# Branding and Spatial Preemption: An Application to the Hospitality Industry

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## Abstract

In many settings where spatial preemption might be expected to produce tightly concentrated industry structures, firms share the market instead. Using a strategic investment model, I show that this can be rationalized by accounting for heterogeneity in consumer demand, particularly with respect to branding. I present an empirical example using data on the branded segment of the lodging industry, which has many characteristics associated with spatial preemption, but is also characterized by strong brand-preferences. Consistent with my model, I find that large lodging companies in Texas do not deter entry by competitors.

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# 1 Introduction

The hospitality industry provides an interesting opportunity to consider the influence of branding on market structure. The industry is highly segmented by quality, and the vast majority of higher-quality hotels are associated with just a few large firms that spend large sums on advertising campaigns. These stylized facts are consistent with the presence of endogenous sunk costs (see Shaked and Sutton (1987), Sutton (2007), Ellickson (2006, 2007)), which produce a concentrated high quality segment. Unlike the settings considered in formal endogenous sunk cost models, however, individual hotel markets grow and change over time. They, thus, bear a strong resemblance to the setting considered by Eaton and Lipsey (1979) in their canonical model of spatial preemption. This would suggest that within individual hotel markets, the branded tier should be extremely concentrated as a result of entry-deterrence by the first-mover. However, examination of retail hotel markets often shows similar branded competitors clustered together (e.g. a Holiday Inn, a Courtyard by Marriott, and a Comfort Inn at one interstate exit).[1] In other words, growth occurs on the extensive margin (i.e. via entry) though theory implies that it should occur on the intensive margin (i.e. by incumbents' expansion).

In this paper, I focus on how branding affects market structure within the high-quality segment, and argue that heterogeneity in consumers' impressions of firms – such as might be created or amplified by marketing campaigns – can explain the un-concentrated nature of the branded segment of individual hotel markets. I begin by presenting a game-theoretic model of strategic product entry similar to Eaton and Lipsey (1979) and Judd (1985) in which consumers have heterogeneous firm preferences. The model shows that preemption will be harder to sustain as consumers are more heterogeneously influenced by the firm a product is offered by. This occurs because the firms concentrate on those consumers who like their products in order to maintain high price-cost margins. However, the presence of firm identifiers in consumers' utility functions amplifies within-firm cannibalization for multi-

[1] Even if there are agglomeration economies of the sort considered in Fischer and Harrington Jr (1996) it is not clear why a first mover could not open other affiliated branches to achieve them.

product firms as seen empirically in papers like Hui (2004). This makes it more difficult for incumbent firms to deter entry, because unless the incumbent introduces a flood of new products, they will be unable to saturate the market. Flooding the market is unlikely to be an equilibrium strategy due to the presence of entry costs which make introducing new products expensive relative to accommodating differentiated competition with the entrant. An extension to the model shows that if firms can further separate their goods in the product space – through the use of sub-brands (e.g. Marriott's Fairfield Inn and Courtyard sub-brands in the mid-market tier) or other product characteristics – it can sufficiently soften cannibalization so as to make preemption viable.[2]

Using data on Texas lodging markets, I provide an empirical example of how heterogeneity in consumer preferences impacts local market structure. Overall, the data are highly consistent with the model's predictions about the relationship between horizontal consumer heterogeneity and spatial preemption. First, static analyses of the high-quality segment of Texas markets show that they are roughly evenly divided among the six firms with large presences in the state. Second, by examining the revenues of individual hotels, I find very sizable cannibalization effects of introducing new hotels affiliated with the same firm. While using a different sub-brand (i.e. Marriott introducing a Fairfield Inn into a market where it already had a Courtyard) softens this effect, it continues to dwarf the impact of a property affiliated with a rival firm (e.g. a Holiday Inn). Indeed, the data show that the introduction of a hotel in the same sub-brand has a negative effect on revenues 1.5 - 2 times larger than a hotel from other sub-brands affiliated with the same firm, which, in turn, have 10 - 15 times larger negative effects than hotels affiliated with other competitors.[3] Third, the revenue effects are consistent with the finding that the incumbent lodging companies in the high-quality segment are not spatially preempting, and that growth as a result of entry by

[2]For the rest of the paper, I use "firm" to refer to a central firm (e.g. Marriott) and "sub-brand" to refer to a product line large enough to possibly generate its own impression on consumers (e.g. Courtyard). To be consistent, I will thus discuss consumers' preferences in terms of "firm preferences" that impact all products affiliated with a single company and "sub-brand preferences" that impact just a single sub-brand or product.

[3]In other words, a Courtyard by Marriott is most negatively impacted by the presence of another Courtyard; the presence of hotels affiliated with other Marriott sub-brands (e.g. Fairfield Inn) have smaller but still substantial effects; and other brands' hotels have an impact that is negative but small in magnitude.

new firms is 50 percent more likely than expansion by an incumbent firm.

The paper contributes to an emerging literature (e.g. Bronnenberg et al. (2006, 2009)) considering the market structures of oligopolies created by endogenous sunk costs. It also provides insight into the ambiguous empirical evidence for spatial preemption. The model rationalizes why in industries like lodging or fast-food – where brand affiliations play a large role in determining consumer interest – cannibalization appears particularly significant (see, e.g., Thomadsen (2005)) and spatial preemption is less likely.[4] By contrast, when branding is opaque or consumers are driven more by product characteristics – as in radio markets (Berry and Waldfogel (2001)), consumer products marketing (Smiley (1988)), or the early computer industry (Stavins (1995)) – spatial preemption has been documented.

The paper also contributes to a growing literature that endogenizes branding in order to understand consumers' behavior and equilibrium industry structure in differentiated goods markets. Previous contributions (e.g. Bagwell (2007), Goldfarb et al. (2009), Basker et al. (2010), Rotemberg (2010)) have suggested that branding plays a substantial role in a variety of settings. Finally, the paper extends the analysis of strategic behavior in the much-differentiated hotel industry (see, e.g., Mazzeo (2002), Conlin and Kadiyali (2006), Kalnins (2006)).

The paper proceeds as follows. Section 2 discusses the characteristics of the hospitality industry, the role of advertising, and consumers' tastes. Section 3 presents the theoretical model. Section 4 discusses the data used in the empirical analysis. Section 5 analyzes the impact of market structure on changes to market structure, while Section 6 considers the relationship between current market structure and individual hotel revenues. Section 7 concludes and suggests possible extensions.

[4]It should be noted, however, that Toivanen and Waterson (2005) present evidence of network economies in fast food.

# 2 Branding and The Lodging Industry

The lodging industry has attracted much scholarly attention in recent years because so many different aspects of industrial economics are present (e.g. product differentiation, spatial competition, vertical contracting, etc.).[5] Several characteristics have emerged as particularly key. First, the industry is highly differentiated in terms of the quality and amenities available to guests. Indeed, previous research has indicated that competition across the different quality segments is extremely weak and there may in fact be cross-segment agglomeration economies (see Kalnins and Chung (2004), Freedman and Kosova (2010)). Within a given quality segment, however, very little distinguishes hotels associated with different firms. For example, Shoemaker and Lewis (1999) state that in a survey of high-end hotel managers, many could not identify the brand of pictured hotel rooms – even for their own hotels.

Second, the industry is quite concentrated. Data compiled by Hotel and Motel Management (2004) show that 50% of all hotels in the country are affiliated with 10 large firms. The bulk of these corporate hotels are of relatively high quality, while the independents tend to be low-quality. Moreover, the large firms often own multiple sub-brands within, as well as across, quality segments. For example, Marriott Hotels controls the Fairfield Inn and Courtyard sub-brands, both of which are in the mid-level segment, as well as luxury sub-brands like JW Marriott.

Third, the large firms' marketing efforts are large and sophisticated, featuring prominently in executives' discussion of strategy. For example, Accor's 2008 Annual Report (p. 16) discusses how brand development and revitalization are a large part of its strategy in the hospitality sector.[6]

Many of the factors listed above are strikingly consistent with versions of the theory of endogenous sunk costs such as in Ellickson (2006, 2007). Although I omit a formal presentation, the relationship between these models and the hotel industry can be quickly sketched. Most hotel traffic is non-repeat, making it difficult for individual hotels to credibly

[5] See Kalnins (2006) for a recent survey.

[6] Further evidencing the size and sophistication of hotel firms' marketing efforts, many hotel sub-brands now appear in *Brandweek*'s annual "Superbrands" issues listing the world's the most valuable brands.

signal quality. By using advertising to develop a strong brand which a consumer can "punish" by avoiding in the future, firms affiliated with multiple hotels can effectively commit to higher levels of quality and thereby earn higher price-cost margins. In the presence of scale economies to advertising and varying tastes for quality, quality-oriented advertising for these brands leads to a multi-tiered market structure with a concentrated branded segment and a fragmented budget segment.

Though sharing many characteristics with them, the details of the lodging industry also notably depart from canonical endogenous sunk cost models in some respects. In particular, local hotel markets evolve over time. Therefore, the assumption of simultaneous entry decisions that has been used to explain the presence of relatively equal sized firms within the oligopolistic tier does not fit. Moreover, in many cases, hotel markets are small and isolated, containing only a few hotels. These are ideal settings for strategic interaction, and the past literature on competition in the hotel industry supports this (see, e.g., Mazzeo (2002), Kalnins and Chung (2004), Conlin and Kadiyali (2006), Suzuki (2009), Freedman and Kosova (2010)).

The small size and gradual evolution of local hotel markets, as well as the objectively undifferentiated nature of intra-segment products, would suggest that spatial preemption might allow first-mover lodging firms to maintain their market power via spatial preemption as in Eaton and Lipsey (1979). However, interstate travel suggests this is not the case, as signs for exits indicate the presence of multiple hotels affiliated with competing firms. This can be explained by the fact that firms' marketing efforts in the hospitality industry are aimed not just at signalling quality but at differentiating themselves from their intra-segment competitors. Firms in the industry view such differentiation as critical due to the aforementioned convergence of standards within quality segments.

Efforts by firms to horizontally differentiate themselves are likely to influence consumers' tastes for the different firms' outlets in much the same way as advertising facilitates vertical differentiation. Further strengthening consumers' heterogeneous firm preferences has been the recent adoption by the industry of marketing innovations like loyalty programs (see

Shoemaker and Lewis (1999)) and firm specific internet booking services for all of their affiliated hotels. As a consequence of these various marketing techniques and consumers' inevitably heterogeneous past experiences, it is accepted wisdom within the industry that consumers have heterogeneous tastes for brands as well as segments. An industry professional explained to me that while consumers may not exactly know why they prefer certain firms' hotels, their behavior indicates they will pay a significant premium to stay in a hotel affiliated with their preferred firm.

While bolstering their market power, the presence of these horizontal firm preferences also has a significant impact on the viability of spatial preemption as I show formally below.

# 3 A Strategic Model of Hotel Market Growth

## 3.1 Model Overview

In Eaton and Lipsey (1979), an incumbent and entrant constantly evaluate whether or not to expand or enter a growing market. Abstracting from the possibility of disinvestment, the authors show that the incumbent will always preemptively introduce new products to ensure the continuation of "soft" price competition. Modifying the set-up slightly so that the model has two horizontally differentiated segments, Judd (1985) shows that spatial preemption will not always be sub-game perfect, because an incumbent with products in both segments might withdraw from an entered segment in some cases. This would occur if intense competition in the entered segment would cannibalize sales from the segment where the incumbent still had a monopoly. Thus, Judd (1985) suggests that cannibalization provide the key to understanding when spatial preemption will occur. However, the paper does not offer intuition for predicting when cannibalization will be so pronounced as to make entry deterrence unprofitable for incumbents.

To close this gap, I employ the same three-stage duopoly game used by Judd (1985) and other papers in the entry deterrence literature (e.g. Ellison and Ellison (2007)), specifying that payoffs depend on a random utility model (RUM) demand system, which has become

the standard in applied work (see, e.g., Berry et al. (1995), Nevo (2001)). The importance of branding and horizontal consumer heterogeneity are factors increasingly being incorporated into both theoretical (e.g. Basker et al. (2010), Rotemberg (2010)) and empirical (e.g. Bagwell (2007), Goldfarb et al. (2009)) work on differentiated product competition. While I focus on heterogeneity in consumers' tastes for specific firms, the intuition extends straightforwardly to other characteristics that are fixed or closely correlated with firm identity.

In the model, there are two rational and foresighted hotel firms competing in a branded segment of a hotel market: the incumbent $I$ and the entrant $E$. As mentioned above, competition across segments has been shown to be extremely weak, so I abstract from the presence of a low quality fringe segment. Somewhat similar to the setting in Eaton and Lipsey (1979), I assume that a market where the incumbent has one hotel has grown and can now support two hotels. A sequential game determines which firm introduces the new hotel. Figure 1 shows the timeline of their decisions.

First, the incumbent, who already has one hotel in the market, decides whether to add a second hotel. Second, the entrant has the option of opening a single hotel of its own. Third, and finally, the incumbent has the option of closing its new hotel. The market structure is fixed once the incumbent has made its disinvestment decision, and firms engage in Bertrand-Nash competition.

In order to assess preemption, I make certain assumptions about the sunk costs involved in changes to the market structure. First, I impose that the entrant faces entry costs too high to offset in a three hotel market. Second, if the incumbent closes the hotel, it receives its fixed scrap value $\kappa$. $\kappa$ might be negative, in which case it would represent an exit cost. In the event that the incumbent also must pay an entry cost, it may be thought to shift $\kappa$ and does not separately enter into the firm's decision process.[7]

[7] I abstract from the evolution of exogenous demand conditions. Similarly, the model does not account for variation in the costs of exit and entry. Though accounting for these things is not infeasible (see, e.g., Pakes et al. (2008)), I believe that little additional intuition would be gained from the added complexity.

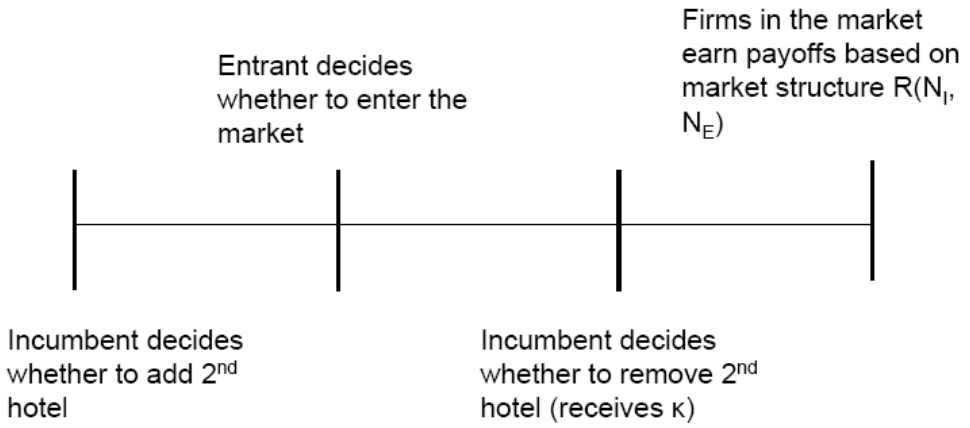


Figure 1: Timing of events in the game

## 3.2 Consumer Demand and Firm Profits

Consumers in the market maximize utility by deciding whether to stay in any of the existing hotels or take the outside option. I specify that the utility that consumer $i$ gains from choosing a given hotel $j$ affiliated with firm $B$ is:

$$V_{i,j,B} = \delta - p_j + \mu_{i,B} + \epsilon_{i,j}. \quad (1)$$

The utility from choosing the outside option $o$ is:

$$V_{i,o} = \mu_{i,o} + \epsilon_{i,o}. \quad (2)$$

$\delta$ is the baseline benefit to all consumers of staying in a hotel and is common across hotels. $p_j$ is the price charged at hotel $j$.[8] The $\mu_{i,B}$ capture consumer $i$'s heterogeneous taste for firm $B$, and are independent draws from identical Normal distributions having variance parameter $\sigma^2$.[9] While the draws will be independent across consumers and firms, hotels associated with

[8]For the sake of simplicity, I assume that consumers are homogeneous in how they perceive the value of lodging and its price. Thus, there are no individual specific subscripts on $\delta$. This is another element that could be endogenized, but which I believe would not serve great purpose.

[9]It is worth noting that while I assign a utility shifter to the outside option, this could be normalized to 0

the same firm share the same $\mu$ for any given person. The $\epsilon_{i,j}$ are independent draws from an extreme value distribution, and distinguish different hotels affiliated with the same firm from each other.

Following the standard results for the mixed logit (see, e.g., Train (2003)), hotels' market shares are determined by integrating out the $\mu$. Thus, the market share of each hotel $j$ is:

$$\begin{aligned} S_j &= \int \frac{\exp V_{i,j}}{\sum_j \exp V_{i,j}} f(\mu) d(\mu) \\ &= S_j(p_j, p_{-j}), \end{aligned}$$

where $f(\mu)$ is the joint density function of the firm-specific utility shifters. Thus, hotel $j$'s share of the market as a function of its own price ($p_j$) and the prices of all other hotels in the market ($p_{-j}$).

I assume that marginal costs are 0, but being in the market requires payment of a fixed cost $f$ in each period.[10] Thus, normalizing the size of the market to 1, the profit of hotel $j$ affiliated with firm $B$ can be written as:

$$\Pi_j = p_j * S_j(p_j, p_{-j}) - f.$$

Firms simultaneously set prices to maximize overall profits. As is common in the applied literature using these models of demand (see, e.g., Berry et al. (1995), Nevo (2001)), I assume the existence of a unique, symmetric pure-strategy equilibrium in positive prices conditional on market structure. Because the products are horizontally differentiated, I assume that an incumbent with two hotels charges the same price in both.

## 3.3 Equilibria and Spatial Preemption

Firms play sub-game perfect investment strategies. Thus, the incumbent will not open a second hotel if it knows that it would close it in the event that entry occurs. Similarly,

with no qualitative effect on the results.

[10] As noted in Kalnins (2006), marginal costs are very low in the hotel industry relative to fixed costs, justifying this abstraction.

because of the aforementioned assumption about the magnitude of entry costs, the entrant will not challenge the incumbent if it opens two hotels and would not remove the second in the event of entry. As shown in Judd (1985), entry deterrence will not be sub-game perfect when it is more profitable for the incumbent to remove one of its two hotels from the market once it sees that the entrant was not deterred. This occurs when:

$$\begin{aligned} R^I(2,1) - 2f &< \kappa + R^I(1,1) - f \\ R^I(2,1) - f &< \kappa + R^I(1,1), \end{aligned} \tag{3}$$

where $R^B(\cdot)$ represents the revenues earned by firm $B$ conditional on the market's structure. The first term inside the parentheses in $R^B(\cdot)$ indicates the number of hotels affiliated with the incumbent, and the second indicates the number affiliated with the entrant.

Equation (3) shows that entry deterrence will not occur when the profits of sharing the market equally net of exit costs are greater than the profits from operating two hotels in a three hotel market net of the fixed cost of operating one hotel.[11] $f$ and $\kappa$ affect the viability of entry-deterrence in straightforward ways. As the fixed cost of operating a hotel increases, the incumbent is less able to credibly deter the entrant. Similarly, as scrap values increase, the region in the parameter space where preemption occurs shrinks, because exiting the market becomes more attractive. Due to the model of consumer demand employed here, $\sigma^2$ also affects the viability of entry deterrence. Unfortunately, the use of the RUM framework means there are no analytic solutions for elements of interest (e.g. optimal prices, profits) with respect to $\sigma^2$. Nevertheless, the consequences of the demand system (explored through numerical simulations) are fairly intuitive.

Rewriting Equation (3) as $R^I(2,1) - R^I(1,1) < f + \kappa$ shows that as the difference between the incumbent's revenues when it has 2 hotels versus 1 hotel while competing with a hotel affiliated with the entrant falls, preemption becomes less credible. In other words, the more the incumbent's second hotel simply cannibalizes sales from the first, the less feasible spatial preemption becomes. My numerical results demonstrate that as $\sigma^2$ increases, the

[11] This is largely analogous to Theorem 1 (i) in Judd (1985).

cannibalization effect increases in magnitude. This occurs because as $\sigma^2$ increases there are more consumers with very strong feelings about each firm's products. The presence of such partisan consumers allows firms to earn higher profits by increasing prices, even if they drive away consumers who were on the margin. However, as the firms focus more on the segments of the population that have strongly favorable feelings about their firm, there is significantly less inter-firm competition. Spatial preemption is unlikely to be credible, because the incumbent gains few additional consumers with its second hotel. Moreover, by removing the hotel, the incumbent can save itself the per period fixed cost (and/or earn scrap value).

Figure 2 illustrates the relationship between the heterogeneity of firm preferences and spatial preemption. The X-axis shows the ratio of $\sigma^2$ to $\delta$, representing the relative importance of consumer heterogeneity, while the Y-axis is the ratio of the per period fixed cost $f$ to the per-hotel revenues received by the incumbent in a market with 2 incumbent hotels and 1 entrant.[12] The changing frontier of Region I illustrates that as the relative importance of firm preferences increases, the magnitude of the per period fixed costs (relative to per hotel variable profits) needed to make preemption non-credible falls.[13]

## 3.4 Extension: Location Choice

The model presented above can be straightforwardly extended to show when spatial preemption would be sustainable. Consider if there are other product characteristics (e.g. sub-brand) about which consumers have heterogeneous preferences, and which firms have control over. In other words, the firm has greater discretion over where their products are

[12] The model is parameterized with $\delta = 3$ and $\kappa = 0$.

[13] If the $\mu_{i,B}$ come from different distributions for the different firms, additional implications about firm behavior can be drawn. If the mean of a firm's $\mu$ are higher, this leads it to have a higher likelihood of expansion than other firms, since on average, consumers view that firm's hotels as more desirable. Any hotel associated with that hotel will thus attract more consumers all else equal. By contrast, if a firm's $\mu_{i,B}$ has higher variance, it should not lead to differences in the likelihood of expansion. This is true because what is important to consumers is the distance between different firms' $\mu$, and differences across firms' variances will not benefit any specific firm.

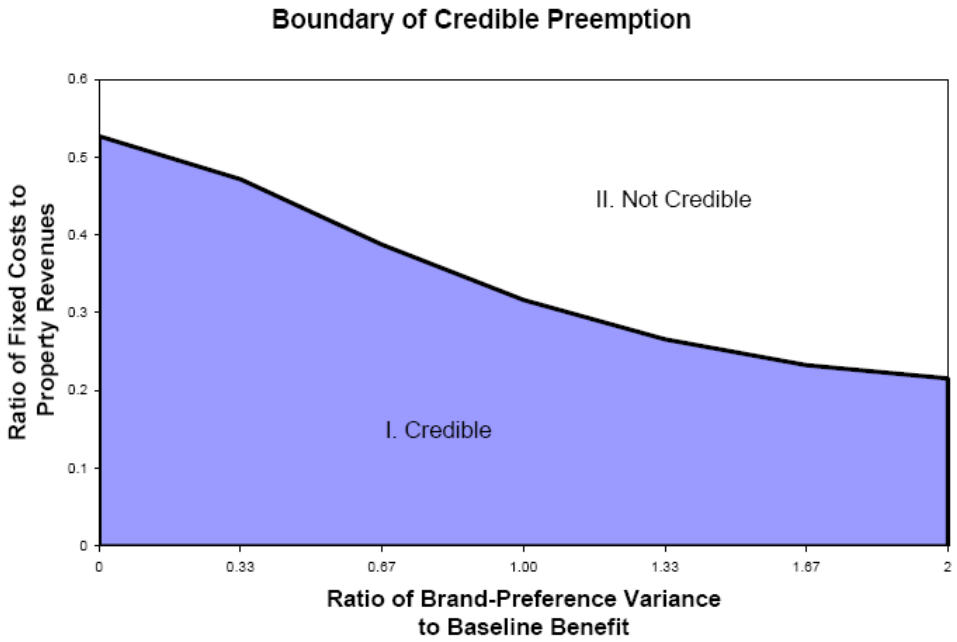


Figure 2: Regions of credible and non-credible preemption

located in the product space. In this case, Equation (1) becomes:

$$V_{i,j,B} \quad = \quad \delta - p_j + \mu_{i,B} + \alpha_{i,j} + \epsilon_{i,j}, \tag{4}$$

where $\alpha$ indicates the effect on consumer $i$'s utility of some product characteristic particular to $j$. Like the $\mu$, the $\alpha$ are independent draws from identical Normal distributions with variance parameter $\tau^2$.

That the $\alpha$ differ for each consumer across products makes it easier for firms to expand their product lines, because it reduces cannibalization. The relative impact of the firm preferences are diluted. Now, firms can extract surplus from a larger population, targeting a wider variety of consumers with strong feelings about the firm and/or its products' specific characteristics. This implies that in industries where firms are able to distinguish their products from each other in the product space, larger product portfolios should be expected. Moreover, on the margin, spatial preemption should be more likely. I illustrate this relationship graphically in Figure 3 by varying $\tau^2$. All parameters are set at the same level as before,

except $\sigma^2$ which I set to 0 to emphasize the role of sub-brands.[14] The Figure shows that as firms are able to more differentiate their products, the viability of preemption increases.

This result connects straightforwardly to the earlier work of Gilbert and Matutes (1993), who consider competition between two brand-differentiated competitors able to offer quality-differentiated products. They model consumers as being spread across a plane where one dimension reflects their taste for the two different firms and the second their taste for quality. Though our models emphasize different elements and rely upon different formulations of demand, both lead to the conclusion that stronger tastes for branding relative to other product characteristics lead to smaller product portfolios.

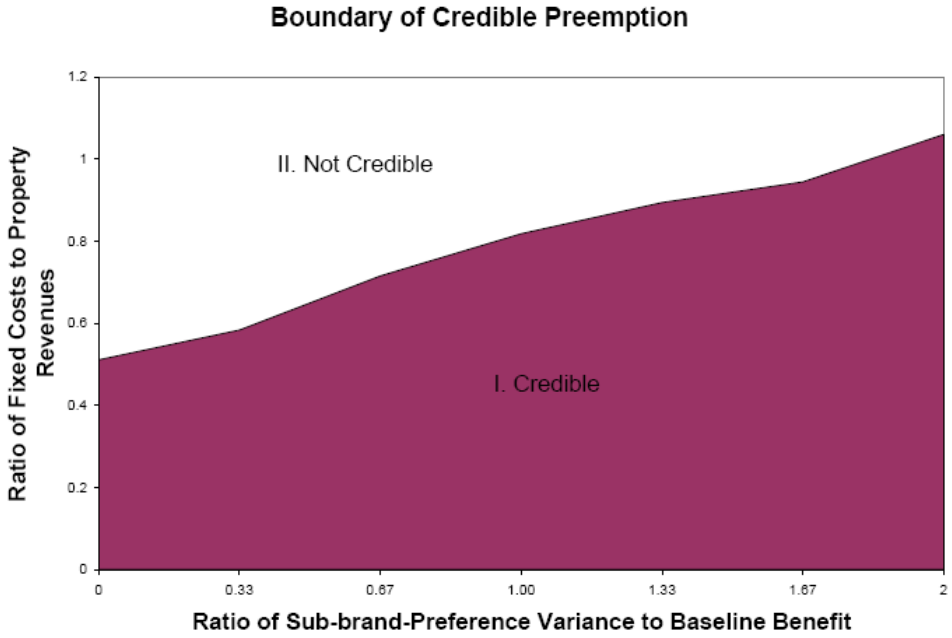


Figure 3: Regions of credible and non-credible preemption

The prediction that greater control over product location should be correlated with larger product portfolios appears upheld both anecdotally and in the literature. For example, consider large consumer products firms like Unilever, which offer a variety of closely related goods that are differentiated by branding (e.g. the Dove and Axe sub-brands of personal hygiene products) as well as product characteristics. Similarly, Berry and Waldfogel (2001)

[14] As before, for modeling convenience, I allow consumers' feelings for the outside option to be shifted by a $\alpha$.

exploit a natural experiment to show that the ability to position (and re-position) products seems linked to successful spatial pre-emption in radio format markets. Finally, recent papers have shown that product positioning capabilities dramatically change the portfolios and pricing of oligopolists (e.g. Gandhi et al. (2008), Draganska et al. (2009)).

### 3.5 Motivating the Empirical Exercise

The simple framework presented above highlights the relationship between spatial preemption and consumer heterogeneity. It shows that as the portion of consumers with strong but heterogeneous preferences about branding grows, it becomes increasingly difficult for a firm to engage in spatial preemption. An ideal test of the model's predictions would exploit cross-industry product portfolio data in conjunction with information on the importance of branding to consumers. Unfortunately, such data are difficult to find. Therefore, I pursue a narrower approach, exploiting data on one industry that seems to have many of the hallmarks associated with spatial preemption, but which also has been characterized as an industry where consumer tastes for firms display significant variance.

## 4 Data and Preliminary Analysis

To test the implications of strong firm preferences on market structure, I use data from the Comptroller of Public Accounts (CPA) for Texas.[15] Between 2000 and 2008, the CPA data identify each hotel in the state by name, city of location, and address, and list its owner, capacity (in rooms), and revenues.[16] Originally reported at quarterly and monthly intervals, I aggregate the data up to yearly observations on the grounds that it takes that long to build a new hotel. In order to focus on the hotel and motel market (as opposed to the boutique and bed and breakfast segments), I exclude observations of hotels with less than 30 rooms.

[15] Several other papers (e.g. Kalnins and Chung (2004), Kalnins (2004), Conlin and Kadiyali (2006), Suzuki (2009)) interested in studying differentiated competition in the hotel industry have also used various periods of CPA data.

[16] In many instances, I found that the reported name or address for a given hotel might vary slightly from one year to the next. I systematize name and address conventions over time as failing to account for such variation would lead to an inaccurately large estimate of the churn in hotels.

Like Mazzeo (2002), I use cities rather than zip-codes as the relevant market definition as even cities of modest size often have more than one zip code. Moreover, focusing on cities follows the convention adopted by the industry insofar as hotels advertise themselves based on their city of location, and guidebooks organize their reviews around cities. However, a city-based approach to market definition has important drawbacks. It assumes that within a market the geographic location of different hotels does not matter. In small cities this assumption may hold, but in larger markets – where it may be time-consuming to get from one point to another – it will fail. Additionally, using cities assumes that there are no spillover effects across markets. In many cases, this also may not hold.

Following Bresnahan and Reiss (1987), I address these concerns by focusing on geographically isolated markets of modest size. I determine such markets in the following manner. First, I use Google Earth to determine the "centrum" of each city in the CPA data.[17] Second, I calculate the distance between each of the centrums using the Great Circle methodology. Third, I discard those cities whose centrums are less than 10 miles from that of their nearest neighbor or less than 50 miles from the major economic hubs of San Antonio, Austin, Dallas, El Paso, and Houston. Then, I drop the cities that never had a population of more than 1,000 people during the sample period according to U.S. Census data; I also drop the resort cities of South Padre and Corpus Christi.[18] This leaves a total of 183 cities, with 1,198 different hotels and 7,286 hotel-year observations. Figure 4 shows the locations in Texas of all markets in the sample.

I differentiate hotels in two dimensions: quality and corporate affiliation. First, I match the hotel names to an author-constructed data set containing the names of the national sub-brands and their parent firms. Of the 7,286 hotel-year observations, 37 percent are affiliated with sub-brands belonging to 17 different national firms.[19] To control for quality, I follow

[17] I define the centrum to be the latitude-longitude point that the software converges to when the city is entered into the search bar.

[18] The Census data can be downloaded from the Census at factfinder.census.gov. I exclude the coastal resort cities as they had vastly more hotels than all other markets of similar size. As in Bresnahan and Reiss (1987), I explored whether cities near the borders with Mexico or other states are outliers. I found that excluding these cities did not affect the results, so I have left them in the sample.

[19] A further complication is the fact that several firms in the sample changed hands during the sample period. Baymont Suites shifted from being a largely independent national firm to part of Wyndham's sub-brand

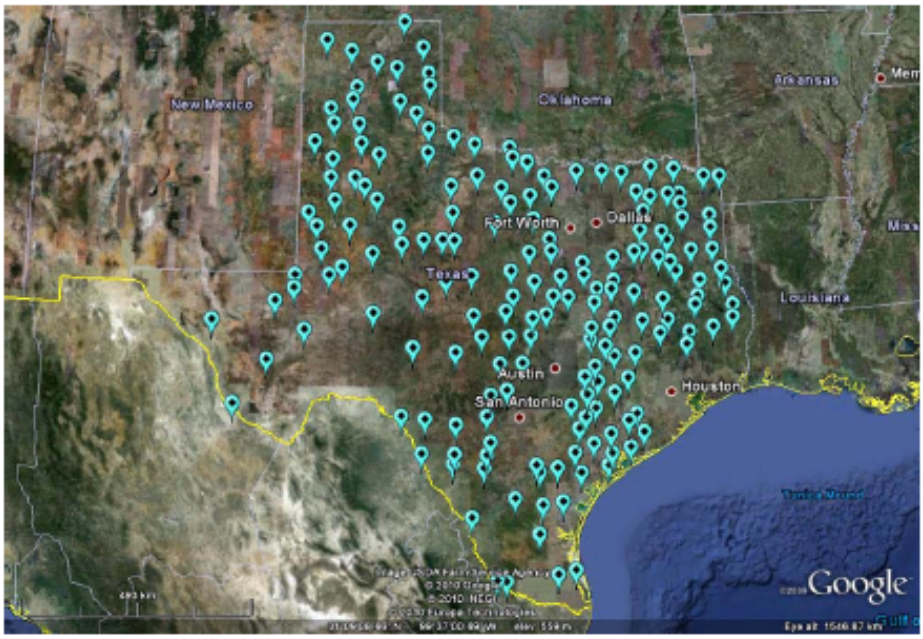


Figure 4: Map of Market Locations in Texas

Kalnins and Chung (2004) in assuming that hotels have the average quality rating of their sub-brand, which I determine using the American Automobile Association's (AAA) Texas Tourbooks.[20]

The restriction of the sample to geographically isolated markets means that the very high end of the quality spectrum is largely absent. Moreover, the data indicate that the hotels in the low quality tier are almost all independents with no national firm affiliation, and that almost all independents are low-quality. Therefore, in my empirical analysis, I focus on firms with substantial (defined as having at least 150 such hotel-year observations) operations in the mid-level (i.e. 2-3 star) segment in Texas, and assume that the hotels associated with

portfolio in 2005; and La Quinta was acquired by Blackstone in 2005, a private equity group. I assume that Baymont hotels were always affiliated with Wyndham. I believe this assumption is innocuous as Baymont accounts for less 1.5% of all Wyndham hotels. I also assume that Blackstone's acquisition did not affect a change in La Quinta's overall strategy. I also make the assumption that the possibility of such transactions had no anticipatory effect on firm behavior.

[20] Quality averages are based off of ratings in the 2001, 2002, 2005, and 2006 AAA guides for the sample markets. Individual hotels' qualities range from 0 (in rare instances) to 5 (also rare) stars. Sub-brands that do not appear in the AAA data are set to 3 stars. Table A-1 in Appendix A shows the number of hotel-market-period observations associated with each of the firms and their quality tiers, where the high quality tier is composed of all sub-brands with average ratings of between 2 and 3 stars.

smaller networks do not benefit from the same firm reputation effects as those affiliated with the large firms. Instead, consumers view them as analogous to independents. These restrictions leave six large firms: Choice Hotels, Continent Hotels, Hilton Hotels, La Quinta Inns and Suites, Marriott International, and Wyndham, which together account for 2,479 hotel-year observations (92 percent of all branded hotels in the sample markets).[21]

Table 1: Portfolio Changes

| Change in $\omega$ | Incumbents | Entrants | Total |
|---|---|---|---|
| -2 | 1 | | 1 |
| | 0.07 | | 0.01 |
| -1 | 68 | | 68 |
| | 4.67 | | 0.77 |
| 0 | 1,290 | 7,234 | 8,524 |
| | 88.66 | 98.7 | 97.04 |
| 1 | 87 | 95 | 182 |
| | 5.98 | 1.3 | 2.07 |
| 2 | 8 | 0 | 8 |
| | 0.55 | 0 | 0.09 |
| 3 | 1 | 0 | 1 |
| | 0.07 | 0 | 0.01 |
| Total | 1,455 | 7,329 | 8,784 |
| | 100 | 100 | 100 |

Notes: The top row in a cell indicates the number of observations, while the second indicates the percentage of that column's observations.

To control for market structure in a given period, I use each firm's portfolio (i.e. stock) of existing hotels. In keeping with the theoretical model presented above, I start by treating all hotels affiliated with a firm as identical and then relax the assumption to account for differences in sub-brand affiliation.[22] Thus, for each firm $j$ in market $m$ in period $t$, I count the number of unique name-address pairings affiliated with that firm to determine the size of its portfolio, $\omega_{j,m,t}$. If firm $j$ has not yet entered a market, $\omega_{j,m,t} = 0$. Alterations to firms'

[21] Table A-2 in Appendix A shows the sub-brands affiliated with each firm in the sample and their average quality rating.

[22] I maintain the assumption that hotels within a market are of identical size. This can be justified by examining the average coefficient of variation of capacity in hotels across markets. I find that the average is a very modest 0.32. Moreover, as a robustness check, I re-estimated the models of entry deterrence based on firms' total stock of rooms in the market. The results were qualitatively similar.

portfolios are defined as the net change in the number of unique name-address pairings from one period to the next, i.e. $\omega_{j,m,t} - \omega_{j,m,t-1}$.

Table 1 shows the magnitude and frequency of changes to portfolio size for entrants and incumbents, and indicates that the large firms chose to alter their portfolios only 3 percent of the time. This modest amount of portfolio variation makes sense as demand conditions in hotel markets evolve slowly, and there are substantial sunk costs involved. Of the 258 firm-period observations in which a firm altered the size of its portfolio of hotels, only 10 of the changes are greater than 1 in absolute value. For this reason, in the empirical analysis of changes to market structure, I topcode those that are greater than 1 to 1 and those that are less than -1 to -1.

Table 2 examines the structure of the markets in the sample. It shows the Herfindahl-Hirschman Index (HHI) of industry concentration in different sized markets computed in two ways: by firms' shares of branded hotels and firms' shares of branded revenues. The Table is consistent with what the theoretical model predicts insofar as the HHI scores reflect an approximately equal division of the markets. Thus, the equilibrium market configurations are inconsistent with spatial preemption or other forms of entry deterrence by the large lodging companies in the branded segment.

While this is certainly in-line with the model's implications about an industry where consumer heterogeneity in firm preferences is important, it does not account for important factors that might vary across markets. Nor does it speak to the incumbents' incentives for expansion emphasized in the model. To obtain a more precise understanding, it is necessary to employ formal econometric frameworks, which I do in the following sections.

# 5 Hotel Revenues, Branding, & Market Structure

In the previous section, I showed that the equilibrium market structure of the high-quality hotel segment is quite flat. The theoretical model presented above relates this to consumers' heterogeneous firm preferences. These lead to large revenue cannibalization effects, dampening the incentives for the spatial preemption strategies that would lead to tighter

Table 2: HHI Summary Statistics by Market Size

| # Branded | Obs | Equal Share | HHI-Hotels | HHI-Revenues |
|---|---|---|---|---|
| 2 | 93 | 0.50 | 0.58 | 0.65 |
| 3 | 69 | 0.33 | 0.41 | 0.44 |
| 4 | 61 | 0.25 | 0.37 | 0.41 |
| 5 | 63 | 0.20 | 0.33 | 0.33 |
| 6 | 23 | 0.17 | 0.26 | 0.26 |
| 7+ | 95 | 0.17 | 0.23 | 0.22 |

Notes: The Table shows how concentration varies with the number of hotels affiliated with the large firms.

concentration. I now test this prediction.

Holding demand conditions constant, a hotel's revenue should fall with the number of both affiliated and competing hotels.[23] However, if firms are catering to those consumers with strong preferences for them, then the cannibalization effect of facing an affiliated hotel should dominate the softer competition from intra-firm competition. This can be detected by comparing the coefficient on the number of hotels belonging to the decision-making firm $j$, $\omega_{j,m,t}$ with the coefficient on the total number of hotels belonging to other firms, i.e. $\sum_{i \neq j} \omega_{i,m,t}$.

Thus, I estimate the following equation using OLS:

$$R_{k,j,m,t} = \beta_1(\omega_{j,m,t} - 1) + \beta_2 \sum_{i \neq j} \omega_{i,m,t} + X'_{j,m,t}\lambda + \epsilon_{k,j,m,t}, \quad (5)$$

where $R_{k,j,m,t}$ indicates the (logged) revenues of specific hotel $k$ affiliated with firm $j$ in market $m$ at time $t$. $X$ represents a vector of controls for market and firm heterogeneity. Specifically, I control for variation in local market demographics using each market's population (in thousands) using U.S. Census data and the average household income (in thousands) taken from the Statistics of Income (SOI) collected by the Internal Revenue Service.[24] To

[23] This is true unless there is some scale- or network-related factor that fosters demand. Toivanen and Waterson (2005) find evidence consistent with such a phenomena in fast food markets.

[24] See: http://www.irs.gov/taxstats/article/0,,id=120303,00.html. These data are only available at the county level, so I use the value for the most common county for each city. As the SOI data are only available through 2005, I linearly extrapolate the data for the remaining years.

further control for differences in the local competitive environment, I include the number of "independent" hotels as a control.[25] To control for variation in the macroeconomic environment, I include year fixed effects in all regressions. The model also suggests that firms with higher brand-values or more distinct sub-brands should be better able to expand their portfolios. I control for this possibility through the inclusion of firm and sub-brand fixed effects in some regressions.[26]

Estimating the specification in Equation (5) will lead to consistent estimates provided the markets are fundamentally equivalent after controlling for the observables listed above. If, however, these factors do not fully capture the profit potential in a given market, the coefficients on the market structure variables could be biased. In particular, if some markets are inherently more profitable – due to the presence of a tourist attraction perhaps – then it is likely that there will be more competitors in the market and also that revenues will be higher. Exploratory analysis showed that such market heterogeneity was present and important. Therefore, I employ market fixed effects in all analyses presented here.[27]

I extend the empirical approach described above to test the theoretical model's predictions about sub-brand proliferation. As noted above, the cannibalization effect should be reduced if two hotels affiliated with the same firm belong to separate sub-brands. The results above suggest that the reduction is not sufficient to enable spatial preemption, however. I test this by disaggregating the portfolio associated with a firm into the number of hotels affiliated with the hotel's own sub-brand and the number affiliated with all other sub-brands of the firm. If the sub-brand effect is important, then the magnitude of the coefficient on the number of hotels affiliated with the hotel's own sub-brand should be largest, followed by the coefficient on other hotels affiliated with the same firm, followed by that associated with

[25]This variable is a control rather than key independent variable because past research (e.g. Kalnins and Chung (2004), Freedman and Kosova (2010)) has shown that hotel segments are sufficiently differentiated as to not compete. Indeed, there may actually be inter-segment agglomeration economies.

[26]Examination of *Brandweek* suggests that abstracting from intertemporal variation in firm preferences is reasonable as the relative ranking of different hotel firms appears comparatively time-invariant over the sample period. Moreover, recent research by Clark et al. (2009) suggests that advertising has little effect in the short term on consumers' quality impressions.

[27]Unlike random effects, fixed effects may be correlated with the other variables, and thus can control for time invariant unobserved differences in market profitability or costs. A joint test that all of the market effects are equal to 0 is rejected at the 1 percent level in all models except models 2 and 3 for entry.

Table 3: Summary Statistics for Revenue Regressions

| **Variable** | **Obs** | **Mean** | **Std. Dev.** | **Min** | **Max** |
|---|---|---|---|---|---|
| Log Revenues ('000s) | 2479 | 5.59 | 0.74 | 0.98 | 7.84 |
| Revenues ('000s) | 2479 | 341.59 | 251.98 | 2.66 | 2528.25 |
| Hotels in the Portfolio | 2479 | 1.08 | 1.47 | 0.00 | 7.00 |
| - Same Sub-brand | 2479 | 0.11 | 0.35 | 0.00 | 2.00 |
| - Different Sub-brands | 2479 | 0.97 | 1.33 | 0.00 | 7.00 |
| Other Branded Hotels | 2479 | 13.82 | 24.71 | -1.00 | 104.00 |
| Independent Hotels | 2479 | 9.72 | 8.10 | 0.00 | 28.00 |
| Population ('000s) | 2479 | 67.99 | 70.53 | 1.22 | 223.18 |
| Income ('000s) | 2479 | 44.62 | 9.21 | 22.26 | 93.61 |

the number of competing hotels.[28]

Table 3 shows the summary statistics for the variables used in the revenue regressions, while Table 4 shows the results of OLS regressions of the natural log of hotel revenues (in thousands) on different combinations of market structure variables using a variety of firm and sub-brand fixed effects. In all regressions, I employ standard errors clustered at the market level. Clustering at this high level allows me to account for the possibility that the decision-makers' choices in markets may be correlated across firms and periods. This reduces the number of degrees of freedom, making it more difficult to find statistically significant results, and hence is a conservative approach.

Column 1 is the baseline model, and omits controls for time invariant heterogeneity across firms. Column 2 adds such controls. In Column 3, I continue to control for firm fixed effects, and test the sub-brand prediction, which says that the effect of affiliated hotels with different sub-brands should have smaller negative effects than hotels of the same sub-brand. Column 4 remains focused on the sub-brand proliferation story, and includes sub-brand (as opposed to firm) fixed effects.

Overall, the data strongly support the theoretical model's prediction that strong firm preferences – such as exist for branded hotels – create large cannibalization effects. The baseline results shown in Column 1 indicate that the addition of a hotel affiliated with the

[28]I cannot test the effect of sub-brand differentiation in the dynamic analysis, because there are not enough data to incorporate the choice of sub-brand after deciding to open a new hotel.

Table 4: Hotel Revenues

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Same Brand | -0.245*** | -0.070*** | | |
| | 0.029 | 0.019 | | |
| Shared Sub-brand | | | -0.127* | -0.106 |
| | | | 0.066 | 0.07 |
| Different Sub-brand | | | -0.064*** | -0.072*** |
| | | | 0.022 | 0.021 |
| Other Branded Hotels | 0.002 | -0.004** | -0.004** | -0.005*** |
| | 0.002 | 0.002 | 0.002 | 0.002 |
| Independent Hotels | -0.018 | -0.01 | -0.008 | -0.011 |
| | 0.012 | 0.014 | 0.014 | 0.012 |
| Population ('000s) | -0.005 | -0.006 | -0.006 | -0.008 |
| | 0.005 | 0.007 | 0.007 | 0.007 |
| Income ('000s) | 0.018*** | 0.016** | 0.016** | 0.015* |
| | 0.006 | 0.007 | 0.007 | 0.008 |
| Ratio of Properties to Owners | | | | |
| Constant | 6.007*** | 5.679*** | 5.640*** | 6.194*** |
| | 0.585 | 0.775 | 0.776 | 0.892 |
| Year Fixed Effects | Yes | Yes | Yes | Yes |
| Market Fixed Effects | Yes | Yes | Yes | Yes |
| Brand-network Fixed Effects | No | Yes | Yes | No |
| Chain Fixed Effects | No | No | No | Yes |
| Observations | 2479 | 2479 | 2479 | 2479 |
| R-squared | 0.49 | 0.58 | 0.58 | 0.66 |
| Number of Markets | 90 | 90 | 90 | 90 |

* p<0.10, ** p<0.05, *** p<0.01

Notes: Standard errors clustered at the market level are below coefficients.

same firm reduces a hotel's revenues by 24.5 percent. By contrast, the presence of hotels affiliated with competing firms has almost no impact. When controls for time-invariant firm characteristics are included, the magnitude of shared-firm effect is reduced by two thirds but remains 17.5 times larger than the impact (now also negative and significant) of a hotel affiliated with a competitor.[29]

Columns 3 and 4 support the theoretical model's prediction that using multiple sub-brands can attenuate the cannibalization effect. As predicted, the estimated coefficients in Column 3 show that hotel revenues are most negatively affected by the presence of hotels sharing both firm and sub-brand effects with it. A hotel that shares just a firm effect has half as large an impact on revenues, while being affiliated with another competitor has only one thirtieth the impact.[30] When the firm fixed effects are replaced with sub-brand fixed effects – which more fully account for unobserved variation – in Column 4, the resulting estimates remain similar. However, the coefficient on the number of identically sub-branded hotels is no longer statistically significant at conventional levels. I do not find this problematic given the large number of sub-brand effects that must be estimated and the small number of observations where a market contains two hotels from the same sub-brand.

The effects of the controls in the revenue regressions are broadly in line with intuition. Higher income areas are statistically significantly associated with higher revenues, while population has a negative but insignificant relationship. Interestingly, the impact of independent hotels is negative and of a magnitude similar to competing branded hotels, though insignificant at conventional levels.

Taken together, the revenues results strongly support the theoretical model's prediction that in industries – like the branded segment of lodging – where consumer heterogeneity is an important component of demand, cannibalization makes spatial preemption hard to sustain. Instead, firms differentiate and concentrate on those consumers most disposed towards them.

[29] Other papers in the literature on competition in the lodging industry (e.g. Suzuki (2009)) have generated similar findings.

[30] The difference between the coefficient on the number of hotels in the same sub-brand and the coefficient for the number of all others affiliated with the hotel's firm is not statistically significant. This lack of significance is not surprising given that I only observe a few instances where more than one of a given sub-brand are present in a market in a given period.

Nevertheless, while strongly consistent with the theoretical model's predictions, these results do not address the central prediction of the model that spatial preemption should not be observed when firm preferences are important. I address this issue below.

# 6 Changes to Market Structure

## 6.1 Econometric Approach

As Eaton and Lipsey (1979) showed, when spatial preemption is credible, the break-even point in time for introducing a new hotel for an incumbent occurs *prior* to when it occurs for a potential entrant. Thus, if incumbents are engaging in entry-deterrence, it can be empirically detected by observing a higher likelihood of expansion by incumbents than entry *ceteris paribus*. I operationalize this approach by estimating and comparing the conditional choice probabilities of entry and expansion.

My baseline approach is to estimate the likelihood of entry and expansion separately using binary and ordered logits, respectively, and then compare the predicted conditional choice probabilities. As a robustness check, I estimate the likelihood of entry and expansion simultaneously conditional on at least one firm having decided to add to its portfolio of properties.[31] A secondary prediction of the model is that holding market conditions constant, a larger incumbent should be less likely to expand than a smaller one. This is because the larger incumbent has even more trouble attracting consumers to a new hotel that would not otherwise have gone to another of its affiliated hotels.

Because of data limitations, I am unable to separate the impact of firms' ability to associate their hotels with multiple sub-brands. Thus, finding that market growth on the

[31] Ideally, I would estimate a dynamic structural model of entry and exit by the different firms (see Ackerberg et al. (2005) for a recent survey of these methods). This would maximize efficiency by estimating entry and expansion decisions simultaneously. Unfortunately, several factors make a structural approach infeasible. First, and most problematic, unobserved heterogeneity across markets is very important. This means that the state space would be too large to make structural estimation feasible. Second, firms' behavior appears to be non-stationary. In other words, adjustment behavior seems to change non-monotonically over time. This would also inflate the size of the state space to be considered. Third, I observe only a modest amount of variation in market structures over time, which would increase the importance of parametric assumptions.

extensive (i.e. via entry) is more likely than on the intensive margin (i.e. via expansion) would be particularly strong evidence of the impact of heterogeneous brand preferences on firm strategy.

In all regressions, the dependent variable is the change in the firm's market portfolio size between time $t$ and time $t+1$, i.e. $\Delta\omega_{j,m,t+1}$, while the regressors are evaluated at time $t$.[32] As before, the key variables in a regression of firm $j$'s behavior are the number of hotels affiliated with it, $\omega_{j,m,t}$, and the total number of hotels belonging to other firms, i.e. $\sum_{i \neq j} \omega_{i,m,t}$.[33]

My baseline empirical models thus have the following form:

$$\Delta\omega_{j,m,t+1}* \quad = \quad \beta_1 \omega_{j,m,t} + \beta_2 \sum_{i \neq j} \omega_{i,m,t} + X'_{j,m,t}\lambda + \epsilon_{j,m,t} \tag{6}$$

where $\Delta\omega*$ is a latent utility variable indicating the desired modification to the current portfolio of firm $j$ in market $m$ at time $t$. As $\Delta\omega*$ increases, the firm will choose higher ordered outcomes as it crosses unobservable (but estimable) cutpoints (see Cameron and Trivedi (2005) for details). $X_{j,m,t}$ represents the same vector of competition, demographic and time controls as used in the revenue models, while $\epsilon_{j,m,t}$ is an independent draw from an extreme value distribution. As before, I include market fixed effects in all regressions and cluster the standard errors at the market level.[34]

In addition to the controls described above, I sometimes include other competition-related

[32] This approach assumes that a firm's decision to alter its portfolio in one market does not affect the likelihood of changes to any other market (e.g. Jia (2008)), which is reasonable here given the substantial distance between markets. To check the reasonable-ness of the assumption, I performed sub-sample analyses using especially remote markets, which yielded similar results. These results are available upon request.

[33] I experimented with more detailed market structure descriptions, but did not find that doing so altered the results. For example, I experimented with separating the total number of independents into the number of high and low quality independents. The results were essentially unchanged. I also experimented with other representations of the portfolios of competing firms, including the number of hotels affiliated with the dominant competitor. Again, the results were qualitatively the same. Details are available upon request.

[34] Insofar as I have 8 years of data for each market and more than one observation for most market-periods, I believe that the probability of sizable incidental parameter bias due to the inclusion of the market fixed effects is small. This assumption is supported by recent work by Collard-Wexler (2009), who finds evidence of only small bias in a pure panel with 12 observations per group. As described below, I test the robustness of this assumption in a variety of ways.

variables. First, to capture the fact that the theoretical model focused on an incumbent monopolist, while the empirical setting is often richer, I add a control for the incumbent's market share (as indicated by its proportion of all branded hotels in the city). Second, Ellison and Ellison (2007) show that it is reasonable to expect a non-monotonic relationship between preemptive behavior and the threat of entry by incumbents.[35] To a large extent, I believe the market-specific fixed effects should capture the level of the threat of entry. Nevertheless, as another robustness check, I include a time varying control for the threat of entry in some regressions. Specifically, I use a quadratic function of the difference in size between the largest and smallest portfolios in the market in some regressions. The theoretical model suggests that entry should be most likely when there is a large gap between the incumbents' portfolio size and the potential entrant, so I use this gap as a proxy for the threat of entry. Third, I sometimes include firm indicator variables to control for time invariant characteristics, which were shown to be important in the context of the revenue analyses.

## 6.2 Empirical Analysis

Summary statistics of the variables used in the analysis of changes in firms' portfolios appear in Table 5. Table 6 shows the results of ordered and binary logit regressions of how incumbents (i.e. those with at least one affiliated hotel in a market) and potential entrants change their portfolios as a function of their own current stock of hotels, the number of hotels affiliated with the other five firms, the number of independents, and local demographic conditions. Table 7 indicates the average effect of a marginal change in the different independent variables on the probabilities that firms add an additional hotel to their portfolios.[36] Bold coefficients indicate that the related logit estimates are significant at least at the 5% level; italicized coefficients indicate logit estimates significant at the 10% level.

[35] This is because if the threat of entry is very low, it is unlikely that the incumbent will wish to incur the cost of deterrence. Similarly, when the probability of entry is very high, then it is unlikely that deterrence will work, making it unappealing. Only when the threat of entry is modest should deterrence be an attractive strategy.

[36] I follow Cameron and Trivedi (2005) in presenting average effects of a small change rather than marginal effects calculated at the mean of the explanatory variables.

Table 5: Summary Statistics

| **Variable** | **Obs** | **Mean** | **Std. Dev.** | **Min** | **Max** |
|---|---|---|---|---|---|
| Hotels in the Portfolio | 9,882 | 0.25 | 0.68 | 0.00 | 8.00 |
| - Choice | 1,647 | 0.36 | 0.83 | 0.00 | 6.00 |
| - Continent | 1,647 | 0.26 | 0.51 | 0.00 | 3.00 |
| - Hilton | 1,647 | 0.13 | 0.44 | 0.00 | 4.00 |
| - La Quinta | 1,647 | 0.13 | 0.38 | 0.00 | 3.00 |
| - Marriott | 1,647 | 0.10 | 0.48 | 0.00 | 4.00 |
| - Wyndham | 1,647 | 0.53 | 1.05 | 0.00 | 8.00 |
| Other Firms' Hotels | 9,882 | 1.25 | 2.66 | 0.00 | 23.00 |
| Independent Hotels | 9,882 | 2.92 | 3.88 | 0.00 | 28.00 |
| Population ('000s) | 9,882 | 14.28 | 29.85 | 0.96 | 223.18 |
| Income ('000s) | 9,882 | 41.39 | 9.41 | 18.57 | 93.61 |
| Share of Branded Portfolios | 1,675 | 0.05 | 0.13 | 0.00 | 0.71 |
| Changes to Portfolios | 8,784 | 0.01 | 0.18 | -2.00 | 3.00 |
| Total Number of Branded hotels | 9,882 | 1.51 | 3.15 | 0.00 | 25.00 |
| Entry Threat | 9,882 | 0.69 | 1.10 | 0.00 | 8.00 |

Column 1 shows the results of my baseline estimation of incumbents' decision-making. In Column 2, I add the additional controls described above, which help account for firms' relative dominance, the threat of entry, and time-invariant firm characteristics. Columns 3 and 4 show the analogous analyses of potential entrants' behavior.

Across the different columns, the predictions of the theoretical model are strongly upheld. Columns 1 and 2 show that one additional unit in an incumbent firm's own portfolio is associated with a 6 - 7.5 percent decrease in the likelihood of expanding. By contrast, an additional branded competitor translates to a reduced likelihood of expansion of just 2.5 - 3.3 percent. The differences between these coefficients are statistically significant at the 1 percent level and inconsistent with large incumbents preempting smaller ones. These results support the theoretical model's prediction that when consumer-specific firm preferences plays a large role in consumers' decision-making incumbents with large market shares will have difficulty maintaining their dominance over time. Moreover, this result is robust to controlling for the incumbent's share of the market, the threat of entry, and unchanging firm characteristics. Indeed, the time-varying controls for the threat of entry support the contention that incumbent firms are not spatially preempting as they show that the more

Table 6: Alterations to Brand Networks' Portfolios

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Hotels in the Portfolio | -1.052*** | -1.375*** | | |
| | 0.227 | 0.296 | | |
| Other Branded Hotels | -0.599*** | -0.473*** | -1.828*** | -2.104*** |
| | 0.16 | 0.179 | 0.384 | 0.575 |
| Independent Hotels | 0.124 | 0.042 | 0.024 | -0.247 |
| | 0.115 | 0.136 | 0.235 | 0.262 |
| Population ('000s) | 0.168*** | 0.202*** | 0.772*** | 0.610* |
| | 0.058 | 0.064 | 0.266 | 0.338 |
| Income ('000s) | -0.008 | 0.021 | 0.084 | 0.073 |
| | 0.049 | 0.06 | 0.16 | 0.102 |
| Share of Branded | | -1.101 | | |
| | | 1.211 | | |
| Entry Threat | | -1.102* | | -3.656*** |
| | | 0.638 | | 1.031 |
| (Entry Threat)2 | | 0.105 | | 1.201*** |
| | | 0.143 | | 0.371 |
| cut1 | 9.628* | 9.923 | | |
| | 5.6 | 6.035 | | |
| cut2 | 16.129*** | 16.781*** | | |
| | 5.743 | 6.204 | | |
| Constant | | | -70.726** | 3.69E+07 |
| | | | 28.097 | 6.62E+07 |
| Year Fixed Effects | Yes | Yes | Yes | Yes |
| Market Fixed Effects | Yes | Yes | Yes | Yes |
| Firm Fixed Effects | No | Yes | No | Yes |
| Observations | 1455 | 1455 | 2064 | 2064 |
| Number of Markets | 87 | 87 | 65 | 65 |
| Log Likelihood | -553.916 | -528.329 | -312.827 | -316.372 |

* p<0.10, ** p<0.05, *** p<0.01

Notes: Standard errors clustered at the market level are below coefficients. *cut*1 and *cut*2 represent the two threshold parameters between the different ordered outcomes.

likely entry is, the less likely an incumbent is to expand.

Columns 3 and 4 show, intuitively, that entrants are less likely to enter markets where they face a large number of competitors, holding all else constant. The marginal impacts of an additional hotel affiliated with a competitor on the likelihood of entry are approximately twice as large as those on the likelihood of expansion. However, this difference is not necessarily concerning as the coefficients (including the important market fixed effects) were estimated from different data, small sample issues would naturally lead to differences. As with the incumbent model, adding time varying controls for the threat of entry strengthens the finding that incumbents cannot preempt entry. The quadratic function shows that holding the number of competing hotels constant, entry is more likely if there is a dominant incumbent than if the competing hotels are equitably distributed across incumbent firms.

Table 7: Estimated Mean Marginal Effects of Independent Variables on Likelihood of Adding Hotel

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Hotels in the Portfolio | **-0.059** | **-0.075** | | |
| Other Branded Hotels | **-0.033** | **-0.025** | **-0.071** | **-0.065** |
| Independent Hotels | 0.007 | 0.002 | 0.001 | -0.006 |
| Population ('000s) | **0.010** | **0.012** | **0.029** | *0.017* |
| Income ('000s) | -0.001 | 0.001 | 0.003 | 0.003 |
| Share of Branded | | -0.060 | | |
| Entry Threat | | *-0.060* | | **-0.133** |
| (Entry Threat)2 | | 0.006 | | **0.039** |

**Boldface** indicates coefficient significant at the 5% level; *italics* indicates coefficient significant at the 10% level.

The findings on the control variables are broadly intuitive and consistent across specifications. In line with the cross-segment agglomeration effects found in Kalnins and Chung (2004) and Freedman and Kosova (2010), the number of independent hotels is positively correlated (albeit statistically insignificantly and of small economic magnitude) with the likelihood of expansion. Population has a positive and significant effect, indicating that growing markets are more likely to see expansion by incumbent firms. Household income, however, is economically and statistically insignificant.

### 6.2.1 Comparing Entry to Expansion

To assess whether or not incumbents are preempting I look at the marginal effects of the market structure variables on the likelihood of expansion versus entry holding all factors constant, including unobserved market heterogeneity.[37] I provide an example of this approach for one particular market in Figure 5, which shows the relative likelihood of expansion versus entry as a function of market structure. The X-axis indicates the number of branded hotels in the market. In calculating the predicted likelihood of expansion, I assume these are all affiliated with the incumbent; for the entrant, I assume that they are all competitors. The other variables – including the market identifier – are set at the level for Nacogdoches in 2002. The coefficients used come from Columns (1) and (3) of Table 6.

The Figure shows that the likelihood of expansion is substantially lower than the likelihood of entry for all values of the number of hotels in the market.[38] In 2002, Nacogdoches had 6 independents, a population slightly in excess of 30,000, and an average household income of $40,700. It supported a total of six branded hotels. Thus, it is not surprising that the likelihood of entry is high when the number of branded competitors is small. However, the likelihood of expansion is surprisingly low even when the incumbent has only a small presence in the market, which is consistent with the very large cannibalization effects found above.

Though striking, these results are for only one market. As a more comprehensive approach, I compare the predicted likelihood of expansion by incumbents to the predicted likelihood of entry by potential entrants holding all else constant. For the 392 market-periods where both entry and expansion are possible, the mean likelihood of expansion is 4.54 percent (using estimation (1) of Table 6), while the mean likelihood of entry is 6.84 percent (using estimation (3) of Table 6). Thus, the likelihood of entry is almost 51 percent higher, and the difference between the two moments is statistically significant at the 1

[37] One cannot simply focus on the estimated mean marginal effects due to the fact that the models have different baseline likelihoods since the market fixed effects are not the same.

[38] While Figure 5 is generally indicative of the data, it is worth noting that there are some markets where differences in the values of the market-effects are such that the probability of entry or expansion are both essentially zero, with the likelihood of entry slightly lower.

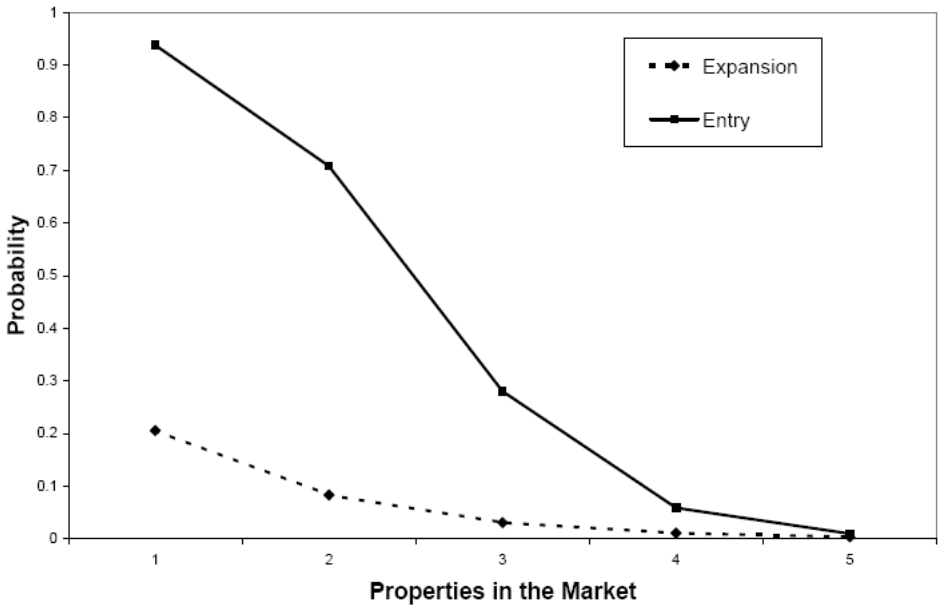


Figure 5: Likelihood of entry versus expansion in Nacogdoches

percent level.[39]

To check the robustness of these results, I estimate binary logits of the decision to add a hotel conditional on the fact that at least one branded hotel was added to the market between periods.[40] This approach has the benefit of constraining the different control variables to symmetrically impact entrants and incumbents, and reduces the likelihood that the need to separately estimate coefficients that should be identical will lead to noisy estimates. However, it has the drawback of dramatically reducing the sample to just those market-periods where either entry or expansion took place.

Table 8 shows the results of these regressions, while Table 9 shows the mean marginal impact of changes in the independent variables on the likelihood of each firm adding a hotel. Column 1 is my baseline model, while Column 2 adds controls for time-invariant firm characteristics.

[39]There are 392 observations, and the standard errors for the propensity to expand and enter are 0.044 and 0.099, respectively.

[40]Specifically, I focus on those markets where at least one new branded hotel was added to the market, and no incumbent chose to reduce its portfolio. This limitation was implemented to make it as reasonable as possible to reduce the left-hand side to a binary choice for both entrants and incumbents. There were 25 market-years where two or three new hotels opened.

Table 8: Models of Conditional Addition Decisions

| | (1) | (2) |
|---|---|---|
| Entrant Dummy | 0.613* | 1.064** |
| | 0.353 | 0.433 |
| Hotels in the Portfolio | -0.023 | -0.306 |
| | 0.192 | 0.227 |
| Other Branded Hotels | -0.111 | -0.054 |
| | 0.124 | 0.143 |
| Independent Hotels | -0.064 | -0.082 |
| | 0.087 | 0.094 |
| Population ('000s) | -0.032 | -0.048 |
| | 0.037 | 0.042 |
| Income ('000s) | 0.015 | 0.015 |
| | 0.023 | 0.026 |
| Constant | 3.713 | 6.426* |
| | 3.312 | 3.783 |
| Year Fixed Effects | Yes | Yes |
| Market Fixed Effects | Yes | Yes |
| Firm Fixed Effects | No | Yes |
| Observations | 762 | 762 |
| Number of Markets | 72 | 72 |
| Log Likelihood | -376.632 | -340.001 |

* p<0.10, ** p<0.05, *** p<0.01

Notes: Standard errors clustered at the market level are below coefficients.

Consistent with what I found using the predicted likelihoods, both models indicate that entrants are much more likely to account for new hotels. Depending on the specification, I find that an entrant is 10 - 15 percent more likely to account for a new hotel than an incumbent with one property. When firm fixed effects are employed, I find that large incumbents are less likely to expand than smaller incumbents, and the difference between the coefficients on the number of hotels in a firm's portfolio and its competitors' is statistically significant.

None of the control variables are statistically or economically significant. This is not surprising given that I am already conditioning on the fact that entry and/or expansion will take place.

Table 9: Estimated Mean Marginal Effects of Marginal Change in Independent Variables

| | (1) | (2) |
|---|---|---|
| Entrant Dummy | *0.097* | **0.153** |
| Hotels in the Portfolio | -0.004 | -0.044 |
| Other Branded Hotels | -0.018 | -0.008 |
| Independent Hotels | -0.010 | -0.012 |
| Population ('000s) | -0.005 | -0.007 |
| Income ('000s) | 0.002 | 0.002 |

**Boldface** indicates coefficient significant at the 5% level; *italics* indicates coefficient significant at the 10% level.

* Effect of Entrant Dummy calculated by taking the mean of the differences between predicted likelihoods when the dummy is equal to 1 and when it is set equal to 0.

Overall, the analyses are strongly consistent with the theoretical model's predictions about how strong consumer preferences for branding should influence market structure. The regressions indicate that contrary to what initial intuition might suggest about oligopolistic behavior in growing markets, growth in the branded hotel segment is likely to occur on the extensive margin as new entrants build new hotels. Even the ability of incumbents to engage in sub-brand proliferation does not enable them to spatially preempt. Thus, while advertising and its impact on consumers' opinions may lead to an enduring oligopoly in the branded segment, it appears to help ensure that the segment is comparatively un-concentrated.

While the consistency of the results with the theoretical model is striking, it is worth asking whether there are other explanations for the observed behavior. One alternative story might be that there are important network effects. As noted during the data description, however, there is no particular reason to assume this; moreover, my results are robust to increasing the distance between markets. A second possible explanation might focus on firms' operating costs. However, in order for expansion to be less likely than entry, firms' cost functions would have to be convex in the number of hotels in a market. This seems improbable; if anything, a concave function would be more likely as there might be economies of scale, making my results particularly strong evidence regarding the impact of cannibalization. A third, and related, explanation could hinge on monitoring. However, to be consistent with my findings, firms' monitoring costs also would have to be convex in the number of local hotels. The large literature on the subject, however, predicts that a concave function is more likely.[41] Thus, I believe that no factor other than cannibalization adequately explains the patterns observed in the data.

### 6.2.2 Robustness

I performed a number of robustness checks to ensure that the inferences drawn above are appropriate. I first estimated the ordinary least squares (OLS) analogues to the entry and expansion models, which produced coefficients consistent in sign and relative magnitude to those of the non-linear models' marginal effects. Also consistenet were models where the market structure variables were instrumented for using lagged values. My qualitative results are also robust to a wide variety of modifications such as using firms' total rooms in a market as the market structure measures, sub-sample analysis of just small markets (as indicated by the number of hotels there), including an indicator variable for when the incumbent is a monopolist, using more isolated markets (i.e. where the markets are at least 20 miles apart as previously defined), and narrowing the focus to hotel chains with an average AAA rating of 2.5 or higher. Additional details on all these models are available upon request.

[41] See Lafontaine and Slade (2007) for an introduction to this literature.

# 7 Conclusion

Endogenous sunk cost theory provides an empirically supported rationale for the persistence of concentration in a variety of industries.[42] However, less attention has been given to the specific nature of industrial structure within these oligopolies. Using rich data on the lodging industry, I consider the relationship between consumers' reactions to branding – which enables enduring oligopoly in the branded hotel segment – and industrial structure within individual lodging markets.

Incorporating insights from the growing literature on estimating demand for differentiated products into a version of the typical entry-deterrence game, I show that consumers' strong and heterogeneous preferences for specific firms can inhibit spatial preemption. This occurs because the presence of firm-identifiers in consumers' value functions makes intra-firm competition more intense than inter-firm competition, reducing the benefits to preemptive expansion. The model also suggests that in industries where products themselves have strong identities, or fall into distinct product segments, spatial preemption can more easily be sustained.

I test elements of the theoretical model using data on hotel operations in Texas from 2000 through 2008. Overall, the data are highly consistent with the model's predictions. Static analyses of the high-quality segment of Texas markets show they consistently are evenly divided among the six firms with large presences in the state. Moreover, the data show very sizable revenue cannibalization when two hotels share a firm affiliation. These are attenuated – but only modestly – if the two hotels have different sub-brands (i.e. one Fairfield Inn and one Courtyard, both of which are affiliated with Marriott), and continue to dwarf the impact of the presence of a property affiliated with a rival firm (e.g. a Holiday Inn). Finally, consistent with the theoretical model's predictions, I find that the large cannibalization effects are correlated with an absence of spatial preemption. Growth as a result of entry by new firms is 50 more likely to occur than expansion by an incumbent firm.

Overall, the paper provides insight into the double-edged impact of advertising on indus-

[42] See, e.g., Ellickson (2006, 2007), Dick (2007) and Berry and Waldfogel (2010).

trial structure. For example, it is intuitive that Berry and Waldfogel (2001) observe spatial preemption by oligopolists in radio markets: stations betray no evidence that they share a common corporate parent and they fall into distinct segments. On the other hand, substantial firm effects could explain the lack of preemption that Burton (1994) finds for the early insecticide industry and the fierceness of intra-firm competition in fast-food markets (e.g. Thomadsen (2005)).

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# Appendix A

Table A-1: Number of market-year observations of different brands' hotels

| | Quality Tier | | |
|---|---|---|---|
| | <2 Stars | ≥ 2 Stars | Total |
| Accor | 232 | 26 | 258 |
| AmericInn International | 0 | 6 | 6 |
| America's Best Franchising | 0 | 15 | 15 |
| Budget Host | 30 | 0 | 30 |
| Candlewood Hotel Company | 0 | 1 | 1 |
| Carlson Hotels Worldwide | 0 | 26 | 26 |
| Choice Hotels | 0 | 595 | 595 |
| Continent | 0 | 424 | 424 |
| Drury Hotels | 0 | 2 | 2 |
| Extended Stay Hotels | 0 | 23 | 23 |
| Hilton Hotels Corporation | 0 | 213 | 213 |
| Hyatt | 7 | 23 | 30 |
| La Quinta | 0 | 209 | 209 |
| Marriott International | 0 | 161 | 161 |
| Starwood Hotels and Resorts | 0 | 13 | 13 |
| Vantage | 0 | 86 | 86 |
| Wyndham | 1 | 877 | 878 |
| Independents | 3,442 | 874 | 4,316 |
| Total | 3,712 | 3,574 | 7,286 |

Table A-2: Sub-Brands Affiliated with each Brand

| Brand | Sub-Brand | Observations | Average Rating |
|---|---|---|---|
| Choice Hotels | Clarion Inns & Suites | 13 | 2.33 |
| | Comfort Inn | 181 | 2.68 |
| | Comfort Suites | 109 | 3.00 |
| | Econo Lodge | 151 | 2.05 |
| | Quality Inns & Suites | 98 | 2.42 |
| | Rodeway Inn | 21 | 2.00 |
| | Sleep Inn | 22 | 2.00 |
| Continent Hotels | Candlewood Suites | 7 | 3.00 |
| | Crowne Plaza | 1 | 3.00 |
| | Holiday Inn | 107 | 2.97 |
| | Holiday Inn Express | 307 | 2.98 |
| | Staybridge Suites | 2 | 3.00 |
| Hilton Hotels | Embassy Suites Hotels | 10 | 3.00 |
| | Hampton Inn | 172 | 3.00 |
| | Hilton | 9 | 2.85 |
| | Hilton Garden Inn | 2 | 3.00 |
| | Homewood Suites by Hilton | 20 | 3.00 |
| La Quinta | La Quinta Inns | 209 | 2.93 |
| Marriott International | Courtyard | 34 | 2.88 |
| | Fairfield Inn | 81 | 2.81 |
| | Residence Inn | 31 | 3.00 |
| | Ritz-Carlton | 3 | 3.00 |
| | Springhill Suites | 3 | 3.00 |
| | Towneplace Suites | 9 | 3.00 |
| Wyndham | Baymont Inn & Suites | 11 | 3.00 |
| | Days Inn Worldwide | 370 | 2.19 |
| | Hawthorn Suites | 3 | 3.00 |
| | Johnson International | 62 | 2.24 |
| | Ramada | 151 | 2.24 |
| | Super 8 Motels | 230 | 2.06 |
| | Travelodge Hotels | 42 | 2.42 |
| | Wingate | 8 | 3.00 |

# Appendix B

In this section, I provide the results of numerical solutions to the theoretical model. In these simulations, I assume that the $\mu$ are all drawn from normal distributions with mean 0 and variance $\sigma$. I show the relationship between heterogeneous brand preferences and cannibalization by varying the parameters affecting the variance of consumers' heterogeneous brand preferences ($\sigma$) and the baseline benefit to staying in one of the hotels in the market ($\delta$). Code for the simulations is written in Matlab 7.8 by the author and is available upon request.

Table B-1 shows the prices, revenues, and market shares for one hotel under different market structures for different parameter values. The first column of the Table indicates the behavior and payoffs for one hotel in a 2-hotel market where both hotels are affiliated with a single brand. Column two indicates the results for one hotel in a duopolistic market. Column 3 shows the results for one hotel affiliated with a 2-hotel incumbent in 3-hotel markets. Column 4 indicates the results for the entrant in such markets.

As described in the text above, the results show that as the magnitude of $\sigma$ grows relative to $\delta$, the returns to adding an additional hotel fall for brands. For example, when $\delta$ is fixed at 3, the tables show that as $\sigma$ increases from 0 to 4, the difference between $R^I(2,1)$ and $R^I(1,1)$ falls from 0.28 to 0.19.

Analogous results for markets with the local-owners as decision-makers are available upon request.

Table B-1: Numerical Results of Theoretical Model for One Hotel Under Different Market Structures

| | | 2 Hotels | | 3 Hotels | |
|---|---|---|---|---|---|
| | | Monopoly | Competition | Incumbent | Entrant |
| $\sigma = 0$ & $\delta = 3$ | Price | 3.00 | 1.77 | 2.04 | 1.63 |
| | Revenue | 1.00 | 0.77 | 0.52 | 0.63 |
| | Mkt Share | 0.33 | 0.44 | 0.26 | 0.39 |
| $\sigma = 1$ & $\delta = 3$ | Price | 3.26 | 2.16 | 2.44 | 2.05 |
| | Revenue | 0.94 | 0.86 | 0.56 | 0.75 |
| | Mkt Share | 0.29 | 0.40 | 0.23 | 0.37 |
| $\sigma = 2$ & $\delta = 3$ | Price | 3.93 | 2.87 | 3.13 | 2.78 |
| | Revenue | 0.93 | 0.98 | 0.61 | 0.90 |
| | Mkt Share | 0.24 | 0.34 | 0.19 | 0.33 |
| $\sigma = 3$ & $\delta = 3$ | Price | 4.81 | 3.68 | 3.92 | 3.60 |
| | Revenue | 0.97 | 1.12 | 0.67 | 1.05 |
| | Mkt Share | 0.20 | 0.30 | 0.17 | 0.29 |
| $\sigma = 4$ & $\delta = 3$ | Price | 5.75 | 4.53 | 4.76 | 4.45 |
| | Revenue | 1.05 | 1.27 | 0.73 | 1.22 |
| | Mkt Share | 0.18 | 0.28 | 0.15 | 0.27 |
| $\sigma = 5$ & $\delta = 3$ | Price | 6.73 | 5.37 | 5.60 | 5.33 |
| | Revenue | 1.14 | 1.42 | 0.80 | 1.38 |
| | Mkt Share | 0.17 | 0.26 | 0.14 | 0.26 |
| $\sigma = 6$ & $\delta = 3$ | Price | 7.75 | 6.32 | 6.54 | 6.23 |
| | Revenue | 1.24 | 1.60 | 0.89 | 1.54 |
| | Mkt Share | 0.16 | 0.25 | 0.14 | 0.25 |
| $\sigma = 1$ & $\delta = 2$ | Price | 2.73 | 1.95 | 2.19 | 1.86 |
| | Revenue | 0.67 | 0.66 | 0.45 | 0.58 |
| | Mkt Share | 0.25 | 0.34 | 0.21 | 0.31 |