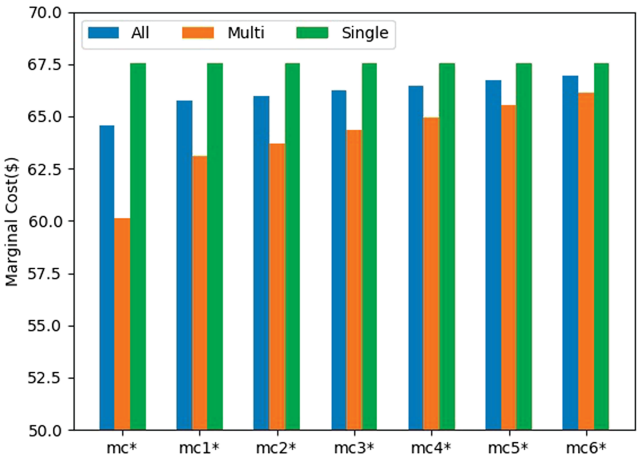

FIGURE 7 Various marginal cost assumptions [Color figure can be viewed at wileyonlinelibrary.com]

TABLE 10 Additional counterfactual analysis with different MC

Model	Pre		Post		Estimated price (p_c^*)
	Single-unit	Multi-unit	Single-unit	Multi-unit	
Baseline	$\widehat{mc}$	$\widehat{mc}$	$\widehat{mc}$	$\widehat{mc}$	p^*
Model 1	$\widehat{mc}$	$\widehat{mc}$	$\widehat{mc}$	$\widehat{mc}$ *** 1.05	p_1^*
Model 2	$\widehat{mc}$	$\widehat{mc}$	$\widehat{mc}$	$\widehat{mc}$ *** 1.06	p_2^*
Model 3	$\widehat{mc}$	$\widehat{mc}$	$\widehat{mc}$	$\widehat{mc}$ *** 1.07	p_3^*
Model 4	$\widehat{mc}$	$\widehat{mc}$	$\widehat{mc}$	$\widehat{mc}$ *** 1.08	p_4^*
Model 5	$\widehat{mc}$	$\widehat{mc}$	$\widehat{mc}$	$\widehat{mc}$ *** 1.09	p_5^*
Model 6	$\widehat{mc}$	$\widehat{mc}$	$\widehat{mc}$	$\widehat{mc}$ *** 1.1	p_6^*

TABLE 11 Changes in average prices($p*$) with different marginal costs

Ownership	p	p^*	p_1^*	p_2^*	p_3^*	p_4^*	p_5^*	p_6^*
All mean (%)	82.865	79.621	80.9	81.162	81.426	81.692	81.96	82.23
	0.00%	−3.91%	−2.37%	−2.06%	−1.74%	−1.42%	−1.09%	−0.77%
Multi-mean (%)	84.623	77.012	79.911	80.502	81.097	81.695	82.298	82.905
	0.00%	−8.99%	−5.57%	−4.87%	−4.17%	−3.46%	−2.75%	−2.03%
Single mean (%)	81.677	81.386	81.568	81.607	81.648	81.689	81.731	81.773
	0.00%	−0.36%	−0.13%	−0.09%	−0.04%	0.01%	0.07%	0.12%

Abbreviations: p, the observed prices; p^*, p_c^*, estimated prices; %, percentage changes (%) from the observed prices.

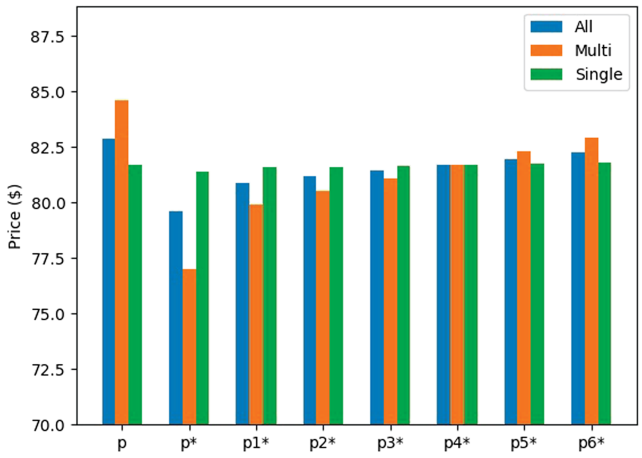

FIGURE 8 Price variations [Color figure can be viewed at wileyonlinelibrary.com]

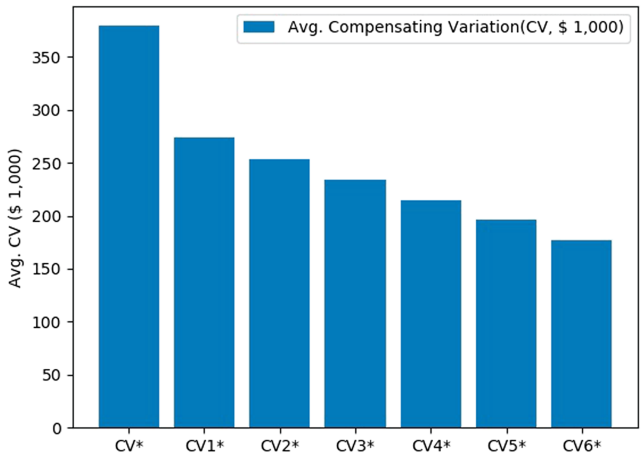

FIGURE 9 Changes in average CVs with different marginal costs [Color figure can be viewed at wileyonlinelibrary.com]

The results of these additional counterfactual analyses are summarized in Table 11 and Figure 8. As the upward scaling factor for the marginal cost of multi-unit owners increases, one observes counterfactual prices ($p_1*,\ldots,p_6^*$) that are higher than those observed in the baseline counterfactual reported in the prior section (p^*). However, the estimated counterfactual average price ($p_c^*; c = 1,\ldots,6$) remains below the average of observed prices (p). These results suggest that even under a scenario in which multi-unit ownership is associated with a 10% reduction in marginal costs, the exercise of market power (i.e., higher prices) would overcome such efficiency gain.

In sum, market power seems to be a likely and quantitatively important (albeit not the only) explanation (vis-á-vis efficiency) for the increase in price that one observes in multi-unit operation.

6.4.3 | Consumer welfare

To measure changes in consumer welfare, we calculate the market-level CV. Total annual CV for all markets is $43,998,262.12, which is equivalent to 5.22% of total consumer annual spending. Thus, without multi-unit ownership, consumers would spend 5.22% less than what they actually do, holding their utility constant. This result is a direct effect from the reduction in prices observed in the counterfactual analysis.

Figure 9 shows how average CV varies depending on the marginal costs assumption (Section 6.4.2).[16] As estimated marginal costs increase for multi-unit owners, the average CVs decreases accordingly, indicating that consumer welfare decreases, but consumers are still better off without multi-unit ownership even if that means erasing some efficiency gains.

6.5 | Additional results

Another (more direct) way to compare market power of hotels operated by mulit-unit owners with market power of hotels that are not operated by multi-unit owners, is to analyze the markup that is implied by the estimated price elasticities reported in Section 6.3. Table 12 reports the average Lerner Index $\left(\left[\frac{p-mc}{p}\right]\right)$ across groups of hotels.[17] The first row considers all markets and compares the average Lerner Index for multi-owner hotels and non-multi-owner hotels. The second row considers only those markets with (at least) one hotel operating under multi-ownership modality. These results clearly indicate that MUO hotels command a substantially superior level of

[16] $CV*$ represents CV calculated with price $p*$. All other CVs are calculated with the corresponding counterfactual prices. For example, $CV1*$ is obtained with price p_1^*, and so on

[17] This index was introduced by Abba Lerner (Lerner, 1934).

TABLE 12 Lerner index by market and by type (MOU v. non-MUO) of hotel

	MUO hotels	Non-MUO hotels	*t* stat	*p* value
All markets	0.31826	0.29753	1.92	0.055
Markets w/MUO hotel(s)	0.31826	0.19905	11.56	0.000

market power, especially when such market power is compared to that of rival hotels operating in the same market (second row).

7 | CONCLUSION

This paper investigates the effects of multi-unit ownership on prices, market shares, and consumer welfare by analyzing data on hotels near interstate highway exits in Texas. Our approach proceeds in two steps. First, using reduced-form model analysis, we find evidence that multi-unit ownership causes higher prices.

Motivated by the results of the reduced-form analysis, we carry out a second empirical exercise. We construct and estimate a structural model of the hotel industry to study a counterfactual scenario: What would market prices look like of multi-unit owners were to become single-unit owners? The results support the hypothesis that multi-unit owners exercise market power: Without multi-unit ownership, prices of multi-unit owners would fall by about 9%. Further, market shares of all owners (in particular multi-unit owners) would increase significantly. These findings imply that consumers' welfare is lower in the presence of multi-unit ownership.

The findings of this paper provide a unique view on franchising, especially the role of franchisees. Franchising is seen as an intermediate point between vertical separation (i.e., two independent firms at each vertical level) and vertical integration(i.e., an integrated firm controlling both vertical levels). The market that is analyzed here provides a set up where the upstream unit (franchisors) may have limited control over the downstream (franchisees) decisions. In this scenario, and using the lodging industry as an example, this paper finds that some franchisees have multiple franchising contracts with more than one franchisors and that this multi-unit onwership causes prices to be higher. This evidence provides one explanation for why owners might want to operate multiple units in local markets and why franchisors would have an incentive to permit this.

Some limitations need to be considered when interpreting the results of this study. First, the narrow market definition in this paper excludes some markets where multi-unit owners exist (i.e., less isolated markets and hotels outside of Texas). While multi-unit ownership in larger markets could in principle be studied, the lack of a clear market definition (that clearly excludes cross-market competition) creates a hurdle in being able to credibly and precisely identify reliable substitution patterns across firms in a market (a crucial ingredient in the counterfactual analysis). Second, multi-unit owners might operate units in different markets in which the owners exercise market power through different mechanisms, such as multi-market contact. Third, multi-unit franchising is less prevalent in larger markets (where management contracts might be preferred by franchisors in lieu of franchising contracts) making our research question less relevant in such segments of the hotel industry. Finally, other aspects of multi-unit owners, in particular as they pertain to insights regarding their managerial practices, are not studied in this paper but can be fruitful avenues for future research.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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APPENDIX

A.1 | Multi-unit owners in texas

TABLE A1 Multi-unit owners in different market definitions

(Unit: Hotel)					
Market definition		Period	Total	MUO hotels[a]	Avg. MUO hotels
State[b]	All		18,050	2,494 (13.8%)	623.50
	MSA	4[e]	14,318	2,165 (15.1%)	541.25
	Non-MSA		3,732	245 (6.6%)	61.25
City[c]	All		18,050	1,391 (7.7%)	347.75
	MSA	4[e]	14,318	1,266 (8.8%)	316.50
	Non-MSA		3,732	125 (3.3%)	31.25
Highway[d]		28[f]	5,186	240 (4.6%)	8.57

[a]Hotels owned by multi-unit owners.
[b]State as a single market.
[c]Cities as markets.
[d]The definition of market in this paper.
[e]Four periods (2014Q1 to 2014Q4).
[f]periods (2008Q1 to 2014Q4); The one that this paper uses.

A.2 | Variable definitions

- Prices of hotels (p_{jt}): Average daily room rate ($100)
- Distance to exit: Distance to the nearest highway exits (miles)
- Shares of hotels: Rooms sold/total rooms available in the market
- No. of activities: Restaurant, bar, lounge, pool, gym, spa, and kid-activities
- No. of room types: No. of room types available in hotels
- No. of services for bus.: Meeting room, conference facility, business center, fax/office support.

TABLE A2 Market size by market types

		No. of hotels in the market					
Type	No. of markets	Mean	St. Dev.	Min	25 %	75 %	Max
All	1,595	3.251	2.297	1	2	4	12
Single and multi[a]	116	5.129	2.656	2	3	9	10
Single[b]	1,479	3.104	2.200	1	2	4	12

[a]Markets with both single- and multi-unit owners.
[b]Markets with only single-unit owners.

A.3 | Results of first stage regression of the instrument variable models

TABLE A3 Descriptive statistics by ownership types in all markets

Statistic	*N*	Mean	St. Dev.	Min	25 %	75 %	Max
Price							
All	5,186	68.101	32.930	13.379	43.589	85.742	273.621
Multi[a]	240	84.623	37.503	22.800	60.006	98.645	223.530
Single[b]	4,946	67.300	32.483	13.379	43.017	85.227	273.621
Room							
All	5,186	62.594	26.910	9	46	74	200
Multi[a]	240	67.046	23.854	24	52	97	105
Single[b]	4,946	62.378	27.033	9	45	74	200
Rating							
All	5,186	2.125	0.536	1	2	2.5	3
Multi[a]	240	2.337	0.272	1	2.	2.5	2.5
Single[b]	4,946	2.115	0.544	1	2	2.5	3

[a]Multi-unit owners.
[b]Single-unit owners.

TABLE A4 Descriptive statistics of owners in markets with multi-unit owners

Statistic	*N*	Mean	St. Dev.	Min	25 %	75 %	Max
Price							
All	595	82.865	37.994	22.800	58.066	96.403	223.530
Multi[a]	240	84.623	37.503	22.800	60.006	98.645	223.530
Single[b]	355	81.677	38.330	26.518	55.420	94.766	210.890
Room							
All	595	73.613	35.609	24	52	96	200
Multi[a]	240	67.046	23.854	24	52	97	105
Single[b]	355	78.054	41.165	25	55	96	200
Rating							
All	595	2.361	0.312	1	2	2.5	3
Multi[a]	240	2.337	0.272	1	2	2.5	2.5
Single[b]	355	2.377	0.336	1	2	2.5	3

[a]Multi-unit owners.
[b]Single-unit owners.

TABLE A5 Results of first stage IV

Dep. Var.: Price	Coef. (Std.Err.)
Exogenous Var.	
Distance to exit	−0.099***
	(0.036)
No. of activities	0.361***
	(0.044)
No. of room types	0.090***
	(0.034)
No. of services bus	0.367***
	(0.061)
Instruments	
Distance to rival	−0.031***
	(0.018)
No. of rooms	−0.110***
	(0.016)
Sum of rivals' rooms	0.056***
	(0.005)
No. of rooms *** distance to rival	0.002
	(0.028)
Sum of rivals' rooms *** distance to rival	0.010***
	(0.005)
Fixed effects:	Location, chain
Observations	5,186
Adjusted R^2	0.641
F statistic	129.654***

*p < 0.1. **p < 0.05. ***p < 0.01.