

# In-House *and* Arm's Length: Productivity Heterogeneity and Variation in Organizational Form.

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## Abstract

This paper investigates why a firm vertically integrates with some suppliers and outsources production to others. In a simple model of organizational form choice with firm-supplier productivity heterogeneity, we illustrate how explicit performance incentives that reduce contractual incompleteness interact with incentives related to ownership in determining firm boundaries. Evidence from the U.S. hotel industry suggests that both types of incentives help explain observed variation in organizational form. For most hotel brands, the least- and most-productive properties are managed at arm's length by franchisees and intermediate-productivity hotels are vertically integrated. This sorting pattern is not observed for the highest-tier brands.

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# 1 Introduction

A firm's choice of whether to vertically integrate with a supplier or contract at arm's length is one of the most extensively studied decisions in economics. Empirical analysis of the determinants of firm boundaries, however, is complicated by the fact that different theoretical models generate similar predicted associations between the propensity to vertically integrate and observable variables.<sup>1</sup> In this paper, a firm's supplier relationships differ in productivity and all contracts are incomplete. Supplier underinvestment in the relationship can be mitigated in two ways: (1) with explicit performance incentives and (2) with incentives related to residual control rights (from ownership). The two types of incentives generate contrasting predictions for the association between organizational form choice and productivity. Using novel firm-supplier-level data from the hotel industry, we find evidence suggesting that firms consider both types of incentives in deciding whether to outsource management of a given property to a franchisee. Our results help explain which properties of a given brand are outsourced and why firms differ systematically in their use of the two types of incentives.

A hotel brand is a multi-unit organization that is appropriate for exploring the interplay of these mechanisms because, as noted by Lafontaine and Slade (2007), the downstream integration decision and the decision of whether to integrate with an upstream supplier are essentially versions of the same "make or buy" decision at the center of the large theoretical literature that started with Coase (1937). Each hotel property in our data is analogous to a different firm-supplier relationship, where the supplier provides hotel management services for the branded property. A property can be managed by an employee of the firm (chain managed). Alternatively, property management can be outsourced to a third party (a franchisee). Hence, we observe variation in organizational form choice for each firm across different "suppliers" performing the same task.

We report a new empirical finding: Hotel properties with low and high occupancy rates tend to be managed by franchisees (outsourced), while properties with intermediate occupancy rates are managed by company employees (vertically integrated). This finding is consistent with a non-monotonic relationship between productivity and the probability that a property is vertically integrated. This pattern exists for hotel brands within the economy hotel tier (e.g., Econolodge),

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<sup>1</sup>Lafontaine and Slade (2007) comment that models including performance incentives related to claims on output and models that allow for mitigated ex ante underinvestment due to the incentives associated with ownership often generate similar predictions. When the third party's investment is relatively important in contributing to output, both types of models tend to predict more arm's length contracting. Hubbard (2008) describes how empirical researchers have tackled the difficulties inherent in evaluating theoretical predictions related to the relatively abstract model variables in this literature.

mid-scale tier (e.g., Holiday Inn), and upscale tier (e.g., Courtyard). For hotel properties in the economy and mid-scale tiers, the relationship is especially strong for hotels located in states with low corporate income taxes. However, the non-monotonic relationship between the occupancy rate and organizational form choice is not observed within the upper upscale tier (e.g., Marriott), where high-productivity properties are likely to be vertically integrated and lower-productivity properties tend to be outsourced.

These findings are consistent with the equilibrium predictions of a model that includes both explicit managerial incentives and incentives arising from property rights as tools to mitigate underinvestment in the relationship.<sup>2</sup> Hotel franchisees face performance incentives since, unlike property managers of vertically integrated properties, they typically share directly in the proceeds of the relationship.<sup>3</sup> Franchisees also differ from headquarters-employed managers in that they hold residual control rights over the investments in hotel management that are not specified in contracts. In our model, explicit performance incentives reduce the scope of residual claims and serve to mitigate some—but not all—supplier underinvestment.

The ownership incentives mechanism in the model draws from the property rights strand of the literature (Grossman and Hart, 1986; Hart and Moore, 1990) and, in particular, from Antras and Helpman (2004).<sup>4</sup> In their model, underinvestment from each party resulting from fear of future holdup is increasingly damaging to output and to headquarters' payoffs as the productivity of the relationship increases. Since only one party has residual control, organizational form choice always involves a trade-off in the input levels each party supplies. Outsourcing leads to more input from the supplier and less input from headquarters; vertical integration leads to less input from the supplier and more input from headquarters. This mechanism suggests that at higher levels of productivity, it is more important to allocate ownership to the party whose investment is used relatively intensively in production. Thus, Antras and Helpman predict a monotonic relationship between productivity and the probability of vertical integration.

In contrast, a non-monotonic relationship is predicted by a performance incentives mechanism,

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<sup>2</sup>The property-level occupancy rate is treated throughout this paper as a measure of output (guests' night stays) per unit of capital (hotel room). The model generates predictions for the relationships between output and organizational form choice based on the underlying relationships between each of these variables and the productivity of the relationship-specific investments made by each party. These predictions are then evaluated in the data.

<sup>3</sup>See Bradach (1998: 22-23 and 37-39) for a description, based on five in-depth case studies, of why franchisors are typically unable to replicate the incentives given to franchisees for their company-employed managers.

<sup>4</sup>Antras and Helpman (2004) is one of several prominent models in international economics that employs theories from organizational economics to explore how variation in relationship productivity can lead to a sorting of organization form choice for firms sourcing inputs from abroad. These models characterize vertically-integrated headquarters and suppliers as multinational firms since production takes place in more than one country.

drawn from the model developed in Grossman and Helpman (2004), and included in the model presented here. Incentives tied to relationship performance lead a supplier to exert greater effort on all tasks as productivity increases. The payoff to headquarters under outsourcing in this contractual arrangement is a share of the total surplus generated, and can be an increasing convex function of relationship productivity. When the supplier is brought in-house and the employed manager’s incentives are less high-powered, headquarters retains a larger share of the surplus, but this payoff increases more slowly in productivity—that is, headquarters’s payoffs are less convex in relationship productivity under vertical integration. If vertical integration also incurs greater fixed costs, the headquarters may prefer to integrate production at intermediate levels of productivity and to outsource low- and high- productivity relationships.

Combining these mechanisms reveals that the non-monotonic relationship between productivity and the probability of vertical integration predicted in Grossman and Helpman (2004) can persist in the presence of ownership incentives related to residual control. Even when headquarters’ investment is used relatively intensively in production—so that the property rights mechanism would predict vertical integration—headquarters’ ability to include high-powered performance incentives can lead headquarters to choose outsourcing when the return to such incentive provision is greatest—i.e., at high productivity levels. This is in part because, to paraphrase Holmstrom and Milgrom (1994), using performance incentives more intensively increases the marginal benefit of using ownership incentives more intensively. This means that performance and ownership incentives are complementary means of reducing supplier underinvestment in the most productive relationships. Headquarters is particularly likely to outsource supply in the most productive relationships when it is less costly to provide these incentives. This prediction is consistent with the patterns observed in low- and mid-tier hotel brands, both within-brand and across states.<sup>5</sup>

A second insight from the model is that when the relative intensity of headquarters’ investment in production is very high—so that the headquarters’ underinvestment under outsourcing is particularly costly—the property rights mechanism dominates, and the non-monotonic relationship no longer holds. Firms are not more likely to choose outsourcing at very high productivity levels. Because headquarters-investment intensity in the brand-level production function is increasing in brand value, the model predicts that the highest-tier brands are least likely to outsource management of the highest-productivity properties.<sup>6</sup> This prediction is consistent with our findings for the

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<sup>5</sup>Variation in corporate tax rates across states means there is variation in the cost of providing franchisees with performance incentives that are sufficient to induce efficient levels of contractable supplier input.

<sup>6</sup>In a similar setting, Horstmann and Markusen (1987) describe how a firm’s reputation for product quality can be modeled as an input in a plant-level production function due to its influence on consumer demand. Our data also

upper upscale tier.

Our study relates to two recent empirical papers about the "make or buy" decision that also explore general propositions from property rights models of firm boundaries. Lileeva and Van Biesebroeck (2010) examine the relationship between organizational form and the relative technological intensities of the inputs provided by the buyer and different suppliers. Their model allows for interrelatedness of investments that can undermine the property rights prediction that outsourcing is most likely when investment intensities are symmetric. In contrast, in our paper, we use variation in relationship productivity across different suppliers of the same input to production (hotel management services) to evaluate when the ability to include performance incentives overturns the typical property rights predictions for organizational form choice.

Second, Feenstra and Hanson (2005) study the organizational form of export-processing plants in China. They show how allocating control over the purchased production inputs to either a foreign firm or the local supplier can mitigate underinvestment by each party. Their model predicts that control over inputs should be allocated to the supplier when the relationship specificity of human capital is low. They use variation in observed organizational forms across different Chinese provinces to estimate variation in human capital relationship-specificity. In our setting, the relationship specificity of supplier inputs is constant within a hotel brand, as is the relative investment intensity of use in production. We demonstrate that headquarters will include performance incentives in contracts with suppliers to influence supplier investment levels only when the relationship productivity is high.

The existence of persistent productivity heterogeneity is a well-established empirical fact, both within industries (Ravenscraft, 1983; Schmalensee, 1985; Syverson, 2011; Ichniowski and Shaw, 2010) and within multi-unit firms (Shelton, 1967; Darr et al., 1995; Griffith et al., 2006). As evidenced by the hotel industry (Kalnins, 2004 and 2006), and at the product level in papers in the international trade literature (Antras, 2003; Yeaple, 2006; Nunn and Trefler, 2008), there is often substantial variation in the organizational form governing the transaction of narrowly defined products or services.

The implications of productivity heterogeneity have been explored in depth in international economics following Melitz's 2003 study of firm productivity and exporting behavior. The starting point for our paper is that the Antras-Helpman and Grossman-Helpman models of how firms source

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suggest that the relative intensity of headquarters' investment in the production function is increasing with brand value since almost all luxury-tier brands vertically integrate all their properties (and are excluded from our analysis for this reason).

inputs from abroad predict contrasting sorting effects, resulting from the different incentives mechanisms at work in each model. Combining the performance-incentives and ownership-incentives mechanisms in one model generates predictions that are shown to be consistent with both the within-firm and within-industry variation in organizational form choice in this empirical setting.<sup>7</sup> Empirical predictions arising from only one or other of the two theoretical mechanisms studied here would be unable to explain important features of the data.

The paper proceeds as follows: Section 2 combines features of the managerial incentives model in Grossman and Helpman (2004) and the property rights model in Antras and Helpman (2004). Section 3 describes the data used in the study. Section 4 shows that variation in organizational form in the data is consistent with the equilibrium predictions of the model set out in Section 2, and also presents some robustness tests. Section 5 concludes.

## 2 A Simple Model of Organizational Form with Relationship Heterogeneity

This section illustrates a simple partial equilibrium model of organizational form choice for a single firm-supplier pair under contractual incompleteness, describing the structure of the game played between the headquarters (HQ) and the third-party manager or entrepreneur.<sup>8</sup>

We extend the structure of the model in Antras and Helpman (2004) by allowing headquarters to choose whether or not to offer explicit performance incentives, as in Grossman and Helpman (2004). To do this, we assume that HQ and the supplier can contract on an observable outcome that is correlated with some part of the supplier's relationship-specific investment. Explicit performance incentives (such as a bonus payment or revenue sharing in the event of project success) based on

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<sup>7</sup>The link between the theory and the empirical work in this paper does not rely on differences in the production function across firms since the nature of production does not vary for properties of a given brand. Similarly, the contracting environment is constant within-brand, since all properties are in the United States and there is limited within-brand variation in the franchising contracts offered to franchisees (Lafontaine, 1992). Prior studies exploiting variation in the tasks required by suppliers and, hence, the contracting environment, to examine propositions related to different models of firm boundaries include Shepard (1993), Baker and Hubbard (2003), Azoulay (2004), and Forbes and Lederman (2009). A large number of studies rely on variation across firms in the relationship specificity of inputs to the production function. These papers are surveyed in Klein (2005) and include Joskow (1987). Feenstra and Hanson (2005) is a recent contribution to this strand of the literature. A third empirical strategy relies on cross-industry variation in the parameters of the production function, such as asset intensity, to evaluate different model predictions. Acemoglu et al. (2009) and Lileeva and Van Biesebroeck (2010) are recent examples of this strategy.

<sup>8</sup>Since the model is general enough to apply to any industry, we use the general terms "headquarters" and "supplier" in this section. In the empirical work, the hotel brand takes on the role of the headquarters, and the manager or entrepreneur of each property within the brand is a supplier.

this observed outcome reduce the extent of contractual incompleteness. Since ownership determines residual claims net of any contracted payments, explicit performance incentives narrow the scope of the bargaining game played between headquarters and the supplier. The headquarters chooses the organizational form that generates the highest payoff to headquarters at each productivity level.

## The environment

Before production begins in each market, HQ incurs a fixed market entry cost  $f_E$ , matches with a potential supplier, and then makes a productivity draw,  $\theta$ , from a known distribution  $F(\theta)$ . The two parties must produce two relationship-specific inputs to generate output: HQ's input is  $x_H$ , and the local supplier's input is  $x_S$ .<sup>9</sup> Both parties are risk neutral. In addition, the supplier's input  $x_S$  can be of low or high quality. When both  $x_H$  and  $x_S$  are positive, and  $x_S$  is high quality, the value of realized production is:  $Y = F(x_H, x_S, \theta) = \theta(hx_H + x_S)$ . If  $x_S$  is low quality, final output is  $Y = \theta(hx_H)$ . That is, low-quality-supplier input does not contribute to the value of the relationship.

The supplier can exert effort on a set of relationship-specific tasks that increases the probability that his input is high quality. Effort levels are chosen ex ante and reflect the anticipated payoffs under successful production.<sup>10</sup> Effort on any given task is a binary choice,  $e \in (0, E)$ . We assume that if no effort is exerted on any task, then the probability of high-quality  $x_S$  is equal to  $p(0) = p_0 > 0$ . If effort is exerted on all tasks, the probability of high-quality  $x_S$  is equal to  $p(1) = p_E$ . Similar to Grossman-Helpman, if effort is exerted on a fraction of tasks,  $\delta$ , the probability of high-quality  $x_S$  is equal to a linear combination of  $p_0$  and  $p_E$  given by  $\bar{p} = (1 - \delta)p_0 + \delta p_E$ . The supplier's expected investment is given by  $x_S p(\cdot)$ .

The expected final output, prior to production taking place, can be summarized as follows:

$$EY = F(x_H, x_S, \theta, p(\cdot)) = \theta(hx_H + x_S p(\cdot)) I \quad (1)$$

where  $h$  measures the importance of HQ's investment relative to the supplier's investment, which is normalized to 1 so that a production function is relatively intensive in HQ's input whenever  $h > 1$ .

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<sup>9</sup>In our empirical setting,  $x_H$  could represent investment by the hotel brand (firm) in the relationship-specific human capital of the operator of the property (supplier)—for example, teaching the operator about the company's policies and procedures.  $x_S$  could represent complementary investments by the operator in his/her own relationship-specific human capital—for example, learning how to use the company's IT systems.

<sup>10</sup>We note that supplier-level input and effort are both ex ante decisions and together make up the property investment. The distinction between the two is expositional, and is motivated by the fact that the latter is assumed to be correlated with an observable and contractible outcome. In practice, it is consistent with the idea that HQ can write a contract based on some aspects of measured property-level performance.

$I$  is an indicator variable that takes on the value of 1 if  $x_H > 0$ , and  $x_S > 0$ .<sup>11</sup>

Each of the investments generates quadratic disutility costs— $\Gamma_H(x_H) = \frac{1}{2}(x_H)^2$ , and  $\Gamma_S(x_S) = \frac{1}{2}(x_S)^2$ —and the supplier also incurs costs associated with exerting positive effort. If the supplier exerts effort on all tasks, then the supplier incurs a cost  $E > 0$ . If the supplier exerts effort on a fraction  $\delta$  of the tasks that make up the supplier’s input, he incurs a cost of  $\delta E$ .<sup>12</sup> As is standard in the literature, we assume that  $x_H$ ,  $x_S$ , and effort are not verifiable by a third party, but we assume that the quality of  $x_S$  is observable ex post. This important assumption means that HQ can write a performance contract related to quality. That is, HQ’s ability to include explicit performance incentives as an additional instrument to mitigate supplier underinvestment depends critically on quality (but not input effort levels) being observable and, hence, contractible. If HQ chooses to write a performance contract, the local supplier will be able to claim a bonus payment specified in the contract if the input is high-quality.

Before investment, effort, and production occur, HQ chooses an organizational form. The organizational form can be either vertical integration (VI) of the supplier into HQ or outsourcing (O), in which the two remain independent. HQ offers the local supplier an organizational form contract, which can include a transfer payment and a bonus payment. The supplier decides whether or not to accept the offer.

The choice of organizational form has three important consequences. First, as in Antras-Helpman, the chosen organizational form affects the outside value and, hence, each party’s investment incentives. Under outsourcing, failure to reach agreement on the division of surplus leaves both parties with zero income from the bargaining game since  $x_H$  and  $x_S$  are specific to the relationship. Under vertical integration, however, HQ has more power. In this case, if negotiations break down, HQ can fire the supplier, recover  $x_S$ , and realize a fraction  $\mu$  of the final output. The supplier receives no income from the bargaining game in this case. Using  $OV_i^k$  to denote party  $i$ ’s expected outside value under organizational form  $k$  (where  $k = O$  corresponds to outsourcing and  $k = I$  corresponds to vertical integration), we have:  $OV_H^O = 0$ ,  $OV_H^I = \mu\theta(hx_H + x_S p(\cdot))$ , and  $OV_S^O = OV_S^I = 0$

Second, as in Grossman-Helpman, the organizational form determines whether HQ can exert

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<sup>11</sup>This indicator variable captures the fact that these two relationship-specific variables are worthless outside the relationship, and the fact that they are complementary only in the sense that a positive amount of each one must be provided in order to realize any output. Once this condition is met, there are no further production complementarities. This assumption mirrors the model in Acemoglu et al. (2010), and differs from Lileeva and Van Biesebroeck (2010).

<sup>12</sup>We note here that the fact that this cost is assumed to be proportional to effort, as in Grossman and Helpman (2004), is not required. For example, a quadratic effort cost would increase the range of productivities over which vertical integration is preferred but would still predict that outsourcing is preferred at low- and high-productivity levels.

managerial control by directly monitoring the supplier's effort level. Under outsourcing, HQ cannot monitor, or contract directly on, the effort exerted on any of the required tasks that affect the quality of  $x_S$ . Under vertical integration, we assume HQ can directly observe and, hence, contract on the effort the manager exerts on a fraction  $\delta$  of all tasks. This means that the optimal level of effort can be induced on a fraction  $\delta$  of tasks without having to share any rents with the manager. As in Grossman-Helpman, HQ would have to share rents with the supplier under vertical integration (that is, make a bonus payment) to create incentives for effort on the fraction  $(1 - \delta)$  of tasks.<sup>13</sup> When effort is exerted on only a fraction  $\delta$  of tasks, the probability that the input is high-quality is  $\bar{p} = (\delta p_E + (1 - \delta) p_0)$ .

Third, and again as in Antras-Helpman, organizational costs depend on organizational form. Outsourcing in any market entails a fixed cost for HQ of  $f^O$ . The fixed cost to HQ of vertical integration is supplier-specific, stochastic, and denoted by  $f^I$ . We assume that in each market,  $f^I$  is drawn from a known distribution  $H(f^I)$ , and  $E(f^I) > f^O$ . That is, on average, vertical integration entails higher management and negotiation costs.

## Utility and bargaining-game payoffs

HQ's (H) expected utility,  $E(U_H^k)$ , and the expected utility of the local supplier (S),  $E(U_S^k)$ , under organizational form  $k$  are, respectively:

$$E(U_H^k) = y_H^k - \frac{1}{2}(x_H^k)^2 - f_E - f^k + T^k - b^k p(\cdot)^k \quad (2)$$

$$E(U_S^k) = y_S^k - \frac{1}{2}(x_S^k)^2 - T^k + b^k p(\cdot)^k - e^k \quad (3)$$

where  $y_H^k$  is HQ's payoff from the Nash bargaining game (a function of HQ's outside value and the quasi rents from production ( $r^k$ ) defined below).  $T^k$  denotes the ex ante transfer payments to HQ from the third party stipulated in the contract (decided before the supplier chooses  $x_S$  and  $e_k$ ), and  $b^k$  is the bonus payment required only in the event that  $x_S$  is high-quality.  $y_S^k$  is the supplier's payoff from the Nash bargaining game and  $e^k$  is the cost of effort.

We model the bargaining process as a symmetrical Nash bargaining game, from which each party obtains its expected outside value plus one-half of the expected quasi rents. Any performance-related

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<sup>13</sup>We note that vertical integration does not fully solve the contractual incompleteness around manager effort since  $(1 - \delta)$  of the effort level cannot be directly contracted upon. That is, performing the task in-house does not fully align HQ and supplier incentives, and thereby remove the transactions costs associated with arm's-length contracting in the "rent-seeking" models of vertical integration (Gibbons, 2005).

bonus payment received by the supplier ex post comes out of the share of the quasi rents going to HQ in this bargaining game and, hence, can be viewed as reducing the scope of residual claims. Following Antras-Helpman, we assume that the supply of local suppliers is infinitely elastic, and that each potential supplier has an outside option equal to zero in both organizational forms. We also assume that potential entrepreneurs are credit constrained, placing a limit,  $l$ , on the size of the transfer,  $T^k$ , that HQ can extract from an entrepreneur.<sup>14</sup>

Once the investments are sunk, the expected quasi rents are equal to expected output less the two parties' expected outside options:

$$E(r^k) = EY - OV_H^k - OV_S^k = \theta(hx_H + x_{SP}(\cdot)) - OV_H^k$$

where the last equation holds if  $I = 1$ —that is, if both  $x_H$  and  $x_S$  are positive. Note that the two parties bargain over the quasi rents ex post under both organizational forms; thus, party  $i$ 's expected payoff from the Nash bargaining game can be written as:

$$E(y_i^k) = \frac{1}{2}E(r^k) + OV_i^k \quad (4)$$

We focus on how HQ's choice of organizational form varies with relationship productivity,  $\theta$ .

## Equilibrium

There are two possible outsourcing contracts: outsourcing with or without explicit performance incentives. Under outsourcing, explicit performance incentives fully solve the agency problem, so that the supplier exerts the maximum effort, but HQ must share rents with the supplier in the form of a bonus payment. The levels of relationship-specific investments chosen and the payoffs generated for each party under each of these choices are derived in Appendix A.

Under vertical integration, there are four possible contracts, corresponding to the possible combinations of effort the supplier exerts on monitored and non-monitorable tasks. Appendix B derives the levels of relationship-specific investments made by each party under each of the four contracts and the payoffs to each party in each case. We focus here on the contract that generates effort on monitored tasks and no effort on non-monitored tasks.<sup>15</sup>

<sup>14</sup>This assumption means that HQ cannot always extract the full value of the relationship from an entrepreneur upfront at all levels of potential relationship productivity. The constraint is more likely to bind in equilibrium, so that  $T^k = l$ , for relationships with a high-productivity draw, precisely when the high-powered performance and ownership incentives that are feasible under outsourcing are more valuable.

<sup>15</sup>A vertical integration contract that produces no supplier effort is dominated by outsourcing with no performance

## The choice of organizational form

**Vertical Integration is preferred to outsourcing with no performance contract at high productivity levels.** HQ prefers vertical integration to an outsourcing contract with no performance incentives when:

$$E(U_H^I - U_H^O) = \frac{\theta^2 h^2}{8} [(1 + \mu)^2 - 1] + \frac{\theta^2}{4} [(1 + \mu)(1 - \mu)\bar{p}^2 - p_0^2] - f^I + f^O - l > 0 \quad (5)$$

where  $\bar{p} = (\delta p_E + (1 - \delta)p_0)$  and  $l$  is the credit-constrained upfront payment from the supplier to HQ.<sup>16</sup>

We now highlight how the model's mechanisms determine whether inequality (5) holds. Vertical integration leads to greater input from HQ due to HQ's reduced concern about future holdup. The level of relationship-specific investment from the supplier in each organizational form depends on the relative importance of two effects: Vertical integration leads to a lower value of  $x_S$ , since the supplier is now more concerned about future holdup; but, the probability that  $x_S$  is high-quality ( $p = \bar{p}$  in equation (1)) is higher since  $\delta$  tasks are monitored directly. Whether the net effect on the level of supplier investment is positive or negative depends on the relative magnitudes of  $h$ ,  $\mu$  and  $\delta$ .

Taking the derivative of inequality (5) with respect to  $\theta$  gives:

$$\frac{\delta E(U_H^I - U_H^O)}{\delta \theta} = 2\theta \left[ \frac{h^2}{8} (\mu^2 + 2\mu) + \frac{1}{4} ((1 - \mu^2)\bar{p}^2 - p_0^2) \right] \quad (6)$$

This derivative shows that there is a monotonic relationship between productivity,  $\theta$ , and the value to HQ of vertical integration relative to outsourcing with no performance incentives for any given values of  $\mu$ ,  $\delta$ ,  $p_0$ , and  $p_E$ .<sup>17</sup> The monotonic relationship is positive when the production function is intensive in HQ's investment—that is, whenever  $h > 1$  in equation (1).<sup>18</sup> Figure 1

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contract, which also leads to zero effort but incurs lower fixed costs. A vertical integration contract with effort on all tasks is also dominated by outsourcing with performance incentives since rent sharing is required under both. Appendix B also shows that the remaining possible vertical integration contract, which leads to no effort on monitored tasks and effort on non-monitored tasks, is strictly dominated by other vertical integration contracts at all  $\delta$ . HQ's payoff under the vertical integration contract which leads to effort only on monitored tasks is given Appendix B, equation (15).

<sup>16</sup>The right hand side of this inequality is the difference between the payoff to the firm under vertical integration (equation (15) derived in Appendix B) and the payoff to the firm under outsourcing with no performance incentives (equation (12) in Appendix A).

<sup>17</sup>We note that the supplier's effort level in each of these contractual forms does not vary with productivity. Zero effort is exerted under outsourcing with no performance incentives, and effort is exerted only on monitored tasks under vertical integration.

<sup>18</sup>Equation (6) tells us that the predicted monotonic relationship is positive whenever  $h^2 > \frac{2(p_0^2 - (1 - \mu)\bar{p}^2)}{\mu^2 + 2\mu}$ . This inequality always holds if  $h > 1$  since  $\bar{p} > p_0 > 0$  by assumption.

Panel A illustrates this case in the comparison of lines  $O_a$  (HQ's payoffs under outsourcing with no performance incentives) and  $VI$  (HQ's payoffs under vertical integration). We define  $\underline{\theta}$  as the lowest value of  $\theta$  where inequality (5) holds.

**Outsourcing with performance incentives is preferred to vertical integration at high productivity levels.** HQ prefers outsourcing to vertical integration when:

$$E(U_H^O - U_H^I) = \frac{\theta^2 h^2}{8} [-2\mu - \mu^2] + \frac{\theta^2}{4} [p_E^2 - (1 - \mu^2) \bar{p}^2] - f^O + l + f^I - p_E \left( \frac{E}{(p_E - p_0)} - \frac{\theta^2 (p_E^2 - p_0^2)}{8(p_E - p_0)} \right) > 0 \quad (7)$$

The level of each party's investment under each organizational form, the monitoring technology under integration (measured by  $\delta$ ), and the rent sharing required under outsourcing to induce supplier effort all affect whether inequality (7) holds.<sup>19</sup> HQ's relationship-specific investment is lower under outsourcing since it is more concerned about future holdup. This decreases HQ's payoff from outsourcing. However, its payoff is positively affected by the fact that the supplier's investment is unambiguously greater under outsourcing than under vertical integration for three reasons: First, the input  $x_S$  is larger since supplier ownership implies that the supplier has residual control and is less concerned about holdup. Second, the supplier exerts more effort (increasing the probability  $x_S$  is high quality,  $p$ ) because it shares in rents. The third reason arises from the complementarity that exists between ownership and performance incentives. Since effort amplifies the impact on output of  $x_S$ , and since the supplier is now sharing in output and is less concerned about holdup, the supplier further increases the level of  $x_S$ .

The derivative of inequality (7) with respect to  $\theta$  is:

$$\frac{\delta E(U_H^O - U_H^I)}{\delta \theta} = 2\theta \left[ \frac{h^2}{8} (-2\mu - \mu^2) + \frac{1}{4} \left( p_E^2 - (1 - \mu^2) \bar{p}^2 + \frac{p_E (p_E^2 - p_0^2)}{2(p_E - p_0)} \right) \right] \quad (8)$$

When this derivative is positive, outsourcing with performance incentives is preferred to vertical integration at high-productivity levels. We note that there is a range of values for  $h$  when  $h > 1$  for which derivative (8) is positive.<sup>20</sup> That is, even though production is relatively intensive in HQ's investment, HQ increasingly prefers to outsource the relationship as productivity increases. In Figure 1 Panel A, line  $O_b$  illustrates HQ's payoffs under outsourcing with explicit performance incentives as a function of relationship productivity,  $\theta$ . We define  $\bar{\theta}$  as the lowest value of  $\theta$  where

<sup>19</sup>Inequality (7) holds when the expected payoff in equation (13) derived in Appendix A exceeds the expected payoff in equation (15) derived in Appendix B.

<sup>20</sup>The derivative given in equation (8) is positive for  $h^2 < \frac{2 \left( p_E^2 - (1 - \mu^2) \bar{p}^2 + \frac{p_E (p_E^2 - p_0^2)}{2(p_E - p_0)} \right)}{\mu^2 + 2\mu}$ .

inequality (7) holds.

When the other model parameters take on values where both derivatives (6) and (8) are positive and  $\underline{\theta} < \bar{\theta}$ , then vertical integration is HQ's preferred organizational form over an intermediate range of relationship productivity levels, and outsourcing is preferred at low- and high-productivity levels. Figure 1 Panel A represents this equilibrium outcome. HQ prefers vertical integration for all  $\theta \in (\underline{\theta}, \bar{\theta})$ , outsourcing without performance incentives for  $\theta < \underline{\theta}$ , and outsourcing with performance incentives for  $\theta > \bar{\theta}$ .

### The relationship between productivity and output in equilibrium

Expected output as a function of  $\theta$  under each organizational form choice can be found by substituting equilibrium investment values under each contract into the production function given in equation (1).

Under outsourcing with no performance incentives, expected output is given by:  $EY_{O_a} = \theta^2 \left( \frac{h^2}{2} + \frac{p_0^2}{2} \right)$ . Under the vertical integration contract of interest here with no performance incentives, expected output is:  $EY_{VI} = \theta^2 \left( \frac{h^2(1+\mu)}{2} + \frac{(1-\mu)\bar{p}^2}{2} \right)$ . Finally, under outsourcing with performance incentives, expected output is:  $EY_{O_b} = \theta^2 \left( \frac{h^2}{2} + \frac{p_E^2}{2} \right)$ .

Expected output is increasing in productivity in each case. Will this relationship be preserved when contractual form chosen by HQ also varies with productivity? To answer this, we start by examining the derivative of each output function with respect to productivity:

The derivative of the expected output function with respect to productivity is greater under vertical integration than under outsourcing with no performance incentives for any  $h$  where  $h^2 > \frac{p_0^2 - (1-\mu)\bar{p}^2}{\mu} = \underline{h}^2$ . This implies that expected output is also higher under vertical integration than under outsourcing with no performance incentives at all values of  $\theta$ . Since derivative (6) is positive for all  $h^2 > \underline{h}^2$  for all feasible model parameter values, the monotonically increasing relationship between productivity and expected output is preserved around  $\underline{\theta}$  (when switching from outsourcing with no performance contract to vertical integration).

The relationship between output and productivity around  $\bar{\theta}$  is more complicated. The rate at which output is increasing in productivity for outsourcing with performance incentives is greater than under vertical integration for any  $h$  where  $h^2 < \frac{p_E^2 - (1-\mu)\bar{p}^2}{\mu} = \bar{h}^2$ . If  $h^2 > \bar{h}^2$ , but  $h$  is nonetheless small enough that derivative (8) is positive, the derivative of output with respect to productivity is smaller under outsourcing with performance incentives than under vertical integration. This means there is a non-monotonic predicted relationship between organizational form and productivity, but

the relationship between expected output and productivity is also non-monotonic at  $\bar{\theta}$  (expected output "jumps down" at  $\bar{\theta}$ ).<sup>21</sup> However, when  $\underline{h}^2 < h^2 < \bar{h}^2$ , expected output is higher under outsourcing with performance incentives than under the vertical integration contract for all values of  $\theta$ . This means there is a range of model parameters where the model predicts a monotonically increasing relationship between expected output and productivity whenever it predicts a non-monotonic relationship between productivity and organizational form.

## Empirical implications

In the empirical work that follows, HQ is the hotel brand headquarters (HQ) and the supplier is the manager or franchisee of an individual property within a hotel brand. For some model parameters, there is a unique equilibrium of the model where:

- **Proposition 1** *There is a non-monotonic relationship between the probability that a hotel property is vertically integrated and property-level output within a hotel brand.*

Figure 1 illustrates this proposition. Panel A shows an example of the payoffs to HQ under each organizational-form outcome derived in the previous subsections. Panel B illustrates the predicted probability that a property is vertically integrated as a function of productivity, based on the assumption that HQ chooses the organizational form to maximize its payoffs at each productivity level. Variation in productivity induces a relationship between output and the probability of vertical integration that is similar to the underlying relationship between productivity and organizational form. Therefore, the model predicts that vertical integration is the most likely organizational form at intermediate levels of productivity or output and franchising is most likely at low and high levels of productivity and output.<sup>22</sup>

- **Proposition 2** *There is an increasing monotonic relationship between the probability that a hotel property is vertically integrated for hotel brands where HQ investment is particularly important in production.*

This proposition is related to the comparative static properties of the model parameter  $h$ , the relative intensity of HQ's investment in production. We assume that the production function is fixed

<sup>21</sup>We note that the possible non-monotonicity between expected output and productivity at this productivity level works against finding the non-monotonic predicted association between output and organizational form observed in the data.

<sup>22</sup>The assumption that the fixed cost of vertical integration is stochastic allows us to derive the empirical predictions as relative probabilities of a given organizational form choice.

at the brand level, so  $h$  can vary across brands but is constant within a brand. We hypothesize that the production function is relatively more intensive in HQ's input for high-tier brands. The model does not predict the non-monotonic relationship between organizational form and productivity described in Proposition 1 if the production function has a very high values of  $h$ .<sup>23</sup> Hence, we predict that for brands that exhibit some variation in organizational form, higher-tier brands are less likely to exhibit the non-monotonic relationship.<sup>24</sup>

- **Proposition 3** *The non-monotonic relationship between the probability a property is vertically integrated and output is less pronounced in geographic locations where it is more costly for HQ to provide performance incentives.*

Holding the parameters in the brand-level production function fixed—that is, within a brand—it is more costly for HQ to provide the supplier with sufficient incentives to exert effort on all tasks in states with high marginal rates of corporate taxation. The entrepreneur must be compensated sufficiently well with the bonus payment to ensure incentive compatibility. If this is more costly to achieve, the payoff to HQ from outsourcing with performance incentives is lower at each productivity level.<sup>25</sup> This suggests that the threshold value at which outsourcing with performance incentives is preferred over vertical integration,  $\bar{\theta}$ , is larger. In the appendix,  $\bar{\theta}$  is shown to be increasing in the size of the required bonus payment.<sup>26</sup> Since this payment is a transfer between HQ and the third party, the required size of the bonus payment does not affect the increasing monotonic relationship between the output and productivity. The HQ of a given brand, hence, prefers vertical integration over a larger range of occupancy rates in states with high marginal corporate tax rates.

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<sup>23</sup>The relationship between output and productivity would be predicted to be non-monotonic at high values of  $h$  only if HQ did choose outsourcing at high values of  $\theta$ . It is this fact, along with rent-sharing under outsourcing with explicit performance incentives, that explains why HQ continues to prefer vertical integration at high  $\theta$  when  $h$  is high.

<sup>24</sup>A version of Figure 1 Panel A that illustrates this equilibrium outcome would show that the relationship between the payoff from vertical integration and productivity (Line  $VI$ ) is much steeper than in the current version of the figure, relative to the slope of the relationship between the payoff to outsourcing with performance contracts and productivity (Line  $O_b$ ). There would be no intersection point between these two payoff functions. That is, the payoff to vertical integration would exceed the payoff to outsourcing with performance incentives at all productivity levels.

<sup>25</sup>In a version of Figure 1 Panel A that illustrates the equilibrium outcome in high-tax states, Line  $O_b$  would be shifted downward at each value of  $\theta$  compared to the payoffs to outsourcing with performance incentives in low-tax states.

<sup>26</sup>The threshold value of productivity at which vertical integration is preferred to outsourcing with no performance incentives,  $\underline{\theta}$ , is unaffected by variation in this tax rate since no bonus is required in either of these organizational forms.

### 3 Data and Empirical Strategy

The data used in the paper are property-level information from over 8,000 hotels affiliated with one of the 38 hotel brands in the United States that exhibit variation in organizational form, in that some brand properties are managed by the hotel brand and some are managed by a third-party franchisee. The data are collected by the hospitality market research firm Smith Travel Research (STR).

STR groups the hotel brands used in the data into one of four tiers: upper upscale, upscale, midscale and economy.<sup>27</sup> While STR requires that the names of the brands in each tier remain confidential, representative brands for the different tiers are Marriott, Radisson, Holiday Inn, and Motel 6, respectively. Table 1 summarizes the data. The upper upscale tier includes 1122 properties under one of nine brands, 46 percent of the properties are chain managed. The upscale tier includes ten brands with at least one property of each organizational form, a total of 2405 properties, of which 23 percent are chain-managed. The midscale tier has thirteen brands with some variation in organizational form. Fifteen percent of the 3704 properties in this tier are chain-managed. In the economy tier, there are six brands with variation in organizational form and 1385 properties. Of these properties, 71 percent are chain-managed, reversing the trend of less chain management overall in lower-tier brands.<sup>28</sup>

The key independent variable in the empirical part of the study is the property-level output measure. Noting that there is no capital input in the production function given in equation (1), this equation can be rewritten as:  $\frac{EY}{K} = \frac{\theta(hx_H + x_{SP}(\cdot))I}{K}$ , where  $K$  is the units of capital employed at the property level. The left hand side of this equation is output per unit of capital, and the right hand side is the sum of relationship-specific inputs from each party involved in production multiplied by the productivity of these investments per unit of capital,  $\theta$ . We measure the realized value of output per unit of capital using the property-level occupancy rate, where output is the average number of guest rooms occupied in the property per night and the capital stock is the number of guest rooms.<sup>29</sup> For each hotel property, we observe the monthly occupancy rate for each month

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<sup>27</sup>Properties are grouped into quality tiers by STR based on average room rate. STR also collects data from properties in a luxury tier (e.g., Four Seasons). There is very little within-brand variation in organizational form for brands in this tier. Almost all properties are vertically integrated (consistent with the hypothesis that the hotel HQ's investment is particularly important in production for high-quality brands).

<sup>28</sup>Of the six economy-tier brands, only 11% of properties are chain-managed for two brands, but, for one brand, 96% are chain-managed, increasing the tier-level average.

<sup>29</sup>We refer to the occupancy rate as a measure of output per room, but it can also be described as a measure of capital productivity. We use "output per room" in the text to avoid confusion between the terms capital productivity, the variable on the left hand side of equation (1), and relationship-specific investment productivity, the variable  $\theta$  on the right hand side of equation (1).

from 2004 to 2009. We take the mean of this measure over all months in the data to provide an average occupancy rate for each property. The mean occupancy rate varies from 60.6 percent to 68.0 percent across tiers, and the standard deviation in occupancy rate across tiers varies from 9.5 percent to 12.2 percent.<sup>30</sup>

The dependent variable of interest in the empirical analysis is binary: equal to one if the property is chain-managed and zero if the property is franchised. This variable refers to the day-to-day management of the hotel property. In a chain-managed property, an employee of the hotel brand runs the property. In a franchised property, a third party manages the property—that is, management is outsourced.<sup>31</sup>

The outcome of this discrete organizational form choice can be seen as reflecting a threshold rule for an underlying latent variable  $y^*$ , so that  $y = 1$  if  $y^* > 0$  and  $y = 0$  if  $y^* \leq 0$ . In this case, the latent variable  $y^*$  is the difference between HQ’s payoffs from chain management and from franchising a property. With reference to Figure 1 Panel A,  $y^*$  corresponds to the vertical distance between line  $VI$  and the maximum of line  $O_a$  and line  $O_b$  at each productivity level. The fixed cost of vertical integration,  $f_I$ , is assumed to be a stochastic relationship-specific term where  $E(f_I) > f_O$ . The property-level realization of the stochastic process determines whether HQ will choose the organizational form that yields the highest predicted payoff at a given productivity level. If the predicted  $y^*$  corresponding to a particular property is positive, HQ is more likely to choose vertical integration, and if the predicted  $y^*$  is negative, HQ is more likely to choose franchising. The payoff difference between each organizational form,  $y^*$ , is unobserved, so we use the outcome of chain management or franchising to infer the effects of the parameters in the underlying model.

We assume that  $y$  is a function of the set of explanatory variables generated by the model,  $\mathbf{x}$ , for which we use a linear approximation  $y = \beta' \mathbf{x} + \varepsilon$ , and normalize the variables so that  $\varepsilon$  has a standard logistic distribution with mean zero and variance one. The values of some model parameters may vary systematically with brand and market location in a way that affects both

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<sup>30</sup>An alternative estimation strategy would be to interpret occupancy as a direct proxy of the productivity of the relationship-specific inputs,  $\theta$ , (as is often done within the industry (Douglas, 2000)). In this case, the empirical work can be viewed as establishing a direct association between productivity and organizational form choice that is consistent with the model’s predictions. We chose to interpret the occupancy rate as measuring the realized value of the left hand side variable in equation (1) normalized by property-level capital, since it is likely influenced by the relationship-specific investments made by headquarters and the local property manager or franchisee.

<sup>31</sup>In the case of chain-managed properties, the asset could be owned by headquarters or a third party. In the case of franchised properties, the asset is likely to be owned by the franchisee managing the hotel but could, alternatively, be owned by a different third party. This is one reason why we have excluded capital from the model and focused on occupancy rate as our measure of output, which is a measure of asset-use intensity. The asset in question is the right to manage the hotel.

output and organizational form. For example, for an HQ-intensive technology, a higher fixed cost of entry for a particular brand or a particular market location will increase both mean output and the average probability of vertical integration. To control for these factors, we include fixed effects for groups of hotels affiliated with the same brand and within the same metropolitan statistical areas (MSAs) in our estimations.

Given these assumptions, the probability that the  $i$ 'th hotel of the  $b$ 'th brand in the  $l$ 'th MSA will be chain-managed ( $y_{ibl} = 1$ ) can be written as:

$$\Pr(y_{ibl} > 0 | \mathbf{x}_{ibl}, \boldsymbol{\beta}) = \Pr(\boldsymbol{\beta}'\tilde{\mathbf{x}}_{ibl} + \alpha_b + \gamma_l + \varepsilon_{ibl} > 0) = F(\boldsymbol{\beta}'\tilde{\mathbf{x}}_{ibl} + \alpha_b + \gamma_l) \quad (9)$$

where  $\alpha_b$  is a brand-specific parameter common to all other properties in brand  $b$ ;  $\gamma_l$  is an MSA-specific parameter common to all properties in MSA  $l$ ; and  $\tilde{\mathbf{x}}_{ibl}$  includes variables related to average property-level occupancy rate,  $Q_{ibl}$ . We estimate reduced form quadratic models of the following type using maximum likelihood estimation:

$$y_{ibl}^* = \delta + \alpha_b + \gamma_l + \beta_1 Q_{ibl} + \beta_2 Q_{ibl}^2 + \varepsilon_{ibl} \quad (10)$$

where  $\delta$  is a constant term.

To investigate whether variation in organizational form in the data is consistent with Proposition 1—the non-monotonic predicted relationship between occupancy rate and the probability of vertical integration—we test the following two restrictions on the coefficient estimates: First, the estimated coefficient  $\beta_1$  is predicted to be positive and the estimated coefficient  $\beta_2$  is predicted to be negative. Second, these coefficients should be such that  $\frac{dy^*}{dQ} > 0$  for low values of  $Q$  and  $\frac{dy^*}{dQ} < 0$  for high values of  $Q$  in the sample. That is, within the data sample, the relationship between occupancy rate and the likelihood of vertical integration actually reverses. In other words, the estimated coefficients indicate more than just a diminishing rate of increase in HQ's relative preference for chain management at high output levels; instead, franchising actually becomes preferred over chain management at sufficiently high output levels. We find the occupancy rate at which the expected probability of vertical integration is maximized in the data—the value of  $Q$  where  $\frac{dy^*}{dQ} = 0$ , which occurs when  $Q = \frac{-\beta_1}{2\beta_2}$ —and compare it to the empirical distribution of occupancy rates.

Second, we look for evidence consistent with hypothesized differences in relationship-specific investment intensity across hotel brands. Proposition 2 of the model shows that if performance incentives are insufficient to outweigh the effect on organizational form choice of relative ownership

incentives even at high productivity levels because  $h$  is very large, there is an increasing monotonic predicted relationship between occupancy rate and the probability of vertical integration. We estimate equation (10) separately for each tier. The estimated coefficients  $\beta_1$  and  $\beta_2$  for the higher-tier brands are predicted to be of the same sign or, if they take on different signs, are of magnitudes that do not imply a predicted reversal of organizational form choice within the observed sample. The model suggests the non-monotonic relationship between output and the probability of chain management to be more pronounced among brands in lower quality tiers.<sup>32</sup>

Proposition 3 of the model states that the non-monotonic relationship between occupancy rate and the probability of vertical integration is less pronounced when it is more costly for the HQ of a given brand to provide explicit performance incentives to the franchisee. We evaluate this proposition in the data by testing whether the relationship between organizational form and occupancy within a given brand varies with the rate of state corporate tax rate. We split the data into properties located in states with a marginal tax rate below the median level in 2009 of 6.5% and those that are located in states with higher marginal tax rates. In the former group, it is less costly for HQ to ensure that the property's incentive compatibility constraint binds in a performance contract. That is, it is less costly to share rents with a third party that are sufficient to ensure any given level of third-party investment in quality. Outsourcing with a performance contract becomes relatively more attractive at all levels of productivity and, hence, output. The proposition from the model is that the maximum predicted probability of chain management occurs at a lower occupancy rate in states with low marginal corporate tax rates.

To further investigate this proposition, we also estimate the following specification, which includes interactions of property-level  $Q$  and  $Q^2$  with the state-level marginal tax rate,  $T_s$ :

$$y_{ibls}^* = \delta + \alpha_b + \gamma_l + \beta_0 T_s + \beta_1 Q_{ibl} + \beta_2 Q_{ibl}^2 + \beta_3 Q_{ibl} T_s + \beta_4 Q_{ibl}^2 T_s + \varepsilon_{ibl} \quad (11)$$

In this specification, the value of  $Q$  where  $\frac{dy^*}{dQ} = 0$  is given by  $Q = \frac{-(\beta_1 + \beta_3 T_s)}{2(\beta_2 + \beta_4 T_s)}$ .<sup>33</sup> We ask whether the predicted maximum probability of chain management occurs at a lower occupancy rate for properties of a given brand located in states at the 10th percentile of the distribution of  $T_s$  than at the 90th percentile.

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<sup>32</sup>We maintain the hypothesis that the production function is relatively intensive in  $h$  in all brands, but the relative intensity is greater in high-tier brands. If, in contrast, we assumed that lower-tier brands were relatively intensive in the property's input, the property rights mechanism would generate a negative monotonic relationship between the probability of chain management and occupancy. There is no evidence of this in the data for any quality tier.

<sup>33</sup>The coefficient  $\beta_0$  is identified using variation in organizational form within the small number of MSAs that span state boundaries.

## 4 Empirical Results

### Main specifications

Consistent with Proposition 1, the data reveal a highly significant non-monotonic relationship between the probability of chain management and the occupancy rate. Estimating equation (10) including brand and MSA fixed effects leaves us with 8359 properties from one of the 38 brands with variation in organizational form.<sup>34</sup> The first column of Panel A of Table 2 shows that  $\hat{\beta}_1$  is positive and  $\hat{\beta}_2$  is negative, both significant at the one percent level. Turning to Panel B of Table 2, the estimated coefficients from this specification predict that the maximum probability of chain management occurs at an occupancy rate of 76 percent. The 90th percentile of the occupancy rate distribution in the data is 78 percent. That is, at least ten percent of all properties lie to the right of the estimated maximum probability of vertical integration—the predicted reversal occurs within sample.

To our knowledge, we are the first to document a non-linear relationship between organizational form and property occupancy rate, a measure of relationship output. These results are consistent with brands choosing to franchise properties at low- and high-productivity draws and vertically integrate properties with intermediate draws.

The next four columns of Table 2 show the results for equation (10) estimated by tier.<sup>35</sup> The non-monotonic relationship between the probability of vertical integration and occupancy is present for the upscale, midscale, and economy tiers:  $\hat{\beta}_1$  is positive and  $\hat{\beta}_2$  is negative for each of these tiers. The maximum likelihood of chain management in each tier occurs well within sample, as seen in the last three columns of Panel B of Table 2. For the upscale chain, the maximum predicted probability of chain management occurs at around 73 percent occupancy. This is below the 90th percentile occupancy rate in the data. For the midscale chain, the maximum predicted probability of chain management occurs at around 76 percent occupancy, within the 90th percentile of occupancy rates observed in the data. For the economy tier, the predicted maximum probability occurs at 69 percent, again within the 90th percentile.

For these quality tiers, HQ prefers outsourcing to chain management at high levels of produc-

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<sup>34</sup>The remaining 257 of the 8616 properties in the data are located in MSAs where there is no observed variation in organizational form.

<sup>35</sup>We present results with unclustered standard errors and standard errors clustered at the brand level for consistency across specifications. While clustering may be appropriate to allow for correlated errors within brands in the pooled data that include all 38 brands, the clustered standard errors may be misleading in the tier-level analysis with fewer brand groups in each specification.

tivity, consistent with the prediction that these relationships generate higher payoffs to HQ. The relative benefits to HQ of outsourcing come from higher supplier-investment levels, since the franchisee faces a combination of performance and ownership incentives, as well as lower fixed costs. These empirical findings suggest that, at high productivity levels, these benefits to HQ outweigh the costs that are associated with outsourcing; arising from both reduced HQ-investment and rent-sharing with the entrepreneur in the form of performance incentives.<sup>36</sup>

For the upper upscale tier, the estimated coefficient  $\hat{\beta}_1$  (for occupancy rate) is positive and the  $\hat{\beta}_2$  coefficient (for occupancy rate squared) is negative, but both estimated coefficients are insignificantly different from zero. There is no evidence of the non-monotonic relationship between occupancy and the probability of vertical integration for this high-quality tier. This finding is consistent with a version of the model where the value of  $h$  (the intensity of HQ’s investment) in the production function is relatively high. In this case, the incentives created by performance contracts are insufficient to outweigh the direct effects of relative ownership incentives on each party’s investment levels in determining organizational form, even at high property productivity levels.

The absence of the non-monotonic relationship in this high-quality tier and its presence in lower quality tiers are consistent with Proposition 2 of the model: higher-tier brands are less likely to exhibit the inverted U-shaped relationship described in Proposition 1. The contrasting results for the upper upscale tier and the lower-quality tiers suggest that the effect of ownership incentives related to residual control rights on each party’s investment is at least partly responsible for explaining overall variation in organizational form in this industry. We hypothesize that the main difference between the brand-level production function across tiers is the relative intensity of HQ investment. In upper upscale brands, the returns to HQ’s investment are high relative to the supplier’s investment returns. Hence, HQ prefers to mitigate its own underinvestment problem by vertically integrating, opting not to provide the property with either ownership or explicit performances incentives by outsourcing.

Table 3 presents the results of the analysis of whether variation in the marginal tax rate affects the nature of the relationship between organizational form and occupancy rate. For the pooled data

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<sup>36</sup>Kaufman and Lafontaine (1994) document evidence that the ex post rents to franchisees of McDonald’s restaurants increase disproportionately with restaurant sales, consistent with incentives-based theories of franchising. Their data also suggest that store managers’ salaries, on average, are between the 25th and 50th percentiles of the distribution of ex post rents earned by franchisees. In a different setting, our model also predicts similar findings, in that vertically-integrated hotel managers’ salaries are equivalent to the payoffs earned by the franchisees of low productivity hotel properties (which are equal to their outside option). The equilibrium of the model described in Section 2 of this paper predicts much higher payoffs (rents exceeding their outside option) for the franchisees managing the most productive properties in lower-tier brands.

and then for each tier, we present the estimated coefficients of equation (10) for the sub-sample of properties located in states where the marginal rate of state corporate tax is lower than the median rate of 6.5%. The adjacent column for the pooled data set and for each tier, presents the equivalent coefficient estimates for properties in states where the marginal rate of state corporate tax is greater than 6.5%.<sup>37</sup>

The results for the midscale and economy tiers are consistent with Proposition 3. In each of these two tiers, the maximum predicted probability occurs at a higher occupancy rate in states with higher marginal state taxes. As shown in Table 3 Panel B, in the midscale quality tier, the predicted maximum probability of chain management occurs at 74% occupancy in low tax states and at 79% occupancy in high tax states. In the economy quality tier, the predicted maximum probability of chain management occurs at 67% in low tax states and 71% in high tax states. Under the assumption that the marginal state tax rate measures how costly it is for headquarters to put performance incentives in place, these findings are consistent with the HQ of a given brand continuing to prefer vertical integration at higher productivity levels in states where performance incentives are more costly. The results for the upscale tier in Table 3 do not provide any evidence consistent with Proposition 3. While the results for the properties in high-tax states exhibit the non-monotonic relationship described in Proposition 1, the estimation for the properties in low-tax states does not yield a  $\hat{\beta}_2$  that is significantly different from zero.

Proposition 3 is tested in more detail in Table 4. This table presents the results of the specification set out in equation (11), allowing estimation of how the maximum predicted probability of chain management varies with the marginal corporate tax rate. Table 4 Panel B uses the coefficients estimated in Panel A to calculate the occupancy rate where the predicted probability of vertical integration is maximized at the 10th percentile tax rate and the 90th percentile tax rate. The maximum predicted probability of chain management occurs at higher occupancy rates in states at the 90th percentile tax rate in the midscale and economy tiers. While this is also the case for the upscale tier, it reflects the fact that for properties in low tax states, there is no predicted non-monotonic relationship between occupancy and the probability of vertical integration. However, the findings that higher tax rates lead HQ to prefer vertical integration over a wider range of occupancy rates for midscale and economy brands provides some further evidence consistent with the prominent role of performance incentives in determining organizational form in this industry.

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<sup>37</sup>Splitting up the data into the high and low tax subsamples causes us to exclude some of the observations in Table 2—those properties from brands with no within-group variation in organizational form in one of the two subsamples. This leaves us with fewer observations in total across each of these specifications.

## Robustness Tests

We first discuss the possibility that there are omitted variables correlated with both occupancy and organizational form that vary within brand and MSA and that could be generating the results described above. The main concern is that there are omitted variables that generate the non-monotonic relationship documented in Table 2 through some channel other than productivity heterogeneity.<sup>38</sup> One possibility is that the parameters of the property-level production function vary with the age of a hotel within a brand, which would then be correlated with output. There may also be time trends in the average propensity to outsource hotel management due to factors outside the model. We re-estimate our baseline specification given in (10) including the age of the property as an additional independent variable. The results in Table 5 show that age is positively and significantly correlated with the probability of being chain-managed in all specifications. That is, newer hotels are relatively likely to be franchised. Nonetheless, the non-monotonic relationship between occupancy and probability of chain management for the overall data set and for the upscale, midscale, and economy tiers is robust to the inclusion of this control.

In our second robustness test, we address the potential inconsistency problem associated with estimating non-linear probability models with fixed effects (Chamberlain, 1980). This problem is particularly severe when including many group-level fixed effects with few observations per group. Out of the 38 brands, only two brands have fewer than 30 properties, and only 12 brands have fewer than 100 properties. This suggests that the incidental parameters problem arising from the brand fixed effects is small. There is a much larger variance in the number of properties across each of the 211 MSAs in the data that contain variation in organizational form. Only 49 MSAs contain more than 40 properties. We repeat the specification given in equation (10) on the subset of 5624 properties located in MSAs with at least 40 properties and belonging to brands with at least one property of each organizational form. These findings, given in Table 6, are very similar to the results in Table 2. Overall, and with the upscale, midscale and economy tiers, but not in the upper upscale tier, properties with low and high occupancy rates tend to be managed by franchisees. Properties with intermediate levels of occupancy tend to be chain-managed.

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<sup>38</sup>Factors that increase property-level demand, such as property location within an MSA, are measured by the productivity parameter in the model,  $\theta_i$ . As such, they are related directly to the occupancy rate measure of output per room, as derived in Section 2, and determine the monotonic relationship between productivity and output that underpins the propositions taken to the data.

## 5 Conclusion

A large theoretical literature shows how organizational form choice can reflect the fundamental problem that outsourcing and vertical integration contracts are incomplete, which means that both headquarters and the supplier will underinvest in the relationship. Theoretical studies of this issue can be categorized according to how firm structure mitigates each party's relationship-specific-underinvestment.<sup>39</sup> The empirical findings in this paper suggest that firms use a combination of contractual tools to help reduce underinvestment in relationship-specific investments. Explicit performance incentives to reduce supplier underinvestment are included in outsourcing contracts when both feasible and profitable for headquarters, thereby reducing the extent of contractual incompleteness. Ownership (allocating the residual, non-contractible, rights) is a separate tool that strengthens the owning party's investment incentives.

Observed variation in organizational form choice in the hotel industry is consistent with a model that includes both these contractual tools and heterogeneity in hotel property productivity. We believe that this is the first empirical study that examines variation in organizational form choice both within and across hotel brands.<sup>40</sup> We find that for upscale, midscale, and economy U.S. hotel brands, hotel properties with intermediate levels of occupancy are more likely to be chain-managed. Low- and high-occupancy hotels tend to be franchised. We are the first to document a non-linear within-brand relationship between hotel performance, as measured by occupancy rate, and organizational form. The non-monotonic relationship within midscale and economy hotel brands is more pronounced in states where it is less costly for headquarters to provide performance incentives to a franchisee. There is no such relationship, however, for upper upscale hotel brands.

The model developed in the paper is quite general, and applies to the question of why some intermediate inputs are made in-house and others are bought from an arm's length supplier. The data validate a key insight from the model—even when HQ's investment is used relatively intensively in production, the effect of performance incentives on supplier investment can lead to outsourcing at high productivity levels. A property rights model that includes ownership incentives but not performance incentives cannot explain the non-monotonic relationship observed for the majority of

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<sup>39</sup>The two main strands of the large theoretical literature on this "make-or-buy" decision that, in contrast to transactions costs models, include contractual incompleteness under both arm's-length contracting and under vertical integration are: managerial incentives models (which include agency models), and property rights models.

<sup>40</sup>Lafontaine and coauthors have conducted extensive empirical work on variation across firms in the firm-level propensity to franchise in hotels and other franchise-intensive industries (Lafontaine, 1992; Lafontaine and Bhattacharyya, 1995; Lafontaine and Shaw, 2005). Other studies find evidence that the average propensity to outsource in this industry is, for example, positively related to distance from HQ (Brickley and Dark, 1987) and negatively related to property size and the local concentration of same-brand properties (Kehoe, 1996).

firms in the industry studied here. Combining both the property rights and managerial incentives mechanisms in one model reveals that ownership and explicit performance incentives for the supplier can be complementary means to mitigate underinvestment at some levels of productivity.<sup>41</sup>

We view our findings as evidence that firms use all the contractual tools at their disposal to help mitigate underinvestment in relationship-specific investments. As Gibbons (2005) notes, ownership can be viewed as one of the instruments in an incentive-system theory of the firm (Holmstrom and Milgrom, 1994). Incentives related to measured performance are one other instrument that can be employed when some aspect of supplier input is observable and, hence, contractible. Specifically, when firms have the ability to write performance contracts based on an observable outcome correlated with input levels, the complementarity between the performance incentives and ownership incentives at high levels of productivity can lead firms to choose outsourcing when ownership incentives alone would favor vertical integration.

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<sup>41</sup>A franchisee is less concerned than an employed manager about future holdup and, hence, earns higher marginal returns from increased effort on all tasks as productivity increases under a performance contract. This is the source of the complementarity of the two types of incentives. In contrast, incentives can be complementary in Holmstrom and Milgrom (1994) and Baker and Hubbard (2003, 2004), in part because time-constrained workers can each undertake a set of competing activities.

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# Appendix A: Outsourcing equilibrium investment and effort levels

The outsourcing contract specifies the upfront fee to be paid by the entrepreneur to HQ,  $T^O$  (up to the capital constraint  $l$ ) and a bonus payment  $b^O$  to be paid to the entrepreneur ex post only in the event that the supplier investment is observed to be high-quality. HQ chooses  $T^O$  and  $b^O$  so as to maximize its own utility, given that it can predict how the entrepreneur will respond to the terms of the contract, and subject to the entrepreneur's participation and capital constraints. HQ takes into account the fact that effort, and hence the cost of effort,  $e^k$ , and the level of the relationship-specific investment,  $x_S$ , will depend on the contract terms.<sup>42</sup>

The discrete nature of  $e^k$  and the probability function  $p(\cdot)$  allows us to specify the payoffs to HQ under each possible effort level, where HQ structures the contract to ensure the maximum possible payoff to itself when zero effort is exerted and when positive effort is exerted.<sup>43,44</sup> When the capital constraint does not bind, HQ can provide incentives for the entrepreneur to exert the efficient level of effort through the bonus payment  $b^O$ . HQ can then capture all of the rents through the upfront fee  $T^O$ . However, when the capital constraint does bind and positive effort is optimal, HQ must either accept suboptimal effort levels or share rents with the entrepreneur.<sup>45</sup>

Under organizational form  $k = O$ , and using equation (4), HQ's expected utility from an out-

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<sup>42</sup>More detailed derivations of the equilibrium outcomes described in the appendices are available from the authors on request.

<sup>43</sup>We require that  $p_0 > 0$ , so that  $p_0 x_S > 0$ . Even if  $x_S$  is low-quality with a high probability, positive output will be realized as long as  $x_H$  and  $x_S$  are positive. We also note that effort is specific to the relationship.

<sup>44</sup>The model allows for only two possible effort levels: zero effort and positive effort. In Grossman and Helpman (2004), effort is a continuous variable. Our intent is to generate the inverted-U shaped relationship between productivity and the probability that a property is vertically integrated using the simplest possible specification. Allowing for only two effort levels introduces the restriction that under vertical integration, HQ can no longer compensate for inefficiently low effort on the non-monitored tasks by demanding inefficiently high effort on the monitorable tasks. All it can do is settle for zero effort on the non-monitored tasks and maximum effort on the monitored tasks. While there may be some range of  $\theta$  in which this is more profitable than outsourcing, the range will be smaller than it would be if HQ could demand even more effort on the monitored tasks. Adding intermediate effort levels would increase the range of  $\theta$  for which vertical integration is preferred.

<sup>45</sup>An alternative way to allow for HQ to include performance incentives might be to allow them to contract on bargaining weights. Supplier input would then be affected by bargaining weights under outsourcing, and by both bargaining weights and the the fraction of output recovered by HQ under vertical integration. The setup presented here—which has fixed bargaining weights but allows for a contractable bonus payment related to output—allows the different types of incentives to affect two different types of supplier input, and allows us to illustrate the separate roles of each incentive type. We believe the alternative setup would generate similar empirical predictions (at the cost of obscuring some of the mechanisms at work in Antras-Helpman (2004) and Grossman-Helpman (2004)).

sourcing contract is:

$$\begin{aligned} EU_H^O &= Ey_H^O - \frac{1}{2}(x_H)^2 - f_E - f^O + T^O - b^O.p(\cdot)^O \\ &= \frac{1}{2}[\theta(hx_H + x_S p(\cdot))] - \frac{1}{2}(x_H)^2 - f_E - f^O + T^O - b^O.p(\cdot)^O \end{aligned}$$

HQ chooses  $x_H$  to maximize this expected utility, given the terms of the contract  $T^O$  and  $b^O$  that were agreed prior to this choice, which gives:  $x_H = \frac{1}{2}\theta h$ .

Under  $k = O$ , outsourcing, the supplier's expected utility is:

$$\begin{aligned} EU_S^O &= Ey_S^O - \frac{1}{2}(x_S)^2 - T^O + b^O.p(\cdot)^O - e^k \\ &= \frac{1}{2}[\theta(hx_H + x_S p(\cdot))] - \frac{1}{2}(x_S)^2 - T^O + b^O.p(\cdot)^O - e^k \end{aligned}$$

The supplier chooses  $x_S$  and its effort level (determining the probability that its input is high-quality) to maximize this expected utility, which gives:  $x_S = \frac{1}{2}\theta p(\cdot)$ .

We note that HQ's input,  $x_H$ , is independent of supplier effort (and the probability that the supplier's input is high-quality) whereas supplier input  $x_S$  is an increasing function of the probability that the input is high-quality, which is an increasing function of effort. This is the source of the complementarity discussed in the main body of the paper.

The following two subsections find the maximum expected payoffs to HQ from a contract under the two possible outsourcing contracts: (a) where the supplier exerts zero effort, and (b) where the supplier exerts effort on all tasks.

**a) The contract does not include performance incentives, so no effort is exerted by the entrepreneur:  $e = 0$ .**

With zero effort, the probability of high-quality supplier investment is  $p_0$ . Given that the supplier exerts this effort in equilibrium,  $x_S$  is given by:  $x_S = \frac{1}{2}\theta p_0$ . From above,  $x_H = \frac{1}{2}\theta h$  and the effort cost is 0, so no bonus payment is required,  $b^O = 0$ . To ensure that the supplier's participation constraint is met, his expected payoff must be at least zero (his outside option), so:

$$0 \leq \frac{1}{2}[\theta(hx_H + x_S p_0)] - \frac{1}{2}(x_S)^2 - T^O + b^O p_0 - e^k$$

The upfront fee  $T^* = \frac{1}{4}\theta^2 h^2 + \frac{1}{8}\theta^2 p_0^2$  is the optimal transfer from HQ's point of view, the highest upfront fee at which the supplier's participation constraint binds. If  $T^* > l$  this optimal transfer exceeds the entrepreneur's capital constraint; then  $T^O = l$ , otherwise  $T^O = T^*$ .

To ensure that the supplier does not deviate and exert positive effort, given the  $T^O$  and  $b^O = 0$  specified in the contract, we assume that for the range of  $\theta$  where this organizational form is chosen:  $\frac{E}{p_E^2 - p_0^2} \geq \frac{1}{8}\theta^2$ .<sup>46</sup>

Under this contract, with  $e_k = 0$ , as long as the capital constraint allows HQ to specify  $T^O = T^*$ , HQ's expected payoffs are:

$$\begin{aligned} EU_H^O &= \frac{1}{2}[\theta \left( h\frac{1}{2}\theta h + \frac{1}{2}\theta p_0^2 \right)] - \frac{1}{2} \left( \frac{1}{2}\theta h \right)^2 - f_E - f^O + T + \theta^2 \\ &= \frac{3\theta^2}{8} (h^2 + p_0^2) - f_E - f^O \end{aligned}$$

and, in the event that the capital constraint binds,  $T^O = l$ , expected HQ payoffs are:

$$EU_H^O = \frac{1}{8}\theta^2 h^2 + \frac{1}{4}\theta^2 p_0^2 - f_E - f^O + l \quad (12)$$

The line  $O_a$  in Figure 1 Panel A illustrates one possible relationship between HQ payoffs under outsourcing with no performance contracts and relationship productivity.

**b) The contract is structured to include performance incentives such that the entrepreneur exerts effort on all tasks:  $e = E$ .**

If effort is exerted, then the probability of high-quality supplier investment is  $p_E$ , and  $x_S$  is given by  $x_S = \frac{1}{2}\theta p_E$ . As above,  $x_H = \frac{1}{2}\theta h$ . The cost of effort is  $E$ , and a bonus payment is required,  $b^O$ . To ensure that the supplier's participation constraint is met:

$$0 \leq \frac{1}{2}[\theta (hx_H + x_S p_E)] - \frac{1}{2} (x_S)^2 - T^O + b^O p_E - E$$

where  $T^* = \frac{1}{4}\theta^2 h^2 + \frac{1}{8}\theta^2 p_E^2 + b^O p_E - E$  is the optimal transfer from HQ's point of view. If  $T^* > l$ , so that this optimal transfer exceeds the entrepreneur's capital constraint, then  $T^O = l$ , otherwise  $T^O = T^*$ .

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<sup>46</sup>Note that if the supplier does deviate, the marginal benefit of his own relationship-specific investment also changes, so a different level of  $x_S$  will be chosen. If the supplier deviates to  $e^k = E$ , re-solving the optimal  $x_S$  choice for the supplier gives:  $x_S^* = \frac{1}{2}\theta p_E$  ( $x_H$  will not change under this deviation).

HQ chooses  $b^O$  so that the supplier does not want to deviate and exert zero effort (and, hence, change the likelihood that his investment is high-quality, and thus his own relationship-specific investment level.) If the supplier deviates to  $e = 0$ , then resolving the optimal  $x_S$  choice for the supplier gives:  $x_S^* = \frac{1}{2}\theta p_0$ . To ensure incentive compatibility, not wanting to deviate to  $e^k = 0$  given  $T^O$  and  $x_H$  requires:

$$\frac{1}{4}[\theta^2 h^2 + \theta p_E^2] - \frac{1}{8}(\theta p_E)^2 - T^O + b^O p_E - E \geq \frac{1}{4}[\theta^2 h^2 + \theta^2 p_0^2] - \frac{1}{8}(\theta p_0)^2 - T^O + b^O p_0$$

This implies the following restriction on the relationship between the specified bonus, effort levels and the probability of high-quality  $x_S$ :

$$b^O (p_E - p_0) \geq E - \frac{1}{8}\theta^2(p_E^2 - p_0^2)$$

Therefore, HQ will set  $b^O$  at the lowest value that this inequality is satisfied, so:

$$b^O = \frac{E}{(p_E - p_0)} - \frac{\theta^2(p_E^2 - p_0^2)}{8(p_E - p_0)}$$

If the capital constraint does not bind, the expected bonus payment ( $b^O p_E$ ) drops out of the payoffs since the HQ can extract it from the supplier upfront. HQ's expected payoff is:

$$\begin{aligned} EU_H^O &= \frac{1}{2} \left[ \theta \left( h \frac{1}{2} \theta h + \frac{1}{2} \theta p_E^2 \right) \right] - \frac{1}{2} \left( \frac{1}{2} \theta h \right)^2 - b^O p_E - f_E - f^O + T^O + \theta^2 \\ &= \frac{3\theta^2}{8} (h^2 + p_E^2) - f_E - f^O - E \end{aligned}$$

and, in the event that the capital constraint binds, HQ's expected payoff is:

$$EU_H^O = \frac{1}{8}\theta^2 h^2 + \frac{1}{4}\theta^2 p_E^2 - p_E \left( \frac{E}{(p_E - p_0)} - \frac{\theta^2(p_E^2 - p_0^2)}{8(p_E - p_0)} \right) - f_E - f^O + l \quad (13)$$

The line  $O_b$  in Figure 1 Panel A illustrates one possible relationship between HQ payoffs under outsourcing with performance contracts and relationship productivity.

### **Finding $\theta$ above which performance incentives are included**

When expression (13) is greater than expression (12), HQ prefers the outsourcing contract that includes performance incentives—that is, prefers rent sharing through a bonus payment in order to

generate supplier effort. This is the case when:

$$\frac{1}{4}\theta^2 p_E^2 - p_E \left( \frac{E}{(p_E - p_0)} - \frac{\theta^2(p_E^2 - p_0^2)}{8(p_E - p_0)} \right) > \frac{1}{4}\theta^2 p_0^2$$

$$\frac{8p_E E}{(p_E^2 - p_0^2)(2(p_E - p_0) + 1)} < \theta^2$$

Hence, HQ chooses to include performance incentives and share rents with the supplier under outsourcing whenever the relationship productivity is sufficiently high—that is, when:

$$\theta > \sqrt{\frac{8p_E E}{(p_E^2 - p_0^2)(2(p_E - p_0) + 1)}} \quad (14)$$

We note that the range of  $\theta$  where inequality (14) holds is independent of the importance of HQ’s investment to output ( $h$ ), since  $x_H$  doesn’t change with the type of outsourcing contract that is chosen. The key factor here is the return to effort in terms of probability of high-quality supplier input and whether it is worthwhile for HQ to create incentives for the supplier to exert effort by sharing expected rents.

## Appendix B: Vertical integration equilibrium investment and effort levels

The utility functions for each party under vertical integration reflect the fact that HQ can monitor directly, and contract upon, the effort level exerted by the supplier on a fraction  $\delta$  of the required tasks. We denote  $p_m$  as the contribution made by the fraction  $\delta$  of monitorable tasks,  $e_m$ , to the probability that the supplier input is high-quality.  $p_n$  denotes the the equivalent for the fraction  $(1 - \delta)$  of non-monitorable tasks,  $e_n$ . In addition, there is no upfront transfer  $T^I$  from the supplier to HQ, to capture the intuition that HQ cannot specify a negative wage for a chain-employed property manager. The contract sets out the required effort level, and a bonus payment,  $b^I$ , to be paid if the manager’s investment is high-quality. As outlined above, the surplus generated,  $r^I$ , reflects the fact that HQ’s outside value is non-zero under vertical integration.

Under organizational form  $k = I$ , and using equation (4), HQ’s expected utility under vertical

integration is:

$$\begin{aligned}
EU_H^I &= y_H^I - \frac{1}{2}(x_H)^2 - f_E - f^I - b^I p(\cdot) \\
&= \frac{1}{2}[\theta(hx_H + \delta x_S p_m + (1 - \delta)x_S p_n) - \mu\theta(hx_H + \delta x_S p_m + (1 - \delta)x_S p_n)] \\
&\quad - \frac{1}{2}(x_H)^2 - f_E - f^I - b^I p(\cdot) + \mu\theta(hx_H + \delta x_S p_m + (1 - \delta)x_S p_n)
\end{aligned}$$

HQ chooses  $x_H$  to maximize this expected utility, given the terms of the agreed contract  $e_m$ , and hence  $p_m$ , and  $b^I$ . Solving this gives:  $x_H = \frac{1}{2}(1 + \mu)\theta h$ .

Under organizational form  $k = I$ , and using equation (4), the supplier's expected utility under vertical integration is:

$$\begin{aligned}
EU_S^I &= y_S^I - \frac{1}{2}(x_S)^2 + b^I p(\cdot) - e^I \\
&= \frac{1}{2}[\theta(hx_H + l\delta x_S p_m + l(1 - \delta)x_S p_n) - \mu\theta(hx_H + l\delta x_S p_m + l(1 - \delta)x_S p_n)] \\
&\quad - \frac{1}{2}(x_S)^2 + b^I p(\cdot) - e^I
\end{aligned}$$

The supplier chooses  $x_S$  and effort levels to maximize this expected utility. This gives:  $x_S = \frac{1}{2}(1 - \mu)\theta(\delta p_m + (1 - \delta)p_n)$ .

As under outsourcing, HQ's input,  $x_H$ , is independent of supplier input and effort, and supplier input,  $x_S$ , is an increasing function of supplier effort. The effort the manager exerts on monitored tasks is agreed to in the contract, but the manager can choose to exert a different amount of effort on the set of non-monitored tasks. There are, hence, four possible combinations of overall effort level that can be exerted. Contracts that generate these four possible combinations of overall effort are now outlined in turn:

**i) The contract is structured so that  $e_m = 0$  and  $e_n = 0$ .** No bonus payment is required since no effort is exerted on non-monitorable tasks. We know that  $x_H = \frac{1}{2}(1 + \mu)\theta h$ . If the manager exerts the desired effort, then  $x_S = \frac{1}{2}(1 - \mu)\theta(\delta p_0 + (1 - \delta)p_0)$ . Setting  $\bar{p} = (\delta p_0 + (1 - \delta)p_0)$  for

this scenario only, we can write  $x_S = \frac{1}{2}(1 - \mu)\theta\bar{p}$ . The manager's expected utility is:

$$\begin{aligned} EU_S^I &= Ey_S^I - \frac{1}{2}(x_S)^2 \\ &= \frac{1}{2}[\theta(hx_H + \delta x_S p_m + (1 - \delta)x_S p_n) - \mu\theta(hx_H + \delta x_S p_m + (1 - \delta)x_S p_n)] - \frac{1}{2}(x_S)^2 \\ &= \frac{1}{4}\theta^2(1 - \mu)\left[h^2(1 + \mu) + \frac{1}{2}(1 - \mu)\bar{p}^2\right] \end{aligned}$$

This expected payoff satisfies the participation constraint (because  $\bar{p}$  and  $\mu$  are between 0 and 1).

To ensure that the manager does not want to deviate and exert effort on  $e_n$ , we need that, for the range of  $\theta$  where this contract is preferred:  $E \geq \frac{\theta^2(1-\mu)^2}{8(1-\delta)}[\bar{p}_E^2 - \bar{p}^2]$ .

HQ's expected payoff is:

$$\begin{aligned} EU_H^I &= y_H^I - \frac{1}{2}(x_H)^2 - f_E - f^I - b^I p(\cdot) \\ &= \frac{1}{2}Er^I + OV_i^I - \frac{1}{2}(x_H)^2 - f_E - f^I - b^I p(\cdot) \\ &= \frac{\theta}{2}(1 + \mu)\left[h\frac{1}{2}(1 + \mu)\theta h + \frac{1}{2}(1 - \mu)\theta\bar{p}\bar{p}\right] - \frac{1}{2}\left(\frac{1}{2}(1 + \mu)\theta h\right)^2 - f_E - f^I \\ &= \frac{\theta^2 h^2}{8}(1 + \mu)^2 + \frac{\theta^2}{4}(1 + \mu)(1 - \mu)\bar{p}^2 - f_E - f^I \end{aligned}$$

**ii) The contract is structured so that  $e_m = 0$  and  $e_n = E$ .** In this case,  $p_m = p_0$  and  $p_n = p_E$ .

Let  $\bar{p} = (\delta p_0 + (1 - \delta)p_E)$ .  $x_H = \frac{1}{2}(1 + \mu)\theta h$ , and  $x_S = \frac{1}{2}(1 - \mu)\theta\bar{p}$ . A bonus payment is required to generate effort on non-monitorable tasks.

The bonus payment must ensure that the expected payoff to the manager is positive and that he doesn't want to deviate to  $e_n = 0$ . The expected payoff to the manager if he doesn't deviate is:

$$EU_S^I = \frac{1}{4}\theta^2(1 - \mu)\left[h^2(1 + \mu) + \frac{1}{2}(1 - \mu)\bar{p}^2\right] + b^I\bar{p} - (1 - \delta)E$$

If the manager were to deviate to  $e_n = 0$ , setting  $\bar{p}_0 = (\delta p_0 + (1 - \delta)p_0)$ , his expected payoff is:

$$EU_S^I = \frac{1}{4}\theta^2(1 - \mu)\left[h^2(1 + \mu) + \frac{1}{2}(1 - \mu)\bar{p}_0^2\right] + b^I\bar{p}_0$$

The lowest bonus payment at which positive effort is exerted on on non-monitorable tasks is: this inequality holds is:

$$b^I = \frac{(1 - \delta)E}{(\bar{p} - \bar{p}_0)} - \frac{\theta^2(1 - \mu)^2}{8(\bar{p} - \bar{p}_0)}[\bar{p}^2 - \bar{p}_0^2]$$

To ensure that the expected payoff to the manager is positive, given this bonus payment, we need:

$$EU_S^I = \frac{1}{4}\theta^2(1-\mu) \left[ h^2(1+\mu) + \frac{1}{2}(1-\mu)\bar{p}^2 \right] + \bar{p} \left[ \frac{(1-\delta)E}{(\bar{p}-\bar{p}_0)} - \frac{\theta^2(1-\mu)^2}{8(\bar{p}-\bar{p}_0)} [\bar{p}^2 - \bar{p}_0^2] \right] - (1-\delta)E > 0$$

Under our imposed assumptions, we can show that this holds for the range of  $\theta$  for which this contract yields the maximum expected payoff to HQ from vertical integration.

HQ's expected payoff is:

$$\begin{aligned} EU_H^I &= \frac{\theta}{2}(1+\mu)[hx_H + x_S\bar{p}] - \frac{1}{2}(x_H)^2 - f_E - f^I - b^I\bar{p} \\ &= \frac{\theta^2 h^2}{8}(1+\mu)^2 + \frac{\theta^2}{4}(1+\mu)(1-\mu)\bar{p}^2 - f_E - f^I - \bar{p} \left[ \frac{(1-\delta)E}{(\bar{p}-\bar{p}_0)} - \frac{\theta^2(1-\mu)^2}{8(\bar{p}-\bar{p}_0)} [\bar{p}^2 - \bar{p}_0^2] \right] \end{aligned}$$

(noting that the definition of  $\bar{p}$  differs from the previous scenario).

**iii) The contract is structured so that  $e_m = E$  and  $e_n = 0$ .** This is the contractual form of vertical integration that is the focus in the main body of the paper. No bonus payment is required in this case, since the desired effort can be monitored directly. We know that  $x_H = \frac{1}{2}(1+\mu)\theta h$ . If the manager exerts the desired effort, then  $x_S = \frac{1}{2}(1-\mu)\theta(\delta p_E + (1-\delta)p_0)$ . Setting  $\bar{p} = (\delta p_E + (1-\delta)p_0)$  for this case only, so  $x_S = \frac{1}{2}(1-\mu)\theta\bar{p}$ , the manager's expected utility is:

$$\begin{aligned} EU_S^I &= y_S^I - \frac{1}{2}(x_S)^2 - \delta E \\ &= \frac{1}{2}[\theta(hx_H + \delta x_S p_m + (1-\delta)x_S p_n) \\ &\quad - \mu\theta(hx_H + \delta x_S p_m + (1-\delta)x_S p_n)] - \frac{1}{2}(x_S)^2 - \delta E \\ &= \frac{1}{4}\theta^2(1-\mu) \left[ h^2(1+\mu) + \frac{1}{2}(1-\mu)\bar{p}^2 \right] - \delta E \end{aligned}$$

Our restrictions ensure that this expression is positive for the range of  $\theta$  where this contract is preferred. To ensure that the manager does not want to deviate and exert effort on non-monitorable tasks, we assume:  $E \geq \frac{\theta^2(1-\mu)^2}{8(1-\delta)} [\bar{p}_E^2 - \bar{p}^2]$ .

HQ's expected payoff is:

$$\begin{aligned}
EU_H^I &= y_H^I - \frac{1}{2}(x_H)^2 - f_E - f^I \\
&= \frac{1}{2}s^I + OV_i^I - \frac{1}{2}(x_H)^2 - f_E - f^I \\
&= \frac{1}{2}[\theta(hx_H + \delta x_S p_m + (1 - \delta)x_S p_n) - \mu\theta(hx_H + \delta x_S p_m + (1 - \delta)x_S p_n)] \\
&\quad - \frac{1}{2}(x_H)^2 - f_E - f^I + \mu\theta(hx_H + \delta x_S p_m + (1 - \delta)x_S p_n) \\
&= \frac{\theta^2 h^2}{8}(1 + \mu)^2 + \frac{\theta^2}{4}(1 + \mu)(1 - \mu)\bar{p}^2 - f_E - f^I
\end{aligned} \tag{15}$$

(noting that the definition of  $\bar{p}$  differs from the previous scenarios).

The line  $VI$  in Figure 1 Panel A illustrates one possible relationship between HQ's payoffs under this vertical integration contract and relationship productivity.

**iv) The contract is structured so that  $e_m = E$  and  $e_n = E$ .** In this case,  $p_m = p_E$  and  $p_n = p_E$ . Let  $\bar{p} = (\delta p_E + (1 - \delta)p_E)$ .  $x_H = \frac{1}{2}(1 + \mu)\theta h$ , and  $x_S = \frac{1}{2}(1 - \mu)\theta\bar{p}$ . The expected payoff to the manager if he doesn't deviate is:

$$EU_S^I = \frac{1}{4}\theta^2(1 - \mu) \left[ h^2(1 + \mu) + \frac{1}{2}(1 - \mu)\bar{p}^2 \right] + b^I\bar{p} - \delta E - (1 - \delta)E$$

If the manager were to deviate to  $e_n = 0$ , let  $\bar{p}_0 = (\delta p_1 + (1 - \delta)p_0)$ :

$$EU_S^I = \frac{1}{4}\theta^2(1 - \mu) \left[ h^2(1 + \mu) + \frac{1}{2}(1 - \mu)\bar{p}_0^2 \right] - \delta E + b^I\bar{p}_0$$

Thus, the lowest bonus payment required to ensure that the supplier does not deviate is: we need:

$$b^I = \frac{(1 - \delta)E}{(\bar{p} - \bar{p}_0)} - \frac{\theta^2(1 - \mu)^2}{8(\bar{p} - \bar{p}_0)} [\bar{p}^2 - \bar{p}_0^2]$$

The expected payoff to the manager is:

$$EU_S^I = \frac{1}{4}\theta^2(1 - \mu) \left[ h^2(1 + \mu) + \frac{1}{2}(1 - \mu)\bar{p}^2 \right] + \bar{p} \left[ \frac{(1 - \delta)E}{(\bar{p} - \bar{p}_0)} - \frac{\theta^2(1 - \mu)^2}{8(\bar{p} - \bar{p}_0)} [\bar{p}^2 - \bar{p}_0^2] \right] - \delta E - (1 - \delta)E$$

which our restrictions ensure is positive.

The expected payoff to HQ is:

$$\begin{aligned}
EU_H^I &= \frac{\theta}{2} (1 + \mu) [hx_H + x_S \bar{p}] - \frac{1}{2} (x_H)^2 - f_E - f^I - b\bar{p} \\
&= \frac{\theta^2 h^2}{8} (1 + \mu)^2 + \frac{\theta^2}{4} (1 + \mu) (1 - \mu) \bar{p}^2 - f_E - f^I - \bar{p} \left[ \frac{(1 - \delta) E}{(\bar{p} - \bar{p}_0)} - \frac{\theta^2 (1 - \mu)^2}{8(\bar{p} - \bar{p}_0)} [\bar{p}^2 - \bar{p}_0^2] \right]
\end{aligned}$$

(noting that the definitions of  $\bar{p}$  and  $\bar{p}_0$  differ from the previous scenarios).

## Appendix C: $\theta$ thresholds

Inequality (5) allows us to derive the value of  $\theta$  at which HQ is indifferent between an outsourcing contract with no performance incentives and vertical integration with contracted effort on monitorable tasks and no effort on non-monitorable tasks. This is denoted  $\underline{\theta}$ , and is given by:

$$\underline{\theta} = \sqrt{\frac{8(f^I - f^O + l)}{h^2(2\mu + \mu^2) + 2(1 - \mu^2)\bar{p}^2 - 2p_0^2}}$$

To facilitate later comparison, we will denote  $X = (f^I - f^O + l)$  and  $Z = h^2(2\mu + \mu^2)$ . So

$$\underline{\theta} = \sqrt{\frac{8Z}{Y + 2(1 - \mu^2)\bar{p}^2 - 2p_0^2}} \tag{16}$$

Under parameter values where the derivative in equation (6) is positive, so that vertical integration is increasingly preferred to outsourcing with no performance incentives at higher values of  $\theta$ , the denominator of equation (16) will also be positive. For  $\underline{\theta}$  to be positive, so that outsourcing with no performance contract is, nonetheless, preferred at low levels of productivity, it must be that  $f^I - f^O + l > 0$ . By assumption, vertical integration incurs a higher fixed cost than outsourcing, so this condition is satisfied for any positive value of  $l$ , the capital-constrained transfer payment from the third party to the firm.

Inequality (7) allows us to derive the value of  $\theta$  at which HQ is indifferent between an outsourcing contract with performance incentives to induce effort on all tasks and vertical integration with contracted effort on monitorable tasks and no effort on non-monitorable tasks. This is denoted  $\bar{\theta}$ , and is given by:

$$\bar{\theta} = \sqrt{\frac{8Z - 8\frac{p_E E}{(p_E - p_0)}}{Y - 2\left(p_E^2 - (1 - \mu^2)\bar{p}^2 + \frac{p_E(p_E^2 - p_0^2)}{2(p_E - p_0)}\right)}} \tag{17}$$

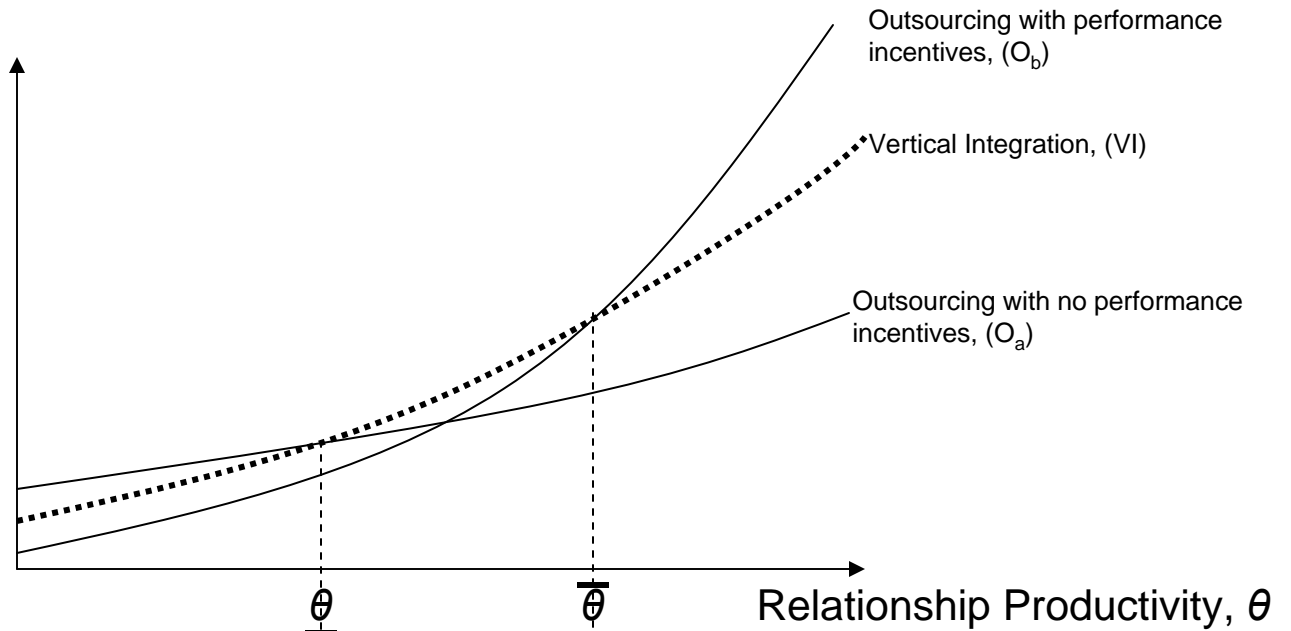
Under what conditions will  $0 < \underline{\theta} < \bar{\theta}$ , so that the relationship between productivity and HQ payoffs resembles Figure 1 Panel A? We know that if outsourcing is preferred to vertical integration at high levels of  $\theta$ , the denominator of equation (17) must be negative since only then will the derivative in equation (8) be positive. So, for  $\bar{\theta}$  to be positive, the numerator of equation (17) must be negative. There are reasonable parameter values for  $E$ ,  $f_I$ ,  $f_O$ ,  $l$ ,  $p_E$ , and  $p_0$ , such that the numerator of equation (17) is negative. This is when the relative fixed costs of vertical integration are positive, but not very large in comparison to the cost effectiveness of performance incentives in increasing the probability that the supplier's investment is high-quality.

When both  $\underline{\theta}$  and  $\bar{\theta}$  are positive,  $\bar{\theta}$  is greater than  $\underline{\theta}$  when the second term in the numerator of equation (17) is a large negative number and the denominator is a relatively small negative number. Intuitively, we require  $E$  to be large enough, relative to the effect of the performance incentive on third-party investment (which is increasing in productivity), for HQ to prefer bearing the increased fixed cost of vertical integration at relatively low levels of productivity. Figure 1 illustrates examples of the predicted relationship between payoffs to HQ and relationship productivity,  $\theta$ , (Panel A), and the implied relationship between  $\theta$  and HQ's preferred organizational form (Panel B), which are consistent with the non-monotonic relationship between  $\theta$  and the probability of vertical integration observed in the data for low- and medium-tier hotel brands.

# Figure 1: HQ Payoffs and Organizational Form Choice

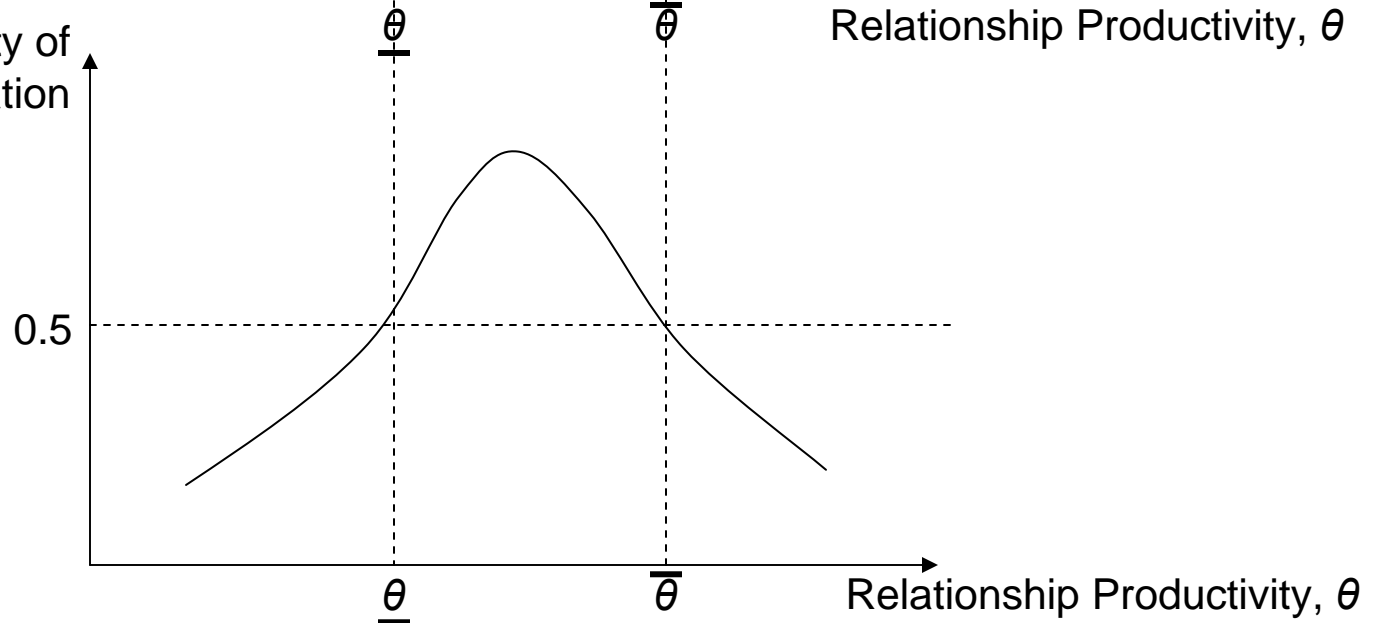
Panel A:

HQ Payoffs



Panel B:

Probability of Vertical Integration



**Table 1: Summary Statistics***Source: STR data*

Quality Tier	Property-level observations, averaged by property over monthly observations 2004-2009				
	Total	Upper Upscale	Upscale	Midscale	Economy
Number of brands with at least one franchised property and one chain managed property	38	9	10	13	6
Number of properties across all brands with at least one property of each organizational form	8616	1122	2405	3704	1385
Proportion of properties that are chain managed	30.0%	46.0%	22.7%	14.7%	70.6%
Mean property-level occupancy rate across all brands	64.6%	67.8%	68.0%	63.0%	60.6%
Standard deviation in occupancy rate across all brands	28.7%	9.5%	10.8%	12.2%	13.5%
Minimum monthly occupancy rate	10.1%	20.3%	18.9%	11.9%	10.1%
Maximum monthly occupancy rate	97.4%	90.5%	96.5%	97.4%	93.8%
Mean ADR across all brands, USD	93.11	138.52	108.02	86.41	48.34
Mean number of rooms	151	382	138	110	97

**Table 2: The Relationship between Organizational Form and Output**

**Panel A: Estimation Output**

	<b>Total</b>	<b>Upper Upscale</b>	<b>Upscale</b>	<b>Midscale</b>	<b>Economy</b>
Occupancy	31.20**	6.93	47.07**	40.25**	43.76**
Unclustered standard errors	(3.28)	(7.76)	(9.78)	(8.61)	(6.67)
Standard errors clustered at brand level	(6.34)	(8.11)	(11.23)	(11.58)	(12.62)
Occupancy Squared	-20.59**	-1.27	-32.28**	-26.50**	-31.55**
Unclustered standard errors	(2.54)	(5.98)	(7.14)	(6.70)	(5.36)
Standard errors clustered at brand level	(5.08)	(5.59)	(8.96)	(9.48)	(9.73)
Constant	-13.96**	-3.11	-20.81**	-17.70**	-14.26**
Unclustered standard errors	(1.14)	(2.44)	(3.50)	(2.80)	(2.13)
Standard errors clustered at brand level	(2.22)	(3.53)	(4.58)	(4.08)	(4.07)
N	8359	985	2037	3039	1005
Brand fixed effects	Y	Y	Y	Y	Y
City fixed effects	Y	Y	Y	Y	Y

+ p<0.1, \* p<0.05, \*\* p<0.01

**Panel B: Occupancy Rate where Predicted Probability of Chain Management is Highest, compared to Distribution of Occupancy Rate in Sample**

	<b>Total</b>	<b>Upper Upscale</b>	<b>Upscale</b>	<b>Midscale</b>	<b>Economy</b>
Occupancy Rate where Probability of Chain Management is Highest*	0.76	2.74	0.73	0.76	0.69
50th percentile of Occupancy Rate Distribution	0.66	0.69	0.70	0.65	0.61
90th percentile of Occupancy Rate Distribution	0.78	0.78	0.80	0.77	0.76
95th percentile of Occupancy Rate Distribution	0.81	0.81	0.82	0.80	0.81

\*This is the occupancy rate at which the first derivative of equation (10) with respect to occupancy is equal to zero.

**Table 3: Organizational Form, Occupancy, and State Marginal Corporate Tax Rate. Split Sample above and below Median Tax Rate**

**Panel A: Estimation Output**

Marginal Tax Rate	Total		Upper Upscale		Upscale		Midscale		Economy	
	<6.5%	>6.5%	<6.5%	>6.5%	<6.5%	>6.5%	<6.5%	>6.5%	<6.5%	>6.5%
Occupancy	26.39** (4.66)	35.98** (4.71)	-2.993 (10.81)	17.74 (12.21)	24.69+ (13.71)	64.03** (14.47)	41.38** (11.46)	39.68** (13.51)	43.02** (10.50)	49.14** (8.95)
Occupancy Squared	-16.97** (3.66)	-24.06** (3.60)	5.686 (8.55)	-8.342 (9.17)	-14.8 (10.27)	-45.17** (10.40)	-27.98** (8.99)	-25.15* (10.40)	-32.25** (8.65)	-34.58** (7.05)
Constant	-12.74** (1.88)	-15.68** (1.61)	0.537 (3.32)	-6.926+ (3.93)	-12.96** (4.65)	-39.26 (806.30)	-17.30** (3.83)	-18.04** (4.41)	-13.70** (3.20)	-16.62** (3.12)
N	3676	4471	406	550	896	1106	1382	1466	411	538
Brand fixed effects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
City fixed effects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Unclustered standard errors in parentheses.  
+ p<0.1, \* p<0.05, \*\* p<0.01

**Panel B: Occupancy Rate where Predicted Probability of Chain Management is Highest, compared to Distribution of Occupancy Rate in Sample**

Marginal Tax Rate	Total		Upper Upscale		Upscale		Midscale		Economy	
	<6.5%	>6.5%	<6.5%	>6.5%	<6.5%	>6.5%	<6.5%	>6.5%	<6.5%	>6.5%
Occupancy Rate where Probability of Chain Management is Highest*	0.78	0.75	0.26	1.06	0.83	0.71	0.74	0.79	0.67	0.71
50th percentile of Occupancy Rate Distribution	0.66	0.67	0.69	0.69	0.69	0.70	0.65	0.65	0.61	0.63
90th percentile of Occupancy Rate Distribution	0.78	0.79	0.78	0.78	0.79	0.81	0.77	0.77	0.74	0.78
95th percentile of Occupancy Rate Distribution	0.80	0.82	0.81	0.81	0.81	0.83	0.79	0.80	0.78	0.83

\*This is the occupancy rate at which the first derivative of equation (10) with respect to occupancy is equal to zero. When the estimated occupancy coefficient is negative but the coefficient on occupancy squared is positive (as is the case for low tax rate upper upscale properties), this is the occupancy rate where the probability of chain management is minimized.

**Table 4: Organizational Form, Occupancy, and State Marginal Corporate Tax Rate, including Interactions.**

**Panel A: Estimation Output**

	<b>Total</b>	<b>Upper Upscale</b>	<b>Upscale</b>	<b>Midscale</b>	<b>Economy</b>
Occupancy	32.49** (7.60)	-0.373 (17.91)	0.365 (17.32)	50.29** (16.24)	56.30** (17.32)
Occupancy Squared	-21.36** (5.93)	1.501 (14.39)	3.839 (12.95)	-34.75** (12.78)	-43.85** (14.03)
Marginal Corporate Tax Rate	5.4 (35.50)	-57.4 (83.90)	-275.6** (94.12)	44.03 (81.54)	45.61 (74.93)
Occupancy x Marginal Tax Rate	-21.8 (110.80)	140.7 (266.50)	766.0** (273.90)	-189.1 (256.70)	-181.9 (242.70)
Occupancy Squared x Marginal Tax Rate	12.88 (85.85)	-63.27 (211.20)	-589.2** (200.90)	155 (201.00)	182.1 (195.60)
Constant	-14.29** (2.46)	0.117 (5.57)	-4.131 (5.87)	-20.06** (5.17)	-17.28** (5.28)
N	8359	985	2037	3039	1005
Brand fixed effects	Y	Y	Y	Y	Y
City fixed effects	Y	Y	Y	Y	Y

Unclustered standard errors in parentheses  
+ p<0.1, \* p<0.05, \*\* p<0.01

**Panel B: Occupancy Rate where Predicted Probability of Chain Management is Highest, compared to Distribution of Occupancy Rate in Sample**

**Panel B: Occupancy Rate where Predicted Probability of Chain Management is Highest at the 10th and 90th percentile of the State Marginal Corporate Tax Rate Distribution**

	<b>Total</b>	<b>Upper Upscale</b>	<b>Upscale</b>	<b>Midscale</b>	<b>Economy</b>
Occupancy Rate where Probability of Chain Management is Highest at 10th Percentile Tax Rate*	0.76	0.00	-0.51	0.73	0.64
Occupancy Rate where Probability of Chain Management is Highest at 90th Percentile Tax Rate*	0.76	1.45	0.70	0.81	0.73

Notes:  
The 10th percentile tax rate is 0.003, the 90th percentile tax rate is 0.094.  
The coefficient on the marginal corporate tax rate is identified using within-MSA variation where the MSA spans state boundaries.

\*This is the occupancy rate at which the first derivative of equation (11) with respect to occupancy is equal to zero. In the cases of the upper upscale and upscale tiers, the signs on the estimated coefficients show us that this is the occupancy rate where the probability of chain management is minimized.

**Table 5: Organizational Form and Occupancy, controlling for Age of Property.**

**Panel A: Estimation Output**

	<b>Total</b>	<b>Upper Upscale</b>	<b>Upscale</b>	<b>Midscale</b>	<b>Economy</b>
Occupancy	27.88**	-0.51	39.15**	31.58**/*	42.11**
Unclustered standard errors	(3.36)	(8.05)	(10.30)	(9.09)	(6.95)
Occupancy Squared	-18.34**	3.76	-27.36**	-20.50**/*	-29.54**
Unclustered standard errors	(2.60)	(6.17)	(7.52)	(7.08)	(5.62)
Age of Property	0.926**	0.50**	1.096**	2.013**	0.769**
Unclustered standard errors	(0.04)	(0.08)	(0.08)	(0.15)	(0.09)
Constant	-14.34**	-1.39	-18.39**	-17.83**	-15.46**
Unclustered standard errors	(1.17)	(2.52)	(3.69)	(2.99)	(2.25)
N	8359	985	2037	3039	1005
Brand fixed effects	Y	Y	Y	Y	Y
City fixed effects	Y	Y	Y	Y	Y

+ p<0.1, \* p<0.05, \*\* p<0.01

**Panel B: Occupancy Rate where Predicted Probability of Chain Management is Highest, compared to Distribution of Occupancy Rate in Sample**

	<b>Total</b>	<b>Upper Upscale</b>	<b>Upscale</b>	<b>Midscale</b>	<b>Economy</b>
Occupancy Rate where Probability of Chain Management is Highest*	0.76	0.07	0.72	0.77	0.71
50th percentile of Occupancy Rate Distribution	0.66	0.69	0.70	0.65	0.61
90th percentile of Occupancy Rate Distribution	0.78	0.78	0.80	0.77	0.76
95th percentile of Occupancy Rate Distribution	0.81	0.81	0.82	0.80	0.81

*\*This is the occupancy rate at which the first derivative of equation (10) (including property age) with respect to occupancy is equal to zero. When the estimated occupancy coefficient is negative but the coefficient on occupancy squares is positive (as is the case for the upper upscale properties), this is the occupancy rate where the probability of chain management is minimized.*

**Table 6: The Relationship between Organizational Form and Output. A Subsample of MSAs with at least 40 Properties.**

**Panel A: Estimation Output**

	<b>Total</b>	<b>Upper Upscale</b>	<b>Upscale</b>	<b>Midscale</b>	<b>Economy</b>
Occupancy	25.32**	3.305	43.39**	35.32**	32.15**
Unclustered standard errors	(3.57)	(7.54)	(10.52)	(9.20)	(6.61)
Occupancy Squared	-16.26**	1.243	-29.76**	-22.71**	-23.12**
Unclustered standard errors	(2.76)	(5.84)	(7.67)	(7.13)	(5.37)
Constant	-11.67**	-1.874	-19.21**	-15.88**	-10.22**
Unclustered standard errors	(1.24)	(2.35)	(3.74)	(3.00)	(2.12)
N	5624	873	1567	2320	764
Brand fixed effects	Y	Y	Y	Y	Y
City fixed effects	Y	Y	Y	Y	Y

+ p<0.1, \* p<0.05, \*\* p<0.01

**Panel B: Occupancy Rate where Predicted Probability of Chain Management is Highest, compared to Distribution of Occupancy Rate in Sample**

	<b>Total</b>	<b>Upper Upscale</b>	<b>Upscale</b>	<b>Midscale</b>	<b>Economy</b>
Occupancy Rate where Probability of Chain Management is Highest*	0.78	-1.33	0.73	0.78	0.70
50th percentile of Occupancy Rate Distribution	0.66	0.69	0.70	0.65	0.61
90th percentile of Occupancy Rate Distribution	0.78	0.78	0.80	0.77	0.76
95th percentile of Occupancy Rate Distribution	0.81	0.81	0.82	0.80	0.81

*\*This is the occupancy rate at which the first derivative of equation (10) with respect to occupancy is equal to zero. When the estimated coefficients on occupancy rate and occupancy rate squared are both positive (as is the case for the upper upscale properties), this is the occupancy rate where the probability of chain management is minimized.*