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Pricing Variation Within Dual-Distribution Chains: The Different Implications of Externalities and Signaling for High- and Low-Quality Brands

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Abstract. Within many of the multioutlet branded chains that dominate the retail and services landscape, the organizational form (e.g., company management, franchising) used to manage an outlet varies from site to site, as do the prices charged at those sites. I propose that organizational form and prices may be systematically related as a result of brand externalities. In particular, I develop logic that the relevant form of externality should differ for upper quality tier brands and lower tier brands. Using panel data on price and organizational form from more than 6,700 branded U.S. hotels affiliated with 40 “dual-distribution” brands—those brands that simultaneously company manage and franchise individual outlets—I find that, consistent with the brand externality arguments, company-managed locations have higher prices within high-quality chains, whereas franchisees price higher in the lower tiers.

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Keywords: organizational studies • strategy • hotel • motel • pricing • brand externality • signaling

1. Introduction

The institution of “dual distribution”—that is, a firm’s simultaneous use of a vertically integrated channel and a contractually based channel to distribute and sell its goods or services—continues to grow across the manufacturing, retail, and service sectors. Dual distribution manifests itself as a mix of house accounts and independent sales “reps” in the case of manufacturing for industrial customers (e.g., Anderson 1985, 1988; Dutta et al. 1995), company-owned fleets of vehicles mixed with independently owned fleets in car leasing (Pierce 2012) or passenger airlines (Forbes and Lederman 2009), company fleets mixed with individual vehicles owned by the operators within taxicab service firms (Rawley and Simcoe 2010, 2013) and long-haul trucking carriers (Baker and Hubbard 2003), and a mix of company-managed outlets and franchised outlets or authorized resellers in the case of service and retail chains (e.g., Brickley and Dark 1987, Fladmoe-Lindquist and Jacque 1995, Kalnins 2004, Kalnins and Mayer 2004, Lafontaine 1995). The emergence of online distribution over the last decade has further increased the ubiquity of dual distribution by giving manufacturing firms a newfound ability to sell directly to consumers. Given the large size and continued growth of the retail sector, the service sector, online commerce, franchising, and chain organizations (e.g., Foster et al. 2006), dual distribution is likely to become even more prevalent in the future.

One major strategic implication of dual distribution, important to academics, policy makers, and practitioners, is that pricing may systematically vary based on the form of distribution, even for identical goods or services of the same brand. Although many published studies have found effects of organizational form on price, these results may appear surprising. Even if a market is not perfectly competitive, the Coase (1960) theorem suggests that, in the absence of noncontractible externalities, an outlet’s organizational form should not prevent any profit-maximizing choices from being made there. As long as the two parties can write and enforce appropriate contracts, there should be no motivation for franchisees to charge different prices than would the franchisor at otherwise identical same-brand outlets.

Furthermore, the direction of the effect in previous work has not been consistent, possibly because scholars have implicitly assumed a constant effect across all levels of product/service quality by pooling the outlets of different quality tiers in their analyses. On the one hand, Lafontaine (1995), Muris et al. (1992), Shepard (1993), Blass and Carlton (2001), and Slade (1998) found that franchisees typically price higher among fast-food chains, cola distributors, gasoline stations, and pubs, respectively. On the other hand, Celen and Thomas (2009) found that the franchisees price lower among upper tier hotels. Vroom and Gimeno (2007), Kosová et al. (2013), and Zhang et al. (2015) found a small

negative, a null, and a positive relationship, respectively, between franchisee management and price in aggregated samples of hotels that include all quality tiers. None of these studies considers the possibility that the relationship between price and organizational form may vary based on firm-level attributes such as brand quality. More generally, the possibility that positive and negative price-based brand externalities can coexist within the same industry—if at different tiers of quality—does not appear to have been considered in any academic literature.

In this study I present the argument that brand quality is likely to be an omitted moderating variable that helps explain these mixed findings, and I propose a theoretical reconciliation by emphasizing brand externalities. Externalities are said to exist when the attributes of one unit of a brand's good or service will affect the brand's demand as a whole, positively or negatively. In the context of multioutlet branded chains, the presence of a price-based brand externality implies that the prices chosen by managers at one outlet will affect demand at other same-brand outlets. I then develop logic based on the signaling literature (e.g., Bagwell and Riordan 1991, Benabou 1993) for the moderating role of brand quality. Different forms of signaling and, thus, different forms of price-based brand externality will be relevant for high- and low-quality brands. If a high-quality brand is attempting to benefit from a brand externality, my arguments below suggest that we should observe company managers setting prices higher than their brand's franchisees. Company managers at the outlets of lower-quality brands are also likely to set prices with future brandwide demand in mind. However, they should be observed pricing lower than franchisees.

I analyze price and organizational form data from more than 6,700 branded U.S. hotels affiliated with 40 brands that simultaneously franchise and company manage their properties. Consistent with the signaling and brand externality arguments, company-managed locations exhibit higher prices within high-quality chains, whereas franchisees price higher in the lower tiers. The findings of this paper are not only consistent with the presence of brand externalities but also help refute possible alternative explanations for correlations of price and organizational form that appeared plausible based on past empirical results. These explanations include double marginalization, organizational form-based cost differences, intrabrand competition, and issues of selection. Unlike the signaling and brand externality arguments, which have different implications for organizational form-based price variation based on brand quality, these alternative explanations have similar implications across all quality levels.

The rest of this paper is organized as follows. In §2 I analyze a mathematical model that relates brand externalities to franchisor and franchisee pricing. I then integrate signaling theories with the intuition of the formal model to deduce why brand quality should moderate the relationship between price and organizational form. Section 3 describes the data and interviews with hotel managers that support the hypotheses of signaling. Section 4 describes the methods. Section 5 presents the results of pricing regressions from upper-tier and lower-tier dual-distribution chains. An instrumental variable is used to reduce the effects of endogeneity of organizational form. Section 6 concludes.

2. Brand Externalities and Signaling by Multioutlet Chains

2.1. A Model of Price-Based Brand Externalities

A brand externality is said to exist when the attributes of one unit of a brand's good or service affects demand for the brand as a whole. I formalize this definition in a simple model. The model shows that the presence of a positive price-based externality will lead to higher prices at the franchisor's company-managed outlets, and that a negative externality will lead to higher prices at franchised outlets.

A demand curve for a product market with a price-based brand externality can be written as

$$Q_i = a - bP_i + dP_j, \quad \text{for } i, j = cm, f, \quad (1)$$

where f and cm are two outlets of the same brand in two different geographic markets. Outlet f is operated by a franchisee, whereas outlet cm is company-managed by the brand-owning franchisor. There is no direct competition between the two outlets, which are monopolies within their own territories. Although the monopoly assumption is analytically convenient, incorporating market power into the model is warranted. Brands are specifically used to differentiate goods from those of the competition, and differentiation provides an ability to raise prices above marginal cost (see, e.g., Porter 1980). In perfectly competitive markets, brand externalities would not exist.

In the presence of a brand externality, customer demand will depend on the prices at both outlets. Equation (1) separates an outlet's own-price effect, b , from d , the externality (other-price) effect. While b is strictly positive, because demand decreases in an outlet's own price, the externality term d can be either positive or negative. Further, I assume $-b < d < b$; it would be difficult to imagine an externality so powerful that it would have a slope, positive or negative, with an absolute value greater than or equal to that of the downward slope of an outlet's own price. The separation of b and d , with b strictly positive and larger in absolute magnitude, is consistent with Pollak's (1977)

well-accepted formalization of price-dependent preferences, of which brand externalities are one source. Pollak emphasized that price-dependent preferences do not imply an upward-sloping demand (a negative b) in an outlet's own current price, a claim that had been made in earlier work.

Pricing decisions are made simultaneously by the franchisee and the franchisor company. The price chosen by the franchisee reflects the fact that she receives residual profits only from her outlet, after paying costs cQ_f , with constant marginal cost c , and after paying a portion of profits or revenues as a royalty to the franchisor. Assuming the franchisee pays a profit royalty k , where $0 < k < 1$, the franchisee's profit function can be written as

$$\Pi_f = (1 - k)(P_f - c)(a - bP_f + dP_{cm}).$$

By contrast, the franchisor makes pricing decisions with brandwide demand in mind because he receives $(k/(1 - k))\Pi_f$ in addition to the profits from the outlet he company-manages. The franchisor's profit function can be written as

$$\Pi_{cm} = (P_{cm} - c)(a - bP_{cm} + dP_f) + k(P_f - c)(a - bP_f + dP_{cm}).$$

After solving the standard first-order conditions, the equilibrium prices for the franchisee-managed and company-managed outlets are, respectively,

$$P_f = \frac{(a + bc)(2b + d) - cd^2k}{4b^2 - d^2(1 + k)} \quad \text{and} \\ P_{cm} = \frac{(a + bc)(2b + d) + dk(a - bc)}{4b^2 - d^2(1 + k)}.$$

The difference between the two prices can be written as

$$P_f - P_{cm} = \frac{-dk(a - bc + dc)}{4b^2 - d^2(1 + k)}. \quad (2)$$

Important conclusions emerge from an analysis of Equation (2). Because the denominator is always positive in the range of analysis, the numerator alone determines the sign of $P_f - P_{cm}$. When $k = 0$ or $d = 0$, both parties will price identically. Without any royalty or externality, there is no reason for prices to differ based on organizational form.

In the most general and realistic case, the franchisor receives a positive royalty k from the franchisee, and there is some form of externality present ($d \neq 0$). I state a necessary lemma.

Lemma 1. *The inequality $a - bc + dc > 0$ will hold if and only if positive quantities will be sold at the outlets at positive prices in a profit-maximizing equilibrium. (See Appendix A for proof.)*

The intuition behind this lemma is that if $a - bc + dc < 0$, then costs will be greater than equilibrium prices at the two outlets. Its importance is that, even within the range of $-b < d < b$, I do not need to consider any values of d where $a - bc + dc < 0$, because an equilibrium will consist of "profits" generated by negative sales. As long as $a - bc + dc > 0$, the numerator of Equation (2) necessarily takes a sign opposite to that of the externality. Given the positive denominator, the logic is now complete.

Proposition 1. *If the franchisor and franchisee are both selling positive quantities at a positive price at their respective outlets (i.e., the lemma holds) and if the royalty is based on franchisee profit, (1) positive externalities ($d > 0$) necessarily lead to profit-maximizing equilibria where the franchisee sets prices lower ($P_f - P_{cm} < 0$), while (2) negative externalities ($d < 0$) necessarily lead to higher franchisee prices ($P_f - P_{cm} > 0$).*

If royalties are based on revenues instead of profit, then a narrow range of a positive externality exists, $0 \leq d \leq 2b^2c/(a - ak + 2bc)$, where $P_f - P_{cm} > 0$. If $d > 2b^2c/(a - ak + 2bc)$, then the franchisor will price higher than the franchisee, just like in the case of the profit royalty. Negative externalities always lead to $P_f - P_{cm} > 0$, also just like the case of the profit royalty. See Appendix B for proof.

2.2. Mechanisms That Induce Externalities

Credible mechanisms exist that generate positive and negative externalities ($d > 0$ and $d < 0$, respectively, in Equation (1)) in product markets with branded chains. Difficulty of ex ante quality evaluation can generate a positive price-based brand externality. In such product markets, high prices may credibly assure customers of quality. In the signaling literature, innately high-quality firms will set prices in equilibrium above a full-information monopoly price in order to credibly signal high costs (Bagwell and Riordan 1991). However, agents such as franchisees will have little incentive to raise prices for this reason. Franchisees do not earn more if customers are willing to pay more at same-brand outlets that they do not own. But the franchisees are likely to earn more if they can lower their price from these supramonopoly levels in order to increase the quantities sold at their own outlet.

In a related signaling literature, Milgrom and Roberts (1986) show that, given repeat customers, a combination of high prices and dissipative advertising, referred to as "money burning," signals quality across a range of cost structures. In such models, the tendency of an agent to price lower is more indirect than in the model of Bagwell and Riordan (1991). However, one could reasonably infer that an agent who receives no reward for performance of the brand other than that at his or her own outlet might "burn" less money and perhaps set prices lower as a result.

The presence of search costs in a product market can also generate a price-based brand externality, but a negative one. Benabou (1993) presents an analytical model where consumers incur costs to ascertain prices of different sellers and repeatedly purchase a product. In equilibrium, consumers will consistently patronize one firm after a thorough initial search, as long as the firm does not surprise them by raising prices. Firms will strive to keep consistent low prices so as not to alienate customers and will earn positive profits by doing so. Barron and Umbeck (1984) and Blair and Kaserman (1994) highlight this mechanism in their models of a negative brand externality for the case of franchised chains. Frequently observed low prices at outlets of a brand will convince consumers that they can save search costs by simply continuing to patronize that brand, regardless of location. High prices will make consumers “shy away from the other outlets of the same franchise system” (Blair and Kaserman 1994, p. 324). But agents such as franchisees may be indifferent to whether customers shy away from outlets that they do not own; they will likely price higher than company managers to increase revenues at their own outlet.

2.3. Relating Positive and Negative Externalities to Quality of Brand

The positive brand externality ($d > 0$ in Equation (1)), which provides incentives for the franchisor to set prices at a higher level than franchisees, is likely most relevant for high-quality brands. First, the signaling models for product markets with difficult ex ante quality evaluation show that high-quality firms are the ones that will enjoy a price premium in equilibrium. Further, Tirole (1988) states that consumers will often use a brand name as a basis to transfer experiences about price and quality. This suggests that the signaling effect of high prices is consistent with the role of the externality term d in Equation (1).

Further, the difficulty of ex ante quality evaluation, the key assumption underlying the need to signal quality via price, is pronounced in service contexts with few tangible search characteristics of the service itself (Nelson 1970). And this argument applies most strongly to the case of high-quality goods and services, because the services there are the most intangible (McColl-Kennedy and White 1997). Finally, Mazzeo (2004) presents empirical evidence from the lodging industry that wealthy customers are most likely to value signals of quality, also suggesting that this form of externality is particularly salient for the upper tiers of quality. Thus we might expect $d > 0$ for high-quality brands.

Testable Hypothesis 1. *The prices at outlets of high-quality brands will be higher at company-managed outlets than at franchised outlets.*

I argue that the models of a negative price-based brand externality (Benabou 1993, Blair and Kaserman 1994) where consumers repurchase from the same firm as a result of costly search are likely most applicable to the lower quality tiers. Although this logic could plausibly hold for all quality levels, customers with low incomes are most likely to patronize the lower quality tiers, and they are the most concerned with finding low prices (Ainslie and Rossi 1998). A widely circulated lodging industry white paper on pricing confirms this point by concluding that “customers of economy hotels are quite sensitive even to small price increases” (Enz et al. 2004, p. 24). Finally, low-quality goods and services are less likely to possess attributes that can differentiate them in the eyes of customers. Low pricing, when combined with cost reduction, becomes a particularly appealing strategy for the lower tiers (Porter 1980). For these reasons, by pricing lower at company-managed outlets, the lower-tier franchisor will increase the likelihood that price-sensitive customers will patronize other outlets of the brand, but franchisees will have no incentive to lower price for this reason. The externality d is thus likely to be less than zero for the lower tiers, leading to higher franchisee prices.

Testable Hypothesis 2. *The prices at outlets of lower-tier brands will be lower at company-managed outlets than at franchised outlets.*

2.4. Potential Alternative Explanations for a Relationship Between Price and Organizational Form

Potential alternative mechanisms exist that may generate an observed correlation between organizational form and price. These are (1) double marginalization, (2) cost differences resulting from the two organizational forms, (3) intrabrand competition, and (4) selection. The first three must be refuted logically based on empirical evidence; the fourth can be controlled for via specific methods.

2.4.1. Double Marginalization. As discussed by Lafontaine (1995), franchisees with some pricing power are likely to build a margin into their price, on top of the margin that the franchisor earns through the receipt of franchisee royalties and fees. By contrast, the franchisor is the only one adding a margin at company-managed outlets, which may result in $P_f - P_{cm} > 0$. Double marginalization has become, to some degree, the explanation of choice in the existing literature on franchise versus company-managed outlet pricing (see, e.g., Lafontaine and Slade 2007 for a review). However, a report of 93 U.S. hotel brands shows that royalty rates are very similar for both the upper and lower quality tiers (Rushmore et al. 2009). Thus, the double marginalization prediction would be the same as Hypothesis 2 but would be the opposite of Hypothesis 1.

2.4.2. Relative Cost Differences of Company Management and Franchising. Consistent with agency-theoretic arguments for franchising (e.g., Mathewson and Winter 1985), Shelton (1967) showed that restaurants had lower costs under periods of franchisee ownership than those same restaurants did under periods of company management, likely because there is often an on-site recipient of residual profits at franchised locations. Relatedly, Krueger (1991) found that company-managed fast-food outlets pay higher wages. If the brand name affords the outlet managers some pricing power, company-managed outlets may indeed charge more than franchisees to make up for higher costs.

Similarly, academics have long recognized that brands may enjoy a quality externality. In other words, production of a higher-quality product or service today will increase future demand for the brand (e.g., Nelson 1970). One well-accepted implication is that franchisees and independent distributors will often free ride on the quality of the brand because they only keep profits from the business they generate (e.g., Klein 1980, Blair and Kaserman 1994). In contrast to price-based brand externalities, franchisees across all quality tiers could be expected to underprovide quality relative to the company-managed outlets. For this reason, costs would likely be lower for franchisees, and, particularly in the presence of competition, this could lead to company-managed outlets charging more than franchisees to make up for higher costs. Regardless of the exact source, the implications of the above logics would be consistent with Hypothesis 1 but would imply the opposite of Hypothesis 2.

On the other hand, a central company such as a corporate franchisor often shares knowledge and capabilities with company-managed outlets (Kalnins and Mayer 2004, Parmigiani and Holloway 2011, Rawley and Simcoe 2013). Alles and Dattar (1998) argue that, if so, a company-managed outlet may in fact operate more efficiently and behave more competitively in terms of low pricing. Thus we might see lower prices at company-managed outlets relative to franchised outlets.

Further, because franchised hotels are more common than company-managed hotels in lower tiers, and company-managed hotels are more common in the upper tiers, we might conjecture that the higher proportion suggests relative efficiency. For example, the capabilities needed for lower tiers, such as frugality, may be easier to accomplish for franchisees than for company-managed outlets, whereas the capabilities necessary in the upper quality tiers, such as sophisticated service, training, and pricing, can be best developed within larger corporations. Therefore, costs may be lower for franchised outlets than for company-managed outlets in the low segments, and

thus $P_f - P_{cm} > 0$, whereas costs would be lower for company-managed outlets in the high segments, suggesting $P_f - P_{cm} < 0$. The implications of these logics would suggest exactly the opposite of both Hypotheses 1 and 2.

2.4.3. Strategic Delegation and Intra-brand Competition. Baye et al. (1996) have shown theoretically that chain firms may use franchising as a means of ensuring that their outlets act as “tough” Cournot competitors. The mechanism is that franchisees view same-brand outlets owned by others as competition. In terms of hotel development, this would suggest that franchised properties are likely to be built closer to each other and have more rooms than company-managed properties. For these reasons, in turn, prices could be lower at franchisee-managed properties.

Consistent with these theoretical arguments, Kalnins (2004) showed empirically that the revenues of a franchised hotel go down when a proximate property switches from another brand to its brand, but no such effect among company-managed properties was found. A likely explanation is that because company-managed outlets of dual-distribution brands often neighbor other company-managed locations (Kalnins and Lafontaine 2004), they may not face the same competitive intensity as their franchisee-managed counterparts, who often neighbor franchised locations owned by other franchisees. For these reasons, it might follow that $P_f - P_{cm} < 0$, consistent with Hypothesis 1 but the opposite of Hypothesis 2.

However, intra-brand competition is a phenomenon that may be more relevant to lower tier hotels because there are far more hotels within the largest lower tier chains than within upper tier chains, and thus the individual lower tier properties are more likely to be spatially proximate to others of the same brand. The lower tier brand Motel 6 has 576 properties for example. By contrast, Marriott is the largest upper tier brand, with 253 properties. Other upper tier brands such as Hilton and Sheraton have 173 and 117 properties, respectively, suggesting fewer opportunities for intra-brand competition.

Based on these arguments, if intra-brand competition were a primary mechanism that affected prices, we should observe lower franchisee prices primarily within the lower tier chains. These arguments would suggest exactly the opposite of Hypotheses 1 and 2.

2.4.4. Selection. Strategic choices are often endogenous to expected performance (Shaver 1998). For example, Martin (1988) and Chaudhuri et al. (2003) applied Akerlof's (1970) market for lemons argument to franchising and argued that franchisors select the least risky and most profitable outlets for themselves. This behavior could yield a noncausal positive correlation of company management and prices. Alternatively, franchisor executives have stated that they sometimes open

multiple outlets simultaneously in the same large market, and that a combination of franchisee and company management may be required to accomplish this, as a result of both parties' limited resources (see Bradach 1998, p. 75). Franchisors might select company management for sites within the market that they believe will be successful in the long term but that no franchisees are willing to invest in at the time of opening, leading to at least a temporary negative correlation of company management and prices.

Unlike the other potential alternative explanations, the effects of endogeneity as a result of selection can be reduced methodologically, using instrumental variable regressions. I employ this method below.

2.4.5. Combination of Potential Alternative Explanations. In sum, these potential alternative explanations are all individually inconsistent with the brand externality and signaling hypotheses, but plausibly, they could be combined in a way to generate the equivalents of Hypotheses 1 and 2. However, as stated in §2.4.2, the upper tier chains utilize the highest level of company management, suggesting that possible cost inefficiencies of company management would unlikely be greatest for those chains. Further, as noted in §2.4.3, intrabrand competition is primarily a problem for the lower quality tiers with their large number of proximate locations. Thus, both existing explanations that suggest lower franchisee prices should operate primarily in the lower quality tiers, in contrast to the brand externality or, signaling prediction of $P_f - P_{cm} > 0$ in these tiers. For these reasons, combinations of the existing theories do not appear capable of mimicking Hypotheses 1 or 2.

3. Research Setting and Data

3.1. Research Setting: Branded Chain Hotels

I analyze branded chain hotels in this study, because price-based brand externalities likely play an important role in this industry. The difficulty of an ex ante quality evaluation is pronounced in service contexts, such as hotels, with few tangible search characteristics of the service itself (Nelson 1970, Parasuraman et al. 1985). Thus, externality and signaling models are likely to be relevant. Further, the natural price variation from location to location based on costs and demand makes externalities more difficult to control by the franchisor. Tactics such as heavily advertised uniform "suggested prices," very common in fast food, for example (see, e.g., Kalnins 2003), would be less effective among chain hotels. And, finally, Wittrock and Johnson (2009) state that independent price setting remains the norm among franchisees within multioutlet chains, despite the repeal of federal resale price maintenance laws, because dual-distribution franchisors are viewed as "competitors" of their franchisees and thus can be

accused of price fixing if they dictate prices to franchisees, or even if they attempt to coordinate prices with franchisees contractually. Thus, the price-based brand externalities cannot be contracted away in the sense of the Coase (1960) theorem, as mentioned in the introduction.

3.2. Conversations with Hotel General Managers

To confirm the potential effect of positive and negative price-based externalities, I conducted 12 telephone interviews with general managers of franchised hotel properties across the United States. Six were in the upper quality tiers and six in the lower tiers. I avoided leading questions and simply asked about their experience regarding the role of the franchisor in their pricing decisions. Five of six lower tier managers made statements along the lines that the franchisor "tries to keep prices as steady as possible so that people know what to expect" and that "we [the brand] want to be known as having the lowest price." Although they usually follow the franchisor's lead in pricing, they pointed out times when they do not. One property manager stated that "for the last several years the company [the franchisor] has wanted the price to be \$39.95. With our new Internet traffic they are okay with \$49.95. We do that but if there is a big race weekend, we raise the price to, say, \$59.95." Another stated, "Some of our owner's other properties get \$80 per night because of the oil boom in their area. Corporate [the franchisor] would like his prices lower but he says, 'Why? We can get it and the hotels still fill up.'" These statements collectively support the idea of a *negative* price-based externality in the lower tiers. These franchisors want to be known for their consistent, low prices, as in Benabou's (1993) signaling results, but the franchisees are likely to deviate from the low prices when it appears profitable to do so.

The statements made by the upper tier property managers emphasized that the franchisor wants higher prices than the franchisee, consistent with a *positive* price-based externality in the upper tiers. Three managers used the word "aggressive" to describe the franchisor's approach to pricing, meaning that the franchisor wishes to price higher than they would. Further, one manager illustrated clearly the franchisor's concern about the externality with an anecdote specific to her multibrand franchisor: "Corporate will tell [an upper upscale flagship brand property] to price higher because they want a price distinction relative to the [midscale product affiliated with the same franchisor], even if that is owned by a different franchisee. They will tell the [upper upscale] property to consider raising price so there is a clear distinction between them and the [midscale] property, for example. If the [upper upscale] owner is not charging enough, corporate will tell them that they are hurting the brand." Another general manager of an upper

upscale hotel mentioned a similar franchisor concern of properties affiliated with the same brand: “They have a policy of consistency. They have their company properties and don’t want the customer going somewhere else [another property of the same the brand] and getting a lower price.”

3.3. The Smith Travel Research Data

The price data were provided by Smith Travel Research (STR). Hotels report to STR the average room-night price received and the number of room nights sold on each day. Hotels that provide data receive, for a fee, aggregated data from competing hotels in their vicinity. I have access to a full panel of monthly price observations for all STR-client properties from January 2002 through July 2009.

In March 2008, 25,921 (94.8%) out of 27,329 total U.S. branded chain hotels and motels provided price information to STR. Over 99% of the 4,642 upper tier hotels provided information, and 94.0% of the 22,687 lower tier properties did so. I matched these data, based on ID number, to STR’s quarterly hotel census file. The census data include zip code, founding date, and room count for all hotels.

The STR census classifies the organizational form of each property as “company-managed,” “franchised,” or “independently managed.” I focus on the first two categories. In March 2008, 19,381 (74.8%) of the 25,921 data-providing chain hotels were listed as franchised, and 4,370 (16.9%) were listed as company-managed. The remaining 2,170 (8.3%) brand-affiliated hotels are listed as independently managed. This signifies that the brand is owned cooperatively by all affiliate hotels; the most notable example is the Best Western chain. Importantly, none of these are dual-distribution chains.

Forty brands are dual-distribution chains—they franchise and company manage properties simultaneously—and have at least two hotels that remain under each organizational form between January 2002 and July 2009. Dual-distribution brands are found in four STR-defined quality categories: upper upscale, upscale, midscale, and economy. I combine the first two as the “upper tiers” and the latter two as the “lower tiers.” My analysis focuses on these brands, which are listed in Table 1.

To use all the information available, I include as a separate observation every monthly observation of price for every one of the dual-distribution chain hotels even though over 90% never change organizational form. Because the STR data are in a panel data form, and thus there are many monthly observations for each establishment, I cluster on individual establishment to ensure that standard errors are not artificially small (Bertrand et al. 2004).

4. Methods

4.1. The Ordinary Least Squares and Two-Stage Least Squares Models

To test the two propositions above, I estimate the following equation:

$$\text{Price} = \text{Franchised } \delta_p + X\beta + \varepsilon. \quad (3)$$

The dependent variable is the average price charged for one room-night by each hotel in each monthly observation, between January 2002 and July 2009. The key independent variable is the organizational form; the variable *Franchised* equals 1 if a hotel is managed by a franchisee and equals 0 if the hotel is company-managed. The parameter δ_p represents the estimate of the difference between the franchised price and the company-managed price; X represents a matrix of control variable values and β the coefficient vector to be estimated.

The vector X includes three control variables and three sets of fixed effects. I include the natural logs of the room count and age of each hotel for the month of each observation, which have been found to be important in previous studies of hotel performance (e.g., Kalnins 2004, Canina et al. 2005). These variables may be correlated with organizational form and with price. I also include a binary variable that indicates whether a property is considered a “resort destination.” Descriptive statistics for all variables are shown in Table 1.

The vector X includes three sets of fixed effects. To remove any brand influence from the estimates of δ_p and δ_o , I include 40 brand fixed effects. The vector X also includes fixed effects for all geographical zip codes. Including zip code fixed effects controls for many factors that are a function of location, such as local competition intensity (Vroom and Gimeno 2007), agglomeration economies (Canina et al. 2005), demographics, and the health and wealth of the local economy. These factors could be correlated with price and organizational form. Finally, I include a fixed effect for every calendar month between January 2002 and July 2009 to sweep out national temporal shocks.

In ordinary least squares (OLS) regressions, Equation (3) is the only equation estimated, and the *Franchised* variable is assumed uncorrelated with ε . But I also employ two-stage least squares instrumental variable (2SLS IV) regressions, which reduce the effects of endogeneity as a result of selection. Equation (3) is the second-stage equation in a 2SLS IV regression, where the organizational form is treated as endogenous. I estimate a first stage—that is, a linear projection of *Franchised* on the instrument associated with 2SLS:

$$\text{Franchised} = (\text{instrument})\beta^l + X\beta + u, \quad (4)$$

where the instrument is, as described below, a variable that does not and should not appear in Equation (3).

Table 1. Descriptive Statistics for Dual-Distribution Brands

	Upper tier brands (<i>N</i> = 233,817 monthly obs.; 3,364 hotels)				Lower tier brands (<i>N</i> = 216,461 monthly obs.; 3,394 hotels)			
	Mean	Std. dev.	Min	Max	Mean	Std. dev.	Min	Max
Dependent variable								
Price (\$)	114.05	36.10	13.18	1,100.00	58.07	20.17	10.42	285.58
—Franchised	109.71	31.9	13.18	1,100.00	68.58	20.52	10.42	285.58
—Company	120.66	40.80	29.41	690.51	50.12	15.78	16.95	235.91
Independent variables								
Franchised	0.60	0.49	0.00	1.00	0.43	0.50	0.00	1.00
Log Rooms	5.25	0.62	1.75	8.01	4.61	0.32	1.45	6.48
Log Age	2.43	0.88	0.00	4.81	2.49	0.76	0.00	4.60
Resort Location	0.08	0.28	0.00	1.00	0.03	0.18	0.00	1.00
Previous 6	0.61	0.35	0.00	1.00	0.46	0.43	0.00	1.00
Brands employing dual distribution, 2004–2009:	AmeriSuites/Hyatt Place Courtyard by Marriott Crowne Plaza DoubleTree Embassy Suites Four Points Hawthorne Inn Hilton Hilton Garden Inn Homewood Suites Hyatt Hyatt Summerfield Marriott Omni Radisson Renaissance Residence Inn Sheraton Staybridge Suites SpringHill Suites Westin Wyndham (22 brands total)				America's Best Inn America's Best Value AmericInn Baymont Inn Candlewood Suites Country Inns Country Hearth Inn Extended Stay America Fairfield Inn Homestead Suites InTown Suites La Quinta Motel 6 Red Lion Red Roof Inn Studio 6 Studio Plus Suites TownePlace Suites (18 brands total)			

The term β^l is the instrument's coefficient to be estimated; X and β are the same as defined as in Equation (3). All variables and fixed effects in X are included in Equation (4) as well as in Equation (3).

4.2. The Instrumental Variable

The same vector X appears in both stages of the 2SLS model. However, the 2SLS model requires the exclusion from the Stage 2 price regressions of an instrumental variable only relevant for the organizational form choice of Stage 1 (i.e., the instrument must have a logical causal relationship with the endogenous variable) but not relevant for the price outcomes of Stage 2 (i.e., the instrumental variable must not be correlated with the error term ε in Equation (3)).

To construct such an instrumental variable, I exploit the difference in time between the choice of organizational form, typically made at founding, and the prices, which were set between 2002 and 2009. My argument for the validity of the instrument is as

follows: first, although the proportions of company-managed and franchised outlets remain stable within most franchisor firms over time, even during periods of growth or decline (Lafontaine and Shaw 2005), temporal variation does exist. Sometimes a particular top management team exhibits systematic and idiosyncratic preferences for particular policies (Bloom and Van Reenen 2010). In the dual-distribution chain setting, management teams may prefer one organizational form at a given point in time (Barthelemy 2008). Love (1986, pp. 288–290) and Hamstra (1998) provide specific examples of top management teams' sudden, temporary preferences for company management at McDonald's and Burger King, respectively, at a national level. More recently, both of those chains have exhibited a preference for "re-franchising" (Maze 2014). These preferences appear to be national in scope and appear unrelated with other aspects of a firm's strategy at a particular point in time, such as expansion in areas with certain market features.

In particular, the preferences for company management (e.g., Love 1986) appear to have stemmed from a sudden focus on the fact that the chains leave substantial profits with franchisees (e.g., Kaufmann and Lafontaine 1994), whereas the recent preferences for franchising appear to arise from a desire for “asset-lite” balance sheets (Maze 2014).

Therefore, I include as an instrument the proportion franchised among the six same-brand hotels that began operations under the same brand name immediately before the hotel under observation, anywhere in the United States other than the same state as the hotel under observation. The commonality in the choice of organizational form for these six hotels with that under observation should be due to such a national preference as described above. Same-state hotels were excluded from this proportion to reduce the possibility of nonindependence among the organizational form choices. All results were consistent when using the proportion franchised among the previous 7–10 hotels as an instrument.

I estimated robustness tests where I included only hotels founded before 2002, the first year of the price data. Because of the temporal gap between these foundings and the organizational preferences for franchising versus company ownership on the one hand, and the observed prices on the other hand, the likelihood of exogeneity increases. The results, consistent with the main results presented below, are discussed in §5.2.

5. Results

5.1. Results of OLS and 2SLS Models

Table 2 presents fixed effects OLS and 2SLS regression results where the population is first pooled but then split between the high- and lower-quality tiers. The first two columns show results for the regressions where all hotels from the high- and lower-quality tiers are pooled. The next two columns show results from the upper tier brand hotels and the final two from the lower tier brands. The first column in each pair is based on a standard fixed effects OLS model. Although

Table 2. Regressions of Dual-Distribution Brands OLS and Stage 2 of 2SLS (Dependent Variable is *Price*)

Quality:	All brands pooled		Upper tier brands		Lower tier brands	
Method:	OLS	2SLS	OLS	2SLS	OLS	2SLS
<i>Franchisee</i>	−0.146	0.906	−2.331**	−3.982+	3.055**	4.774**
<i>endogenous</i>	(0.349)	(1.143)	(0.501)	(2.399)	(0.311)	(0.771)
<i>Log rooms</i>	−2.240+	−1.931	−2.637	−3.050	−2.249**	−1.698**
	(1.345)	(1.444)	(2.099)	(2.260)	(0.552)	(0.628)
<i>Log age</i>	−3.245**	−3.114**	−2.977**	−3.136**	−3.535**	−3.257**
	(0.279)	(0.301)	(0.409)	(0.448)	(0.215)	(0.243)
<i>Resort</i>	6.631+	6.673+	6.785+	12.951*	17.336**	17.673**
<i>Location</i>	(3.743)	(3.750)	(3.881)	(5.418)	(4.301)	(3.449)
Fixed effects						
<i>Months</i>	91**	91**	91**	91**	91**	91**
<i>Brands</i>	40**	40**	22**	22**	18**	18**
<i>Zip codes</i>	1,696**	1,696**	1,020**	1,020**	1,197**	1,197**
Stage 1 of 2SLS (Dependent variable is <i>Franchisee</i> = 1; <i>Company</i> = 0)						
<i>Previous 6</i>		0.495**		0.440**		0.560**
<i>instrument</i>		(0.018)		(0.029)		(0.022)
<i>Log rooms</i>		−0.249**		−0.222**		−0.254**
		(0.017)		(0.022)		(0.020)
<i>Log age</i>		−0.050**		−0.037**		−0.075**
		(0.007)		(0.009)		(0.009)
<i>Resort</i>		−0.028		−0.031		0.047
<i>Location</i>		(0.112)		(0.109)		(0.402)
Fixed effects						
<i>Months</i>		91**		91**		91**
<i>Brands</i>		40**		22**		18**
<i>Zip codes</i>		1,696**		1,020**		1,197**
Cragg–Donald <i>F</i>		756		230		648
<i>N</i>	450,278	447,896	233,817	232,487	216,461	215,409
<i>Hotels</i>	6,758	6,720	3,364	3,346	3,394	3,374
Stage 2 <i>R</i> ²	0.851	0.851	0.721	0.717	0.806	0.802

Note. Robust standard errors, clustered by hotel, are in parentheses.

+*p* < 0.10; **p* < 0.05; ***p* < 0.01.

these models assume exogenous organizational form choice, they at least eliminate temporal, geographic (zip code), and brand-based unobservable heterogeneity via the fixed effects. The 2SLS model in the second column of each pair shows results that treat the organizational form as endogenous. I also display the first-stage results for the 2SLS regressions below those from the respective second-stage regressions.

Results from the pooled regressions that include upper and lower tier hotels suggest that there is no effect of organizational form on price. Both the OLS result in the first column and the 2SLS result in the second column show effects of the *Franchisee* variable that are trivial in magnitude and statistically insignificant. However, when I split the population by quality tier, we observe that the seeming nonresult is actually an aggregation of statistically significant positive and negative results that are meaningful in magnitude. In the third and fourth columns, results for the upper tier hotels are consistent with the price-based quality signaling Hypothesis 1, that prices should be lower for franchisee-managed upper tier hotels. In the fourth column, franchisees price \$3.98 lower, on average, than their company-managed counterparts, when the organizational form choice is treated as endogenous. This difference is \$1.65 greater than the \$2.33 result in third column, where organizational form is treated as exogenous.

Results for the lower tier hotels are consistent with the “low price” signaling Hypothesis 2, that prices should be higher for franchised hotels. In sixth column, franchisees price \$4.77 higher than their company-managed counterparts when the organizational form choice is treated as endogenous. The 2SLS difference is about \$1.72 greater than the result in the fifth column, with exogenous organizational form.

The control variables in the second stage of Table 2 yield consistent results across the quality tiers. In line with intuition from the industry and previous work on performance (e.g., Kalnins 2004, Canina et al. 2005), room count and property age are associated with lower prices in both the high- and low-quality tiers. Finally, hotels in resort locations consistently charge higher prices.

The instrument excluded from Stage 2 yields consistent results across the quality tiers. The proportion franchised out of the previous six same-brand/different-state hotels is significantly and positively related to the likelihood that a hotel is franchised, suggesting a managerial favoritism toward one organizational form at one point in time. Further, this instrument is consistently strong based on the Cragg–Donald *F* Statistics, which far exceed Stock and Yogo’s (2005) critical values.

5.2. Extensions and Robustness Tests

5.2.1. An Analysis of Quantities Sold. The key strategic decision variable in a setting such as chain hotels is the room-night price; quantities sold are a result of the price. All else being equal, given that upper tier franchisees charge less, their occupancy (room-nights sold divided by room-nights available) should be higher than that at company-managed hotels. The opposite should be true in the lower tiers. To verify this, I conducted a 2SLS analysis with the dependent variable of occupancy and the *Previous 6* instrument. Indeed, there is a positive and significant effect of franchising in the upper tiers and a negative and significant effect in the lower tiers. These results provide additional support for the signaling theory that generated Hypotheses 1 and 2.

5.2.2. Test of Instrument Effect on Exogenous Populations. As discussed above, the criterion in a 2SLS model that the instrumental variable not be correlated with the error term ε is a formally untestable assumption. However, Altonji et al. (2005) propose a suggestive test: if a population can be found that is very similar to the main population of interest except that the endogenous variable is irrelevant—typically, its value has been predetermined—the instrument can be included as a simple independent variable in the equivalent of the Stage 2 regression for the similar population. Then, any statistical significance of the instrument in the Altonji, Elder, and Taber (AET) regression can be interpreted as possible bias as a result of a relationship with the error term of the instrument in the main regression. This bias can then be subtracted from the coefficient of interest, and statistical significance can be reassessed using the standard error from the main regression.

In the dual-distribution chain setting, two similar populations exist for which the endogenous franchisee versus company management choice is irrelevant: strictly company-managed upper tier brands and strictly franchised lower tier brands. Note that there are no strictly company-managed lower tier brands nor strictly franchised upper tier brands. Given that the *Previous 6* instrument is generated for dual-distribution brand properties by state and the date the hotel began operations under its brand name, I assigned all strictly company-managed upper tier chain properties an average value of the instrument as calculated for all upper tier dual-distribution properties founded in the same state in the same year. The same procedure was used for the lower tier properties. I found that the *Previous 6* instrument has no statistically significant effect on price in the AET test for the upper tier company-managed brands. However, the AET test suggests that the *Previous 6* variable biases upward the lower tier *Franchisee* coefficient in the sixth column of Table 2. However, when this “bias” is subtracted from the coefficient, the difference remains positive and statistically significant.

5.2.3. Propensity Score Matching. I also estimated propensity score matching models and found all results to be of the same signs and significance levels as those shown in the 2SLS columns of Table 2. This is an important robustness test because it demonstrates the same effects without the explicit use of an instrument.

5.2.4. Analyses of Subpopulations. Finally, I conducted two analyses of subpopulations. First, I eliminated the latest 8.5 years of hotel foundings from the data, which I reasoned might be the most likely to suffer from an endogeneity bias. In other words, all hotels that were founded during the time period of the pricing observations (January 2002–July 2009) were eliminated. This focus on hotels founded before the study period yields results with the same signs and significance levels and similar magnitudes as those in Table 2.

Second, I conducted analyses where I removed the top and bottom 5% of hotels from each quality tier in terms of price, and all signs, significance levels, and magnitudes remained the same as those in Table 2. From the minimum and maximum descriptive statistics for room-night prices shown in Table 1, it is clear that there are some outliers, but these are not driving the observed results.

6. Conclusions and Implications

6.1. Conclusion and Limitations

In this paper, I have refined the concept of the price-based brand externality by deducing a moderating role for brand quality. I first presented a mathematical model of brand externality, which shows that franchisors will price higher than the franchisees of a brand, even if outlets are identical, in the presence of a positive externality, but that franchisees will price higher when a negative externality is present. I then combined these mathematical findings with an analysis of previous theory—specifically, signaling motivations that result from difficult ex ante quality evaluation and search costs—to develop testable propositions: franchisors of high-quality brands will price higher at their own company-managed outlets than would franchisees at equivalent outlets of the same brand. Franchisors of lower-quality brands will price lower than would their franchisees.

I tested these implications in the setting of the U.S. lodging industry and obtained supportive results using 2SLS IV regressions that reduce the effect of endogeneity. I acknowledge that I have only tested one industry in one country, and the results may not generalize to multioutlet chains in all industries. Results may generalize only to the extent that other industries have similar levels of supply- and demand-based pricing variation, for example. Firms in industries with more standardized prices, such as packaged retail

goods or fast foods, might extensively advertise suggested prices to control pricing by independent retailers (e.g., Kalnins 2003). We might then observe little price variation based on organizational form.

6.2. Implications for Strategy and Policy Research

6.2.1. The Dangers of Pooling Observations from Different Quality Tiers. I urge authors of future studies on price and organizational form to explicitly incorporate the moderating effect of brand quality. None of the studies previous to this one has done so. This is a salient point because several key studies on the topic were responses to real policy decisions: papers on gasoline (Barron and Umbeck 1984) and on UK pubs (Slade 1998) analyzed the effects of divorce laws that constrained or prohibited company management in those industries. Although brand quality may exhibit insufficient variation in the case of gasoline, the two forms of price-based brand externality should be relevant for company-managed pubs that operate under a brewery's brand name, given the high importance of brand in that industry. I suspect that upscale company-managed pubs would have an interest in keeping prices higher much like the hoteliers of this study, although the lower tier pubs would benefit from lower prices as well. Given the red flags that are raised in the eyes of welfare-conscious policy makers whenever they observe systematic price variation, as discussed by Barron and Umbeck (1984) and Slade (1998), future policy decisions will likely be informed by the stated conclusions of this literature. Researchers must control for quality so that the analyses are more correctly specified.

More generally, scholars should take care to analyze separately firms that offer high- and low-quality products and services. The relationships between particular organizational form decisions (make or buy, license or sell directly, franchise or company manage) and outcomes such as prices may be quite different for high-quality and low-quality products and services. Pooling high- and low-quality tiers in the same regressions and constraining coefficients to be identical across both groups may well cancel out meaningful coefficients of opposing signs for the two groups and result in misleading conclusions.

6.2.2. Similarities and Differences Between Price-Based Brand Externalities and Quality Externalities. Unlike the price-based externality, where I proposed that the franchisee may price lower or higher than the franchisor based on whether the franchisor wishes to signal high quality or low price, the logic of the quality externality suggests that franchisees may underprovide quality regardless of brand quality tier. That only the negative price-based externality had been considered theoretically in the previous literature on organizational form may well be the result of an implicit

assumption that the quality externalities and price-based brand externalities operate more similarly than they do, i.e., that franchisees will *always* underprovide quality and *always* overprice. Indeed, Blair and Kaserman (1994) used an identical mathematical structure to model both forms of externality. The mathematical model and results here suggest that price and quality externalities have different implications and require different theory.

6.2.3. Impact on the Competitive Landscape. The theory and findings of this paper suggest that the organizational form of entrants in a market might substantially change the competitive landscape of that market. On the one hand, company-managed entrants might put downward pressure on market prices among lower quality tier hotels, and they might even destabilize the fragile pricing equilibria that keep many markets profitable (e.g., Kalnins 2006). Cast in this light, the findings of this paper would likely surprise many managers. Franchisees are typically viewed as the “toughest” competitors by practitioners and academics alike (e.g., Baye et al. 1996, Hadfield 1991). On the other hand, more consistent with conventional wisdom, upper upscale properties may need to be most wary of price-cutting franchisees in their vicinity. The effects of the presence or absence of the two organizational forms on the nature of competition within a geographical market could be explicitly tested. For example, the change to company management from franchising of one of the key outlets in a low-quality product market might well decrease everyone’s price in equilibrium. The switch to franchising might well have the opposite effect.

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Appendix A

Proof of Lemma 1. The inequality $a - bc + dc > 0$ will hold if and only if both outlets produce and sell positive quantities at positive prices in a profit-maximizing equilibrium.

To prove Lemma 1, I analyze the optimal quantities sold by the franchisor and franchisee.

Based on the same solution of first-order conditions that led to the prices that appear in the text, I can write the equilibrium quantities as

$$Q_f = \frac{b(2b - d)(a - bc + dc)}{4b^2 - d^2(1 + k)};$$

$$Q_{cm} = \frac{(2b^2 - d^2k + bd(1 - k))(a - bc + dc)}{4b^2 - d^2(1 + k)}.$$

Similar to the equilibrium prices, the denominators here are necessarily positive in the relevant range of $-b < d < b$. Thus I need to analyze only the numerators.

In the equation for Q_f , it is clear that b and $(2b + d)$ are both greater than 0, the former by assumption and the latter

based on the definition of the relevant range of d . Thus, the sign of Q_f is completely driven by the sign of the first term in the numerator. For the franchisee outlet, then, the quantity sold will necessarily be positive if and only if $a - bc + dc > 0$.

In the equation for Q_{cm} , $2b^2 > d^2k$, based on the relevant range of d , and $d - dk \geq 0$ because $0 \leq k \leq 1$. Thus for the franchisor’s company outlet as well, the quantity sold will necessarily be positive if and only if $a - bc + dc > 0$.

Appendix B. The Revenue Royalty

The franchisee’s and franchisor’s profit functions can be written as

$$\Pi_f = ((1 - k)P_f - c)(a - bP_f + dP_{cm});$$

$$\Pi_{cm} = (P_{cm} - c)(a - bP_{cm} + dP_f) + kP_f(a - bP_f + dP_{cm}).$$

After solving the standard first-order conditions, the equilibrium prices are

$$P_f = \frac{bc(2b + d - dk) - a(2b + d)(k - 1)}{(k - 1)(-4b^2 + d^2(1 + k))};$$

$$P_{cm} = -\frac{bc(2b(k - 1) - d(1 + k)) + a(2b + d + dk)(k - 1)}{(k - 1)(-4b^2 + d^2(1 + k))}.$$

The difference between the two prices can be written as

$$P_f - P_{cm} = \frac{(2b^2c - 2bcd + ad(k - 1))k}{(k - 1)(-4b^2 + d^2(1 + k))}.$$

Setting this difference equal to 0 and solving for d leads to a single solution, $d = 2b^2c/(a - ak + 2bc)$, which necessarily lies between 0 and b . To see this, think of the case where a is infinitely close to 0 and/or k is infinitely close to 1. In this case, d will be smaller than b , but by an infinitely small amount. As a gets larger and/or k gets smaller, d can only get smaller.

Using the quotient rule, I solve for the derivative of the price difference with respect to the externality term d :

$$\begin{aligned} & \frac{d(P_f - P_{cm})}{d} \\ &= \frac{2d(2b^2c - 2bcd + ad(k - 1))k(1 + k)}{(k - 1)(-4b^2 + d^2(1 + k))^2} \\ & \quad - \frac{(-2bc + a(k - 1))k}{(k - 1)(-4b^2 + d^2(1 + k))} \\ &= (k(-a(k - 1)(4b^2 + d^2(1 + k)) + 2bc(4b^2 - 2bd(1 + k) \\ & \quad + d^2(1 + k)))) \cdot ((k - 1)(-4b^2 + d^2(1 + k)))^{-1}. \end{aligned}$$

The first part of the numerator inside the first set of parentheses, $-a(k - 1)(4b^2 + d^2(1 + k))$, is necessarily positive because $-a$ and $k - 1$ are necessarily negative, and the rest of this part is a sum of two quadratic terms. The second part of the numerator, $2bc(4b^2 - 2bd(1 + k) + d^2(1 + k))$, is necessarily positive because $4b^2 \geq 2bd(1 + k)$, given the assumption that $-b < d < b$. And k is necessarily positive. Thus the numerator must be strictly positive in the range $-b < d < b$.

The denominator is necessarily negative because $k - 1$ is negative. Given the positive numerator over the negative denominator, the derivative of $P_f - P_{cm}$ is strictly negative in the entire range of $-b < d < b$. Because we know from above that the difference equals 0 for $0 < d = 2b^2c/(a - ak + 2bc) < b$, we conclude that $P_f - P_{cm} > 0$ when the externality is negative and when the externality is positive but less than $2b^2c/(a - ak + 2bc)$ and $P_f - P_{cm} < 0$ when $d > 2b^2c/(a - ak + 2bc)$.

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CORRECTION

In this article, “Pricing Variation Within Dual-Distribution Chains: The Different Implications of Externalities and Signaling for High- and Low-Quality Brands” by Arturs Kalnins (first published in Articles in Advance, February 22, 2016, *Management Science*, DOI:10.1287/mnsc.2015.2334), the reference to Zhang et al. was omitted and has now been included in the text and in the reference list.