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Only the Ugly Face? A Theoretical Model of Brand Dilution

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Abstract. This paper challenges two common views of brand dilution: first, that it is exclusively the unintended consequence of a poorly executed strategy of brand extension and, second, that its likelihood is heightened by brand licensing. Using a new theoretical model, we show that brand dilution can be seen not just as an unfortunate development to be avoided, but as an opportunity to monetize the brand. We further show that, at the relevant margin, switching from in-house development to licensing reduces the risk of brand dilution. The model offers a novel perspective on some important managerial choices and generates a series of empirically testable hypotheses.

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Keywords: brand extension • brand licensing • moral hazard • reciprocal effect

1. Introduction

Leveraging brand equity is a major strategy for companies that want to grow. It is now so common, in fact, that nearly 90% of all new products are actually extensions of existing brand names (Keller et al. 2008, Hariharan et al. 2015).

Extending a brand beyond its original product category involves both potential benefits and risks. On the positive side, it can enable companies to transfer the image and reputation of an already successful brand[1] to a new product, enhancing the demand for it. In addition, a successful extension may improve the parent brand's reputation. On the downside, the extension may damage the original brand and reduce the demand for the company's core products. The literature refers to the former case as a positive reciprocal effect or brand enhancement and to the latter as a negative reciprocal effect or brand dilution (Keller and Aaker 1992, Gürhan-Canli and Maheswaran 1998, Milberg et al. 2023).

Determining when an extension is more or less likely to dilute a brand name is an important issue in management and marketing, and the literature treats it at length (e.g., Loken and John 1993, John et al. 1998, Swaminathan et al. 2001, Keller and Sood 2003, Milberg et al. 2023). Of particular interest here is how the organizational mode of the extension, that is, in-house development or licensing, affects brand dilution. Both modes are commonly used. Developing the extension product in-house is the most straightforward choice, but going into a new business may require resources and competencies that the brand owner lacks and that may be difficult to acquire or develop internally. When this is so, the company may seek the benefits of specialization through licensing agreements with venture partners. This solution is common enough that revenues from brand licensing are now counted in the hundreds of billions of dollars.[2]

The empirical literature finds that brand dilution is associated more with licensing than with internal development (Choi 2001, Colucci et al. 2008, Jayachandran et al. 2013, Bărbulescu Robinson et al. 2015). The evidence is largely anecdotal,[3] but the correlation seems robust. The prevalent interpretation is causal; that is, a switch from internal development to licensing is supposed to heighten the risk of brand dilution (see, e.g., Quelch 1985, Raugust 2012). The suggested explanation for this causal link is that licensing creates scope for opportunistic behaviors by the licensee that may damage the parent brand, whereas a brand owner that develops the new product in-house never loses control of the extension and will not intentionally inflict any harm on the parent brand.

Drawing causal inferences from empirical correlations is problematic however. In the absence of experimental or quasi-experimental evidence, causal claims need to be underpinned by theory. But, as far as we know, no formal theory either substantiating or refuting such claims has yet been articulated. In fact, the choice of the mode of extension is a nearly untouched issue in the theoretical management literature.[4]

This paper seeks to fill that gap developing a theoretical model in which the decision to extend the brand; the choice between internal development or licensing; and investment in the quality of the core and extension products, which determines the relative likelihood of brand enhancement or dilution, are all endogenously determined.

The key result from this model is that, when both modes of extension are equally profitable, the quality of the extension product is higher under licensing, so the risk of brand dilution is diminished. This finding clearly runs counter to the conventional wisdom cited earlier. It implies instead that the correlation observed in the data does not arise because licensing causes brand dilution; rather, it reflects the fact that companies find it profitable to opt for brand licensing when the risk of brand dilution is more severe. This radically alters the managerial implications of the empirical evidence.

The mechanism behind our result relies on two key properties of the model. First, compared with the first best solution, which is obtained under vertical integration or with complete contracts, firms always underinvest in the quality of both core and extension products. The reason is that, with incomplete contracts, the benefits of specialization are secured only at the cost of contractual inefficiencies that reduce the incentives to invest. Second, the investment in the quality of the core product is always greater under in-house development than licensing because, under licensing, the brand owner only partially internalizes the positive externality that the reputation of the brand exerts on the extension product.[5]

The first property, that is, underinvestment in quality, implies that the higher the quality of either product, the higher the companies' profits; the second property, namely, that the quality of the core product is indeed higher under in-house development, implies that, if the quality of the extension product is also better under in-house development, then this strategy would necessarily be more profitable than licensing. For the two modes to be equally profitable, the quality of the extension must be higher under licensing. Hence, the risk of brand dilution is clearly lower.

This result has several counterintuitive implications. For example, consider how the choice of the organizational mode is affected by an increase in the magnitude of the demand spillovers generated by the extension. Because the weak point of licensing is that these spillovers are only partially internalized, it might seem that greater spillovers should make in-house development relatively more profitable. Actually, however, we find that greater spillovers induce a shift from internal development to licensing rather than the reverse because, at the margin, a shift to licensing improves the quality of the extension product.

After developing the model, we analyze the effects of changes in various exogenous variables, such as the magnitude of the reciprocal effect, the size of the extension market, the perceived distance between the core and extension products, and their technological distance. Other counterintuitive conclusions emerge, which can be explained in light of the foregoing result.

Let us make it clear at the outset that our analysis concerns brand dilution as the outcome of deliberate strategic choices. This approach differs considerably from most of the literature, which, following Aaker (1990), views brand dilution as essentially the unintended consequence of a poorly executed extension strategy: in a word, the "ugly" face of brand extension. We contend, instead, that companies may choose extensions that are destined to damage their brand names in order to monetize the brand.

The rest of the paper is organized as follows. Section 2 introduces the main elements of the model and reviews the empirical literature that supports its assumptions. Section 3 presents these assumptions in detailed fashion. Section 4 derives the model's equilibrium, contrasting in-house development with licensing. Section 5 demonstrates that, in some cases, deliberate dilution of the brand is optimal. Section 6 analyzes the factors that determine brand dilution and discusses the empirical correlations generated by the model. Section 7 analyzes several extensions of the baseline model. We conclude in Section 8 with a discussion of the managerial and empirical implications of our results. A series of appendices give formal proofs and further analytical results omitted in the main text.

2. Relation to the Literature

Our theoretical framework comprises three main components: the demand externalities of brand extension, the benefits of specialization that create the incentive to license, and the moral hazard that arises under licensing. We now present these components in turn, discussing the empirical literature that underpins our modeling assumptions.

2.1. Demand Externalities

Brand extension entails two types of demand spillover: direct (i.e., from the brand owner's core product to the extension product) and reciprocal (i.e., the other way around). This is the starting point of our analysis, but we do not intend here to provide microfoundations for the existence of these spillovers. Since the seminal work of Wernerfelt (1988), considerable effort has been devoted to understanding how brand names can convey information to rational consumers and, thus, affect their behavior.[6] Our contribution is orthogonal to this literature, focusing not on the causes but the consequences of the demand externalities. For our purposes, consumers may be thought of as "black boxes" driven by purely psychological or behavioral mechanisms.[7]

We assume the sign of the direct spillover is always positive (this entails no loss of generality for our purposes for, if the externality were negative, the new product would be marketed under a different name). Its magnitude varies, however. The marketing literature shows conclusively that the extent to which consumers transfer their brand perceptions from the original incarnation of the parent brand (the core product) to its new application (the extension product) depends on the perceived similarity between the two (see, e.g., Aaker and Keller 1990, Park et al. 1991, Broniarczyk and Alba 1994, Völckner and Sattler 2006, Miniard et al. 2018, Peng et al. 2023). Accordingly, we posit that the direct effect is decreasing in the perceived distance between the products.

What distinguishes brand extension from other marketing strategies that entail direct demand externalities is the reciprocal effect on the core product. The empirical literature shows that this effect may have either sign. The crucial factor here seems to be the quality of the extension product as perceived by consumers. A high-quality extension generally strengthens the parent brand and increases the sales of established products, leading to an enhancement in brand equity (Czellar 2003, Völckner and Sattler 2006, Salinas and Pérez 2009, Pina et al. 2013, Michel and Donthu 2014, Milberg et al. 2023). Conversely, a poor-quality extension may weaken the sales of the parent brand's existing products, thus diluting brand equity (Aaker and Keller 1990, Loken and John 1993, Keller and Sood 2003).

The literature also shows that the magnitude of the reciprocal effect, as with that of the direct effect, depends on the perceived similarity of the products. Greater similarity leads to a fuller transfer of consumer perceptions in both directions. For example, consumers' acceptance of Gucci sneakers may have a significant impact on their willingness to buy Gucci handbags, but the quality of Ferrari apparel is unlikely to affect the demand for Ferrari cars. This holds for positive (Keller and Aaker 1992, Gürhan-Canli and Maheswaran 1998, Swaminathan et al. 2001, Pina et al. 2013) and negative (Gürhan-Canli and Maheswaran 1998, Keller and Sood 2003, Sood and Keller 2012) effects alike.

Our model, therefore, allows the reciprocal effect to be either positive or negative. Whatever the sign, the magnitude depends, all else equal, on the perceived distance or similarity between the products.

2.2. Benefits of Specialization

The second element in our analysis is the benefits of specialization: a specialized licensee is assumed to be more efficient than the brand owner in supplying the extension product.

The notion that delegating certain tasks to external, specialized agents may be more efficient than in-house production is so common in the management literature that it hardly needs elaboration. The benefits of specialization are abundantly documented in many areas of economics and management and lie at the heart of the transaction-cost theory of the firm (Coase 1937, Willamson 1991).

The literature on brand extension shows that the efficiency advantages of licensing are the greater the more dissimilar the manufacturing and marketing technologies of the core and extension products (Colucci et al. 2008). In keeping with these findings, we take the technological distance between the products as an additional parameter and assume that the licensee's advantage depends on it. The technological distance may or may not be related to the perceived distance.

2.3. Moral Hazard

The final key component of the analysis is the moral hazard that may arise under brand licensing. Generally speaking, a problem of moral hazard arises when one party makes investments that can increase the value produced by a relationship, but these investments are not verifiable and hence are not contractible. In these cases, contracts are necessarily incomplete and, thus, fail to align the parties' interests perfectly. As a result, opportunistic behavior is inevitable. The resulting inefficiencies constitute the comparative disadvantage of licensing.

Clearly, the conditions that give rise to moral hazard hold for the licensee. The literature documents that licensees invest considerable resources in the design, manufacture, and distribution of the extension product (Raugust 2012). However, because the brand owner cannot perfectly monitor the licensee, such investment is largely noncontractible. The literature also studies how this problem affects the structure of licensing contracts (Jayachandran et al. 2013).

Brand owners, in turn, invest substantially in reputation and brand image. If the licensing contract is signed after this investment is sunk and the investment is verifiable, this does not generate any further inefficiency. But if some investments are made after the signing or are not verifiable, then a two-sided moral hazard problem arises.[8]

Our model accommodates both cases. A one-sided moral hazard problem occurs when the brand owner makes its investments before the licensing contract is signed (and the investments are observable). A two-sided problem obtains, instead, when the parties make their investments simultaneously. The presentation here focuses on the former case, but the longer, working paper version develops a detailed analysis of the two-sided case. Our main results hold in both cases.

Moral hazard problems similar to the foregoing have been analyzed in the industrial organization literature on franchising and technological licensing (e.g., Bhattacharyya and Lafontaine 1995, Choi 2001, Hernández-Murillo and Llobet 2006, Arora et al. 2013, Tauman and Zhao 2018, and the references therein). Brand licensing is different, though, because the brand owner earns profits from core and extension product both, whereas only those from the extension can be shared with the licensee. Furthermore, the literature on franchising and patent licensing ignores the reciprocal effect, which implies that the brand owner must incentivize effort on the part of the licensee not only to increase revenues from the extension, but also to preserve its core revenues. These differences alter the nature of the moral hazard and call for a specific analysis of the contractual arrangements in brand licensing.

3. The Assumptions

This section presents the assumptions of the baseline model. We deliberately keep the model as simple as possible and choose functional forms with closed-form solutions. Section 7 develops several extensions of the model.

3.1. Supply

There are two products: a core product manufactured and marketed by the brand owner and a noncore, extension product. (The case of multiple extensions is discussed in Section 7.) For simplicity, we assume that the markets for the core and noncore products are both monopolistic.[9]

The noncore product can only be marketed under the parent brand name, either by the brand owner itself or indirectly by a licensee. This extension product could potentially be supplied by a number of specialized licensees, but in the end, the brand owner chooses only one as a venture partner. Therefore, the brand owner can play one would-be licensee against the other and, thus, has all the bargaining power. (In Section 7, we consider the case in which there is only one potential licensee, whose outside options limit the brand owner's bargaining power.)

The perceived quality of core and extension products is determined by the efforts exerted by their suppliers in such production stages as design, manufacture, and marketing. We denote efforts by e_C for the core product and e_E for the extension product, respectively. The greater the effort, the higher the perceived quality of the product and, hence, the demand for it. We assume that the demand for both products increases linearly with efforts; the exact functional specifications are given as follow.

Consumers' perceptions may also depend on a series of unpredictable factors. To account for these, one could include idiosyncratic shocks ξ in the model so that the two perceived qualities become $e_C + \xi_C$ and $e_E + \xi_E$. Given linear demand, however, if firms are risk-neutral, these shocks would not change our results.

Effort is costly. The cost for the core product is $\frac{1}{2}\beta e_C^2$.[10] For the extension product, under licensing, when the product is supplied by a specialized licensee, the cost is $\frac{1}{2}\beta e_E^2$;[11] under internal development, it is $\frac{1}{2}\theta\beta e_E^2$. The parameter $\theta > 1$ captures the reduced efficiency of the brand owner outside its core business. It is an index of the technological distance between the products.

In the production stage, these costs are fixed. In principle, the quality of the products might also affect variable production costs, but because any shift in the marginal cost curve would be neutralized by a corresponding shift in demand, there is no loss of generality in normalizing variable production costs to zero and interpreting the demand curves specified as follow as the difference between demand and unit variable cost.

3.2. Demand

The core and extension products are neither substitutes nor complements, so the demand for one does not depend on the price of the other. (This distinguishes brand extension from, say, the choice of product line, for which the different products are substitutes.) However, demands are related, owing to the direct and reciprocal demand spillovers discussed earlier. The magnitude of the latter depends on the distance between the products in consumer perceptions. We denote the perceived distance as α, a parameter that ranges from zero to one (a normalization).

In principle, α could depend on the design of the products and other variables that firms might affect, but here, it is taken as exogenous (we leave endogenization for future work). Note further that α may be correlated with the technological distance θ. In our analysis, however, we treat the two as distinct.[12]

3.2.1. The Extension Product. To get closed-form solutions, we posit specific functional forms for demand. The demand for the extension product q is taken to be linear in both price and quality:

$$q = \rho[e_E + (1 - \alpha)e_C - p], \tag{1}$$

where ρ is a scale parameter that measures the size of the noncore market, $e_E + (1 - \alpha)e_C$ is an index of perceived quality, and p is the price. The perceived quality of the extension depends on both its intrinsic quality e_E and the prestige of the brand, which, in turn, depends on the quality of the core product e_C. This dependence reflects the direct effect of the brand name on the demand for the extension product. This effect is stronger the closer the two products lie in the space of consumer perceptions.

Therefore, all else equal, the demand for the extension product decreases as its perceived distance from the core product increases.

The linear specification (1) yields a quadratic profit function,[13] which implies that e_C and e_E are complements— an important feature of the model.

3.2.2. The Core Product.

The demand for the core product is posited as rectangular. In other words, the product is demanded by $\mu > 0$ symmetric consumers, each of whom purchases either one unit or none and has the same willingness to pay v_C. Under this assumption, the equilibrium price of the core product is simply v_C.[14]

The parameter μ represents the size of the market for the core product. The willingness to pay v_C depends on the perceived quality of the product, which in the absence of brand extension, is simply $v_C = e_C$. With brand extension, however, the reciprocal effect kicks in, v_C now depending on both effort levels, e_C and e_E. For simplicity, we posit a linear specification:[15]

$$v_C = e_C + \lambda(1-\alpha)e_E - \kappa, \tag{2}$$

where the parameter λ measures the importance of the reciprocal effect, the term $(1-\alpha)$ captures the assumption that the reciprocal effect depends on the perceived distance between the products, and κ is a constant that must be positive to allow for the possibility of brand dilution. The parameter λ ranges from zero to one so that the brand owner's effort on the core product always remains the main determinant of the demand for it.

It is convenient to rewrite this expression as

$$v_C = e_C + \lambda(1-\alpha)(e_E - \varepsilon), \tag{3}$$

where $\varepsilon \equiv \frac{\kappa}{1-\alpha} > 0$. Expression (3) clarifies that the sign of the reciprocal effect is endogenous: positive when the quality of the extension exceeds the benchmark level ε and negative otherwise. The linear specification (2) implies that the benchmark ε is exogenous. (The case in which the benchmark increases with the quality of the core product is considered among the extensions; it does not alter the paper's main results.)

Note that, at $\lambda = 0$, the reciprocal effect vanishes, and the model then resembles existing models of franchising or patent licensing. What distinguishes brand licensing is the possibility, when $\lambda > 0$, that the extension may enhance or dilute the parent brand.

3.3. Contracts

We assume that the brand owner cannot merge with the licensee or does not want to and the licensee's effort is not contractible.[16] This may be because the effort is not observable as when the idiosyncratic shocks ξ_E prevent the brand owner from inferring e_E from observation of v_C. Alternatively, the licensee's effort may be observable but not verifiable, that is, objectively measurable by a court of law.

We assume, however, that output q is verifiable so that the payments specified in licensing contracts may depend on q. In the baseline model, we restrict attention to pure royalty contracts, which specify a nonnegative royalty rate $s \geq 0$ per unit of output. Among the extensions, we allow for two-part tariffs.[17]

A summary of the model's notation is presented in Table 1.

3.4. Timing

At the outset, the brand owner decides on brand extension and the organizational mode to use. If it opts for in-house development, it then simply makes all remaining choices (i.e., effort levels and prices). If, instead, it opts for licensing, then the timing of the next moves determines whether the model features one- or two-sided moral hazard.

The case of one-sided moral hazard occurs when the brand owner first chooses the quality of the core product e_C, and it is observed by the licensee. The brand owner then sets the terms of the licensing contract, and the licensee decides whether to sign. If it signs, the licensee then chooses e_E. Finally, brand owner and licensee set the prices of the products they supply. This is the timing adopted in this article. The sequence of moves is depicted in Figure 1.

Instead, a two-sided moral hazard problem arises if the brand owner and licensee chose their effort levels simultaneously and after signing the contract. The working paper version of this article provides a detailed analysis of this case. The exact solution of the model changes, but the main results continue to hold.

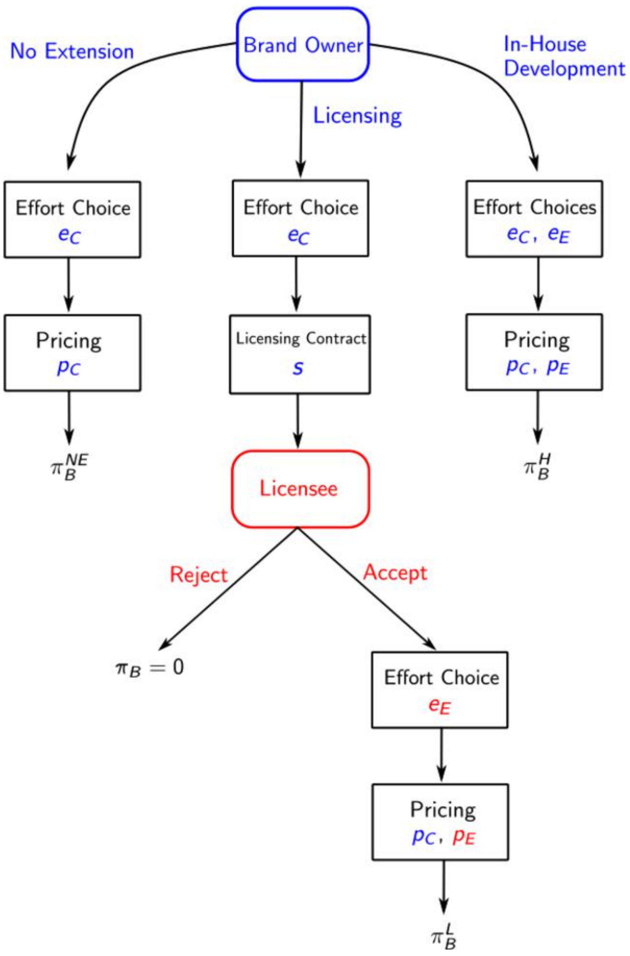
4. Equilibrium

In this section, we derive the equilibrium of the model for each organizational mode and present some preliminary

Table 1. Notation

Notation	Domain	Meaning
Parameters		
α	[0,1]	Perceived distance
β	normalized to 1	Cost of effort
θ	$[1,+\infty)$	Technological distance
μ	$(0,+\infty)$	Size of the core market
ρ	[0,1]	Size of the extension market
λ	[0,1]	Magnitude of the reciprocal effect
ε	$(0,+\infty)$	Benchmark level of quality
Variables		
Notation		Meaning
e_C		Quality of the core product
e_E		Quality of the extension product
q		Demand for the extension product
p		Price of the extension product
π_B		Brand owner's profit
π_L		Licensee's profit
s		Royalty rate

Figure 1. (Color online) The Timing of the Game with Brand Owner's Strategic Choices and Licensee's Choices



comparative statics. Further on, we turn to the choice of the optimal mode of extension.

To ensure subgame perfection, we solve the model backward, starting from the pricing stage.

4.1. Prices

It is easy to determine equilibrium prices. In the market for the core product, the brand owner extracts the entire consumer surplus by setting the price equal to consumers' willingness to pay v_C. Thus, the brand owner nets a profit of $\mu[e_C + \lambda(1-\alpha)(e_E - \varepsilon)]$. In the market for the extension product, the seller charges the monopoly price

$$p^M = \frac{e_E + (1-\alpha)e_C + s}{2}. \tag{4}$$

The corresponding output and profits are, respectively,

$$q^M = \rho\frac{e_E + (1-\alpha)e_C - s}{2}, \tag{5}$$

$$\pi^M = \rho\frac{[e_E + (1-\alpha)e_C - s]^2}{4}. \tag{6}$$

(Under internal development, price, output, and profits from the extension are given by these formulas with $s = 0$.)

Note that $\frac{\partial^2 \pi^M}{\partial e_C \partial e_E} = \frac{\rho}{2}(1-\alpha) > 0$, confirming that efforts e_C and e_E are complements.[18]

4.2. Effort Levels

Moving backward, we next analyze investments in quality, distinguishing between in-house development and licensing.

4.2.1. In-House Development. When the extension is developed internally, the brand owner's overall profit is

$$\pi_B = \mu[e_C + \lambda(1-\alpha)(e_E - \varepsilon)] + \rho\frac{[e_E + (1-\alpha)e_C]^2}{4} - \frac{1}{2}\theta\beta e_E^2 - \frac{1}{2}\beta e_C^2. \tag{7}$$

The first term on the right-hand side is the profit from the core business, the second is that from the extension, and the last terms are the costs of the respective efforts.

Plainly, the profit function is homogeneous of degree one in μ, ρ, and β, so we can normalize by setting $\beta = 1$. We also assume that $\rho < 1$ to ensure concavity.[19] The optimal effort levels e_C and e_E are then determined by the following first-order conditions:

$$e_C = \mu + (1-\alpha)\frac{\rho}{2}[e_E + (1-\alpha)e_C], \tag{8}$$

$$\theta e_E = \frac{\rho}{2}[e_E + (1-\alpha)e_C] + (1-\alpha)\lambda\mu. \tag{9}$$

These conditions mean that, for both products, the marginal costs of quality (the left-hand sides) must be equal to the marginal benefits (the right-hand sides). The marginal benefits comprise two terms, namely, the effect of a product's quality on the profit from that product and the other product. These latter terms reflect the demand spillovers, and as such, they are proportional to the degree of similarity between the core and noncore product, $(1-\alpha)$. In addition, the second term in (9) is proportional to λ, the magnitude of the reciprocal effect.

Solving the system of first order conditions gives the optimal effort levels e_C^H and e_E^H. Substituting these into (7), we get the brand owner's profit under in-house development, π_B^H. The explicit formulas are reported in Appendix A.

4.2.2. Licensing. Next, consider licensing. Again proceeding backward, we first calculate the licensee's effort for any possible royalty rate, then the optimal royalty rate, and finally the brand owner's effort.

4.2.2.1. Licensee's Effort. Given the royalty rate s, the licensee chooses e_E to maximize its profit:

$$\pi_L = \rho\frac{[(1-\alpha)e_C + e_E - s]^2}{4} - \frac{1}{2}e_E^2. \tag{10}$$

The first order condition is

$$e_E = \frac{\rho}{2}[(1-\alpha)e_C + e_E - s]. \tag{11}$$

There are three differences between (11) and (9). First, the marginal cost of effort is lower (i.e., e_E rather than θe_E), reflecting the greater efficiency of the specialized licensee. Second, the licensee does not internalize the reciprocal effect, so the perceived marginal benefit of its effort consists solely of the direct effect. Third, the double-marginalization effect arising with a positive royalty rate reduces the output of the extension product and, hence, the marginal gain from improving its quality. These differences imply that the comparison between e_E^H and e_E^L is, in principle, ambiguous—an issue that we come back to later.

Solving for e_E, one gets

$$e_E = \frac{\rho}{2-\rho}[(1-\alpha)e_C - s], \tag{12}$$

provided that $s < (1-\alpha)e_C$; otherwise, e_E vanishes. Note that e_E is now independent of θ (which characterizes only the in-house development technology) and of λ (because the licensee does not internalize the reciprocal effect directly but only indirectly as the brand owner's choice of the royalty rate accounts for that effect). Furthermore, e_E decreases with s because a higher s reduces the output of the extension product and, hence, the licensee's incentive to exert effort.

4.2.2.2. The Royalty Rate. Taking one step back, consider the choice of the royalty rate s. This involves a double trade-off. First, we have the standard trade-off between profit margins and volumes given that the licensing revenue equals s times q^M, and the volume q^M decreases as s increases. Second, the brand owner must consider that a higher royalty rate reduces the licensee's effort e_E. Taking both effects into account, we get

$$s = \frac{1}{2}(1-\alpha)(e_C - \lambda\mu). \tag{13}$$

For any given e_C, the optimal royalty rate varies inversely with the reciprocal effect parameter λ and with the size of the core market μ. The reason for this is simple: an increase in either λ or μ, or both, implies that the brand owner wants to incentivize the licensee's effort more strongly. This is achieved by decreasing s at the cost of reducing licensing revenue. A similar explanation applies to the perceived distance α.

4.2.2.3. Brand Owner's Effort. Finally, consider the choice of the effort on the core product, e_C. The brand owner's profit is

$$\pi_B = \mu[e_C + \lambda(1-\alpha)(e_E - \varepsilon)] + s\rho\frac{(1-\alpha)e_C + e_E - s}{2} - \frac{1}{2}e_C^2, \tag{14}$$

where the middle term in (14) is the licensing revenue sq^M. Anticipating that e_E is given by (12) and s by (13), the brand owner sets

$$e_C^L = \mu\frac{4-\rho[2-\lambda(1-\alpha)^2]}{4-\rho[3-\alpha(2-\alpha)]}. \tag{15}$$

It is easy to verify that e_C^L is decreasing in α and increasing in λ, μ and ρ.

Plugging e_C^L into the foregoing formulas, one obtains the equilibrium royalty rate s^L, the equilibrium level of the licensee's effort, e_E^L, and the brand owner's equilibrium profit under licensing, π_B^L. The explicit expressions are reported in Appendix B.

4.2.3. No Brand Extension. For completeness, we also consider the case in which the brand is not extended. The willingness to pay for the core product now reduces to e_C, and the brand owner's profit to $\mu e_C - \frac{1}{2}e_C^2$. The optimal choice of effort is then $e_C = \mu$, yielding an equilibrium profit of $\pi_B^{NE} = \frac{1}{2}\mu^2$.

4.3. Underinvestment

We conclude this section by comparing the equilibrium efforts with the first best solution, that which maximizes industry profits. This is the solution that arises under vertical integration or with complete contracts. It is obtained by setting $\theta = 1$ in Conditions (9) and (8).

Proposition 1. *Under both in-house development and licensing, the equilibrium features underinvestment in the quality of both products.*

Whereas the underinvestment result holds always, the intuition for it differs between the two organizational modes. In the case of in-house development, the point is simply that the brand owner cannot benefit from the licensee's specialized capabilities. The complementarity between effort levels implies that this affects not only e_E, but also e_C. With licensing, on the other hand, what reduces the incentive to invest for both parties is the contractual inefficiencies because of the incompleteness of contracts.

5. Intentional Brand Dilution

The conventional wisdom sees brand dilution as the ugly face of brand extension and accordingly describes it as the consequence of miscalculations, poorly executed strategy, or unforeseeable events. In this view, brand dilution is always unintended. In a model such as ours, therefore, it should occur only if the shock ξ_E is negative and sufficiently large.

In reality, however, brand dilution can also be a deliberate choice: a decision to monetize the brand. As such, it can occur even in the absence of adverse shocks. It can be a rational option because the brand owner's earnings consist of two components—the profit from the core product and the revenues from the extension—and it may elect to sacrifice the former for the latter.

One notable set of circumstances in which the optimal strategy is to dilute the brand is when the extension is just barely profitable, formally, when the larger between π_B^H and π_B^L just barely exceeds π_B^{NE}. (In what follows, we refer to the locus of parameter values at which $\max[\pi_B^H, \pi_B^L] = \pi_B^{NE}$ as the extensive margin.)

Proposition 2. *At the extensive margin, if licensing is the best organizational mode (i.e., if $\pi_B^L = \pi_B^{NE} \geq \pi_B^H$), then brand extension necessarily entails brand dilution.*

The logic behind this result is simple indeed. The contribution of the extension to the profit of the brand owner is twofold. On the one hand, the extension product generates a profit on its own, which under licensing, is the licensing revenue sq^M and, thus, always positive. On the other hand, the extension also affects the profit from the core business. To a first order approximation, the variation is $\mu\lambda(1-\alpha)(e_E - \varepsilon)$,[20] and its sign, therefore, coincides with that of $e_E - \varepsilon$. At the extensive margin, the total effect of the extension on the brand owner's profit is nil by definition. Because the profit from the extension market is always positive, the effect on the profit from the core business must be negative. But this implies that we must have $e_E < \varepsilon$, which is to say, brand dilution.

Intuitively, any brand licensing that results in brand enhancement is definitely profitable: a win–win solution. For licensing to be profit-neutral, it must entail brand dilution. By continuity, Proposition 2 implies that some extensions that are strictly profitable must result in intentional brand dilution.

The conclusion does not necessarily hold when the best option at the extensive margin is in-house development, that is, when $\pi_B^H = \pi_B^{NE} > \pi_B^L$. In this case, the direct profit from the extension, $\pi^M - \frac{1}{2}e_E^2$, can be negative, opening up the possibility of brand enhancement at the extensive margin. Yet this possibility arises only under particular circumstances.[21] The extension may well be profitable and entail brand dilution even if the method is internal development.

It is tempting to interpret the profitability of brand dilution dynamically. That is, one may think of a two-stage strategy, in which the company first builds brand reputation and then monetizes the brand. Because our model is timeless, however, we do not pursue this dynamic interpretation here.

6. The Reasons for Brand Dilution

Having established that the owner may dilute the brand intentionally, we now inquire into the factors that may induce this choice. We must analyze the determinants of the effort on the extension product e_E given that brand dilution arises when e_E is low.

Generally speaking, e_E may depend on the model's exogenous parameters for two reasons. First, it generally depends on the parameters for either organizational mode, internal development or licensing. Second, changes in the parameters may affect the choice of mode, which, in turn, may affect e_E.

Let us start from this latter effect. As noted, the impact of the organizational mode on the quality of the extension is, in principle, ambiguous. However, at the switching point, at which the brand owner must be indifferent between internal development and licensing (and, hence, $\pi_B^H = \pi_B^L$), the ambiguity disappears. (In what follows, we refer to the locus $\pi_B^H = \pi_B^L\ (> \pi^{NE})$ as the intensive margin.)

Proposition 3. *At the intensive margin, a switch from internal development to licensing always increases the quality of the extension e_E; therefore, it always reduces the probability of brand dilution.*

To understand the intuition behind Proposition 3, notice first of all that, at the intensive margin, a switch from internal development to licensing always decreases the quality of the core product e_C. (This is shown in the course of the proof of the proposition.) The reason why $e_C^H > e_C^L$ is simple: under in-house development, the brand owner internalizes the entire external effect of the core product on the extension product, whereas under licensing, internalization is only partial.[22]

Taking this into account, now consider the relative profitability of the two organizational modes. Suppose to begin with that the quality of the extension product is the same under both modes. In this case, total industry profits would differ between them for four reasons. First, the cost of delivering the constant quality is lower for the specialized licensee than for the brand owner. Second, the quality of the core product is higher under internal development, and higher quality is associated with higher profits (Proposition 1). Third, when the royalty rate is positive, industry profits under licensing are eroded by the pricing distortions that arise in a vertical chain. Fourth, under licensing, the brand owner must share these profits with the licensee. In our model, the first two effects are exactly mutually offsetting. Because the sign of the last two is unambiguous, if the quality of the extension product were the same under both modes, the brand owner's profit would necessarily be greater under internal development. It follows that for the two modes of extension to be equally profitable, the quality of the extension product must be higher under licensing.

Proposition 3 runs counter to the conventional wisdom that brand dilution is due to licensing. The fallacy here is the causal interpretation of the correlation observed in the empirical literature. In fact, as we show, the correlation may arise for other reasons.

Armed with Proposition 3, we can now examine the combined effects of changes in the model's exogenous parameters on the quality of the extension, e_E.

6.1. The Reciprocal Effect

Consider first the effect of changes in the magnitude of the reciprocal effect, λ, holding the other parameters of the model constant.

Proposition 4. *Under both in-house development and licensing, the equilibrium effort e_E is increasing in λ. Further, if the technological distance θ is sufficiently large, the brand owner develops the extension internally if λ is small, licenses the brand to a specialized licensee for intermediate values of λ, and avoids brand extension if λ is large.*[23]

The way in which e_E varies with λ, accounting for all relevant effects, is illustrated in Figure 2.

The first part of the proposition says that e_E increases with λ in both organizational modes. The intuition is as follows. Under in-house development, a stronger reciprocal effect heightens the brand owner's incentive to invest in the extension in order to better protect the core market. Under licensing, on the other hand, an increase in λ does not affect the licensee's incentive directly, but it does indirectly, via the decrease in the optimal royalty rate.

The effect of λ on the choice of the organizational mode (the second part of the proposition) is less intuitive. The comparative advantage of licensing consists in the greater technological efficiency of the licensee compared with the brand owner, whereas its disadvantage is the more limited internalization of the demand externalities between the products. One may accordingly conjecture that an increase in λ, which amplifies the indirect demand externality, should make licensing relatively less profitable. In fact, however, the opposite holds. To see why, it may be useful to paraphrase the second part of Proposition 4 as follows: an increase in λ makes licensing relatively more profitable than internal development at the intensive margin and relatively less profitable than no extension at the extensive margin. From this standpoint, it appears that the first part of the result follows immediately from Proposition 3, which says that, at the intensive margin, a switch to licensing causes an upward jump in e_E. The result then follows from the fact that the more valuable the jump is, the higher λ. The second part of the result is instead a consequence of Proposition 2, by which, at the extensive margin, licensing entails brand dilution. The result then follows from the fact that such brand dilution is the more damaging the higher λ.

The condition that the technological distance be sufficiently large (the precise lower bound is determined in Appendix G) ensures that licensing can be an optimal strategy. If the condition is not satisfied, the extension product is always developed in-house. In this case, different patterns may emerge. For example, the brand owner may find it optimal to develop the extension internally both when λ is small and when it is large but not to extend the brand for intermediate values. In this scenario, there would be two extensive margins: high and low. Brand extension entails dilution at the lower margin, brand enhancement at the upper. At the upper extensive margin, the brand owner suffers a loss in the extension market,[24] but extension is still profitable because it increases the demand for the core product. In these circumstances, extending the brand becomes as a sort of investment in advertising.[25]

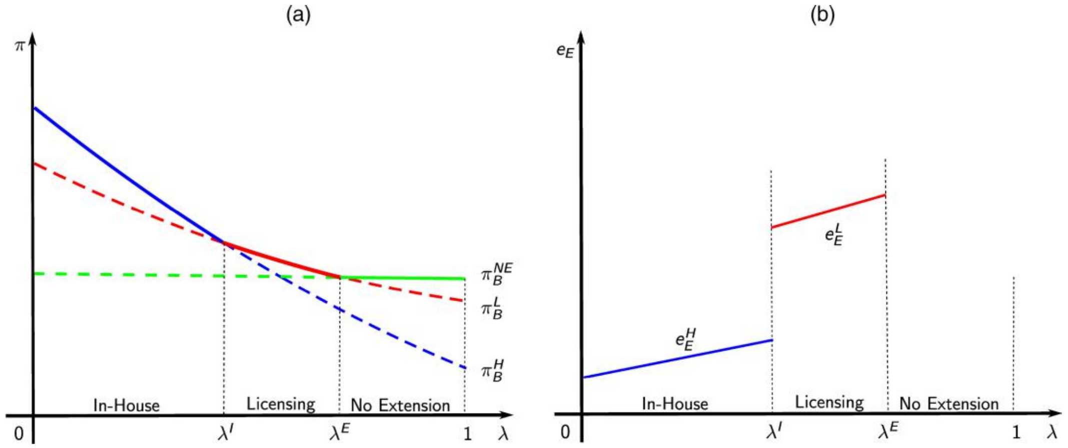
6.2. The Size of the Extension Market

Next, consider the effect of changes in ρ, the size of the market for the extension product.

Proposition 5. *Under both in-house development and licensing, the equilibrium effort e_E is increasing in ρ. Further, the brand owner avoids brand extension when ρ is small, develops the extension internally for intermediate values, and licenses the brand to a specialized licensee when ρ is large.*

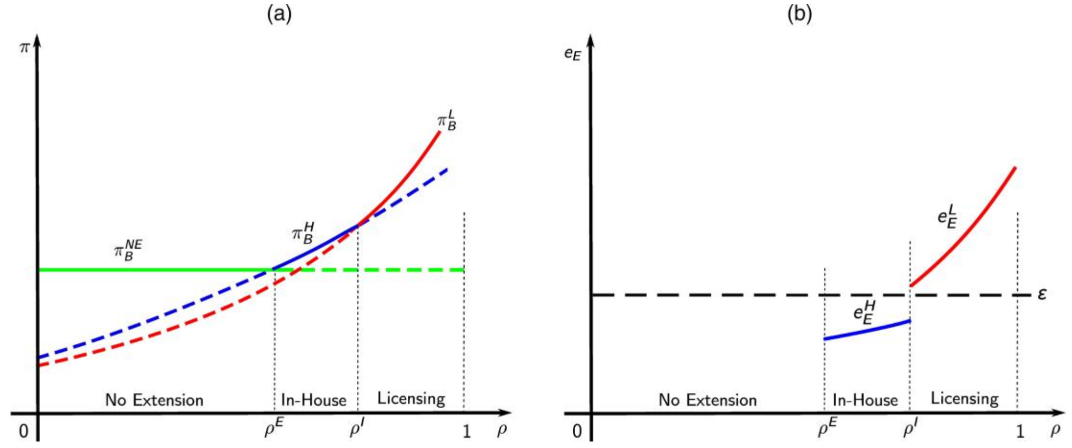
Figure 3 illustrates how e_E depends on ρ, accounting for all relevant effects.

Figure 2. (Color online) Extension Product Effort and Profit as a Function of the Magnitude of the Reciprocal Effect λ



Notes. The intensive and extensive margins are λ^I and λ^E, respectively. The figure is drawn for the following parameter values: $\alpha = 0.3$, $\mu = 1.75$, $\rho = 0.75$, $\varepsilon = 0.9$ and $\theta = 4.4$. (a) Profits. (b) Efforts on extension.

Figure 3. (Color online) Extension Product Effort and Profit as a Function of the Size of the Extension Market ρ



Notes. The intensive and extensive margins are ρ^I and ρ^E, respectively. The figure is drawn for the following parameter values: $\alpha = 0.3$, $\mu = 2.5$, $\lambda = 0.65$, $\varepsilon = 0.9$ and $\theta = 3$. (a) Profits. (b) Effort on extension.

The first part of Proposition 5 is obvious: an increase in ρ enlarges the extension market and, hence, increases the benefits from investment in quality. This also explains why the extension is more likely not to be profitable when the extension market is small. The second part of the proposition may instead sound surprising at first. Going by the logic internalization-of-demand-externalities mentioned earlier, in-house development should become relatively more profitable as the extension market gets bigger. But, in fact, the correct intuition is again provided by Proposition 3: higher ρ makes the quality of the extension more important and, thus, increases the relative profitability of licensing, which generates higher quality at the intensive margin.

6.3. Perceived Distance

Next, consider the effect of the perceived distance between the core and noncore products.

Proposition 6. *Under both in-house development and licensing, the equilibrium effort e_E is decreasing in α. Further, the brand owner develops the extension internally when α is small, licenses the brand to a specialized licensee for intermediate values, and avoids brand extension when α is large.*

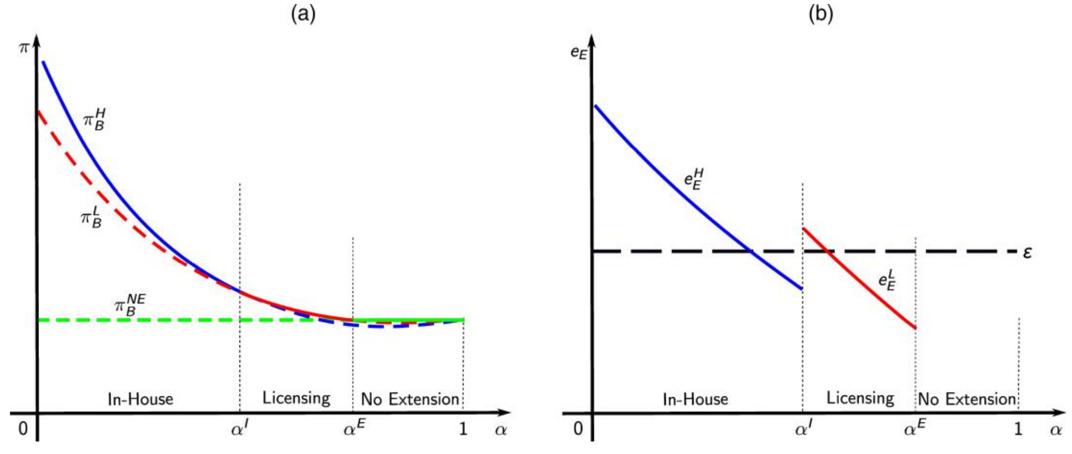
Figure 4 illustrates.

Proposition 6 combines elements of Propositions 4 and 5. An increase in α is similar to a decrease in ρ in that it reduces the size of the extension market. At the same time, an increase in α is similar to a decrease in λ in that it decreases the magnitude of the reciprocal effect. Proposition 6 shows how these effects interact to determine the overall impact of the perceived distance.

6.4. The Technological Distance

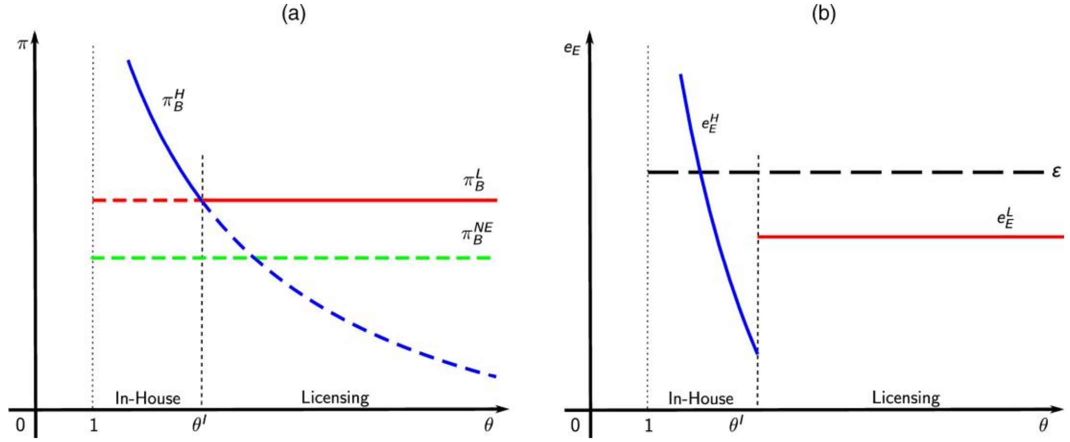
Finally, consider the effect of the technological distance between the two products θ.[26]

Figure 4. (Color online) Extension Product Effort and Profit as a Function of the Perceived Distance α



Notes. The intensive and extensive margins are α^I and α^E, respectively. The figure is drawn for the following parameter values: $\lambda = 0.45$, $\mu = 2.4$, $\rho = 0.75$, $\varepsilon = 0.5$ and $\theta = 3.2$. (a) Profits. (b) Effort on extension.

Figure 5. (Color online) Extension Product Effort and Profit as a Function of the Technological Distance θ



Notes. The intensive and extensive margins are θ^I and θ^E, respectively. The figure is drawn for the following parameter values: $\alpha = 0.4$, $\mu = 2$, $\rho = 0.5$, $\varepsilon = 0.4$ and $\lambda = 0.7$. (a) Profit. (b) Effort on extension.

Proposition 7. *Under in-house development, the equilibrium effort e_E is decreasing in θ; under licensing, instead, it is independent of θ. Further, if $\pi_B^L > \pi_B^{NE}$, then the brand owner develops the extension internally when θ is small and licenses the brand to a specialized licensee when it is larger.*

This result is illustrated in Figure 5. The intuition is straightforward.

6.5. Comovements and Empirical Correlations

In the end, then, does licensing cause brand dilution? In our model, the question is ill posed: licensing is an endogenous choice, so it cannot have a causal effect on another endogenous variable, that is, brand dilution. The right question is whether brand licensing and brand dilution covary or counter-vary with the exogenous factors and, hence, whether they tend to be associated positively or negatively.

An inspection of Figures 2–5 shows that the correlation may have either sign, depending on the source of the variability in the data. Consider, for instance, the effect of changes in the perceived distance α. If the upward jump in e_E at the intensive margin is small, as in Figure 4, e_E tends to decrease with α, whereas the relative profitability of licensing tends to increase. Therefore, in a data set in which the main source of variation is heterogeneity in the perceived distance, one should observe a positive correlation between licensing and brand dilution. But, of course, licensing cannot simply be taken to be the cause of brand dilution. On the contrary, the positive correlation reflects the fact that licensing is the better organizational mode precisely when the concern over brand dilution is greater.

A similar picture emerges when the parameter that varies is the technological distance θ. Here again, if the upward jump at the intensive margin is small, one should find a positive correlation between licensing and brand dilution in a data set in which the variation is driven by heterogeneity in the technological distance. But no causal inference can be drawn.

The changes in the magnitude of the reciprocal effect λ paint a different picture. Figure 2 illustrates the case in which the technological distance is sufficiently great for Proposition 4 to apply. For both organizational modes, the quality of the extension e_E improves as λ increases. And because, for high values of λ, licensing prevails, licensing is now associated with lower risk of brand dilution. Therefore, if the main source of variation in the data were heterogeneity in the magnitude of the reciprocal effect, the model would generate a negative correlation between brand licensing and brand dilution. The same conclusion holds for changes in the size of the extension market, ρ (Figure 3).

Thus, if the main source of variation in the data is heterogeneity in λ or ρ, licensing is associated with less brand dilution. If instead the main source of variation is heterogeneity in α or θ, then licensing is associated with more brand dilution. The empirical evidence indicates that the latter case is probably more relevant. But, in any event, neither variable exerts any causal effect on the other.

7. Robustness

As noted, all our main results extend to the case of two-sided moral hazard, which may be obtained by changing the timing of moves.[27] In this section, we briefly report other extensions of the baseline model. For a detailed analysis of these variants, see the online appendix.

7.1. Endogenous Quality Benchmark

In the baseline model, the benchmark level of quality is an exogenous parameter, but we also analyze an extension in which the benchmark may be an increasing function of the quality of the core product e_C. In this case, v_C becomes

$$v_C = e_C + \lambda(1-\alpha)[e_E - (\varepsilon + \gamma e_C)], \tag{16}$$

where $\gamma \geq 0$ is a new parameter.

The online appendix shows that, whereas the algebra is more cumbersome, the qualitative results remain almost identical to the baseline model with two main differences. First, under both modes of brand extension, an increase in γ reduces the brand owner's incentive to exert effort and, thus, makes brand extension less profitable without affecting the relative profitability of the two organizational modes. Second, at the intensive margin, an additional effect arises: a switch from internal development to licensing decreases e_C (Proposition 3), which increases the reciprocal effect. This new effect reinforces the other effects at work in the baseline model, so Proposition 3 continues to hold. The comparative statics also remains unaltered.

7.2. Multiple Extensions

The baseline model posits a single extension product, but it is straightforward to accommodate multiple extension products $i \in N = \{1, 2, \ldots, n\}$, assuming that the reciprocal effect is the sum of the effects generated by all the extensions:

$$v_C = e_C + \sum_{i \in \mathcal{E}} \lambda_i(1-\alpha_i)(e_{E,i} - \varepsilon_i), \tag{17}$$

where $\mathcal{E} \subseteq N$ is the set of the products for which the brand extension is carried out.

Naturally, the brand owner may choose internal development for some extensions and licensing for others. The determinants of this choice are the same as in the case of a single extension. The more products are developed in house, the better the internalization of the demand externality and, hence, the greater the effort on the core product, e_C.

Propositions 2 and 3 now hold product by product. When the brand owner is exactly indifferent as regards a licensing agreement for product i, the latter's contribution to the reciprocal effect is negative: $e_{E,i} < \varepsilon_i$. When, instead, the brand owner is exactly indifferent between extension via in-house development and licensing, a switch to licensing increases the quality of product i and, thus, reduces the likelihood of brand dilution.

7.3. The Licensee's Outside Option

In the baseline model, the licensee has no outside options and so accepts any offer that yields nonnegative profits. We also consider the case in which the licensee does have an outside option, guaranteeing a profit of $\Omega \geq 0$.

For example, one may imagine that, if the brand owner elects not to develop the extension internally, the extension product could be supplied independently by the potential licensee but with less demand. Assuming, to proceed with the example, that the new demand is $q = \rho(e_E + \omega - p)$ for some parameter ω, the licensee's outside option becomes $\Omega = \rho \frac{\omega^2}{4-2\rho}$.

The online appendix shows that the qualitative results continue to hold for any $\Omega \geq 0$. Naturally, as Ω increases, the licensing option becomes less profitable relative to in-house development. It can be shown that a rise in Ω leads to a decline in the royalty rate and, hence, to an increase in e_E. The impact of Ω on e_C, on the other hand, is ambiguous.

7.4. Two-Part Tariffs

In the baseline model, the licensing contract must stipulate the payment of royalties proportional to the output of the extension product. In another robustness check, we allow the brand owner to apply two-part tariffs $\{s, F\}$, where F is a fixed fee.[28] In this case, the licensing revenue is $sq + F$.

With two-part tariffs, the brand owner sets the fixed part such that the licensee makes exactly its outside option, $\pi_L = \Omega$. This condition pins down the fixed fee F for any value of the royalty rate. The royalty rate is then chosen so as to maximize the brand owner's profits.

In principle, the optimal royalty rate could even be negative as the licensor can extract its profits via the fixed fee. Negative royalty rates are never found in reality,[29] however, and even pure fixed-fee licensing would appear to be rare: see, for example, Raugust (2012). This suggests that extracting rents via the fixed fees entails some cost.[30]

In the online appendix, we develop the analysis using a reduced-form model of such costs, borrowed from Calzolari et al. (2020) and Condorelli and Padilla (2022). All our qualitative results continue to hold even with two-part tariffs provided that the optimal royalty rate is positive.

8. Conclusions

This paper proposes a comprehensive theoretical framework for addressing various economic and managerial issues relating to brand extension and licensing.

The analysis has led us to question the opinion, commonly held by scholars and practitioners alike, that brand dilution is strictly the unintended consequence of a poorly executed extension project. This opinion has become so prevalent, indeed, that it has trickled down to the popular press.[31] In reality, however, we show that brand dilution may be a deliberate strategic choice. Our analysis identifies various cases in which the optimal strategy necessarily entails brand dilution. This is so, in particular, when a licensed brand extension is just barely profitable (Proposition 2). But even internally developed extensions and extensions that are much more than barely profitable may result in intentional brand dilution. In other words, brand dilution is not to be eschewed at all costs, and when it occurs, it is not necessarily the sign of a backfire in strategy. Rather, it may reflect a strategy of monetization of the brand.

Managers, in conclusion, should consider the brand as an asset not only in which to invest but also, possibly, to disinvest. Brand dilution represents a viable opportunity for divestment, a way of cashing in the brand value. On the other hand, brand extension can also be a form of pure investment. Our analysis identifies instances (admittedly rather special cases) in which the brand owner suffers a diminution of profit on the extension product and yet carries out the extension anyway in order to benefit from brand enhancement. In these cases, the extension is a device that serves to enhance the prestige of the brand.

Because our model lacks the time dimension, the investment and divestment phases are distinct not in time but in the space of products. That is, managers invest in brand value by exerting effort on the core product and on those extensions that entail brand enhancement; they divest by pursuing brand extension beyond the point at which it begins to entail brand dilution. In practice, however, time is often crucial to the invest/divest dichotomy. To account for this aspect, a dynamic extension of the model is needed. It would be useful, for instance, to determine the stage in a brand's life cycle at which managers should optimally engage in brand dilution.

Our analysis also challenges the conventional wisdom that licensing always carries a greater risk of brand dilution. We show, in fact, that a switch to licensing always increases the quality of the extension for products for which in-house development and licensing are equally profitable. For these products, licensing systematically produces less brand dilution or more brand enhancement than internal development. Therefore, rather than seeing licensing as a potential cause of brand dilution, managers should view it as a countermeasure against the reduction in brand value that certain profitable extensions might entail.

Our findings challenge the conventional wisdom that licensing causes brand dilution; at the same time, our analysis also explains why such a view could emerge. Our model can indeed produce a correlation between brand licensing and dilution in the absence of any causal link. This is so, in particular, if the main source of variation in the available data are heterogeneity in the perceived and technological distance between the core and extension products. In these cases, the correlation arises because brand licensing becomes the more profitable strategy precisely when the risk of brand dilution is greater.

Another of the paper's contributions is the conceptual distinction between different facets of brand extension that are often conflated together in the scholarly debate and also in managerial practice. The analysis shows that these diverse factors may instead have different, possibly even opposed, implications.[32]

Consider, for instance, the common view that internal development is to be preferred when "the stakes are high." A natural interpretation is that this means when the potential market for the extension product is large. But our analysis offers only partial support for this common view because the model has two parameters correlated with the size of the extension market: the scale parameter ρ and the perceived distance α (closer products being in higher demand than more distant ones because they benefit more from the reputation and image of the parent brand). These parameters differ considerably, however, in the optimal mode of extension. When the extension market is large owing to high ρ, the brand owner should license, but when the large size of the market depends on small α, the owner should opt instead for in-house development. Thus, looking at size only may be misleading. Managers should try to determine why the extension market is large or small and respond in diversified fashion to the different factors. Likewise, scholars who use the size of the extension market as an explanatory variable in empirical research should expect mixed results. Disentangling the different effects can yield more definite findings.

As another example, consider demand spillovers, which are crucial in brand extension. Because these externalities are better internalized under in-house development, it is tempting to think that stronger spillovers should make this relatively more profitable than licensing. Here again, however, our analysis uncovers a more complex picture. Specifically, we distinguish between the demand externalities that run from the core to the extension product and those that run the other way. The magnitude of the former is captured by the perceived distance α but that of the latter also depends on the reciprocal effect parameter λ. As it turns out, these parameters have opposite effects. Stronger spillovers from the core to the extension product (lower α) make in-house development relatively more profitable in accordance with the intuition on the internalization of demand externalities. However, stronger spillovers from the extension to the core product (higher λ) make in-house development relatively less profitable. This once again highlights the importance of disentangling separate effects.

In summary, our analysis demonstrates that the best means of brand extension and the impact on the risk of brand dilution depend on more factors and in a subtler way than is often thought. At the same time, we suggest a unified theoretical framework for analyzing these effects, which can be helpful to managers and empirical researchers alike.

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Appendix A. Equilibrium Under In-House Development

Solving the system of first order Conditions (8) and (9), we obtain

$$e_C^H = \frac{\mu\{2\theta - \rho[1-(1-\alpha)^2\lambda]\}}{\theta[2-(1-\alpha)^2\rho]-\rho} \tag{A.1}$$

and

$$e_E^H = \frac{(1-\alpha)\mu\{\lambda[2-(1-\alpha)^2\rho]+\rho\}}{\theta[2-(1-\alpha)^2\rho]-\rho}. \tag{A.2}$$

Substituting these values into (7), we then get

$$\pi_B^H = \frac{\mu^2\{2\theta+2(1-\alpha)^2\lambda^2-\rho[1-(1-\alpha)^2\lambda]^2\}}{2\{\theta[2-(1-\alpha)^2\rho]-\rho\}} - (1-\alpha)\varepsilon\lambda\mu. \tag{A.3}$$

Appendix B. Equilibrium Under Licensing

Substituting the value of the brand owner's optimal effort e_C^L into (13), we obtain the equilibrium value of the royalty rate:

$$s^L = \frac{(1-\alpha)\mu\{2-\rho-\lambda\{2-\rho[2-(2-\alpha)\alpha]\}\}}{4-[3-(2-\alpha)\alpha]\rho}. \tag{B.1}$$

Plugging this into (12), we obtain

$$e_E^L = \frac{(1-\alpha)(\lambda+1)\mu\rho}{4-[3-(2-\alpha)\alpha]\rho}. \tag{B.2}$$

Finally, substituting (B.1) and (B.2) into the profit function (14), we get

$$\pi_B^L = \frac{\mu\{\mu[4+(1-\alpha)^2\lambda(2+\lambda)\rho-2\rho] - 2(1-\alpha)\lambda\varepsilon\{4-[3-(2-\alpha)\alpha]\rho\}\}}{2\{4-[3-(2-\alpha)\alpha]\rho\}}. \tag{B.3}$$

Appendix C. Proof of Proposition 1

As noted in the main text, the first best efforts are $e_C^{FB} = e_C^H|_{\theta=1}$ and $e_E^{FB} = e_E^H|_{\theta=1}$.

Under in-house development, the underinvestment result then follows directly from the negativity of the following derivatives:

$$\frac{\partial e_C^H}{\partial\theta} = -\frac{(1-\alpha)^2\mu\rho\{\lambda[2-(1-\alpha)^2\rho]+\rho\}}{\{\theta[(1-\alpha)^2\rho-2]+\rho\}^2} < 0, \tag{C.1}$$

$$\frac{\partial e_E^H}{\partial\theta} = -\frac{(1-\alpha)\mu[2-(1-\alpha)^2\rho]\{\lambda\rho+[2-(1-\alpha)^2\rho]\}}{\{\theta[2-(1-\alpha)^2\rho]-\rho\}^2} < 0. \tag{C.2}$$

As for licensing, we have

$$e_C^{FB} - e_C^L = \frac{(1-\alpha)^2(1+\lambda)\mu(2-\rho)\rho}{\{2-[2-(2-\alpha)\alpha]\rho\}\{4-[3-(2-\alpha)\alpha]\rho\}}, \tag{C.3}$$

and

$$e_E^{FB} - e_E^L = (1-\alpha)\mu\frac{(2-\rho)\rho+8\lambda-\rho\lambda\{12-5\rho-(2-\alpha)\alpha[6-5\rho+(2-\alpha)\alpha\rho]\}}{\{2-[2-(2-\alpha)\alpha]\rho\}\{4-[3-(2-\alpha)\alpha]\rho\}}. \tag{C.4}$$

It is easy to check that both expressions are always positive given our restrictions on the model's parameters. □

Appendix D. Proof of Proposition 2

If licensing is the optimal extension mode at the extensive margin, the margin is defined by

$$\pi_B^L = \pi_B^{NE}. \tag{D.1}$$

For the purpose of the proof, it is convenient to solve this equation for parameter μ:

$$\mu = \frac{\{4-(3-(2-\alpha)\alpha)\rho\}-2\lambda\varepsilon}{(1-\alpha)(1+\lambda)^2\rho} \equiv \mu^E. \tag{D.2}$$

At this value of μ, we have

$$e_E^L|_{\mu=\mu^E} = \varepsilon\left(1-\frac{1-\lambda}{1+\lambda}\right), \tag{D.3}$$

and hence, $e_E^L|_{\mu=\mu^E} < \varepsilon$, meaning that there is brand dilution at the extensive margin. □

Appendix E. The Extensive Margin with In-House Development

Here, we show that, if, at the extensive margin, in-house development is the optimal extension mode, then there can be brand enhancement. In this case, the extensive margin is defined by

$$\pi_B^H = \pi_B^{NE}. \tag{E.1}$$

The locus is well-defined only if $\theta > \frac{\rho(\alpha\mu-\varepsilon-\mu)^2}{\varepsilon^2[2-(1-\alpha)^2\rho]}$; otherwise, developing the extension in-house is always more profitable than avoiding brand extension.

Under this condition, Equation (E.1) has two roots:

$$\lambda_1^{EH} = \frac{\varepsilon\Xi-(1-\alpha)\mu\rho-\sqrt{\Xi[(1-\alpha)^2\mu^2\rho+\varepsilon^2\Xi-2(1-\alpha)\varepsilon\mu\rho]}}{(1-\alpha)\mu[2-(1-\alpha)^2\rho]}, \tag{E.2}$$

and

$$\lambda_2^{EH} = \frac{\varepsilon\Xi-(1-\alpha)\mu\rho+\sqrt{\Xi[(1-\alpha)^2\mu^2\rho+\varepsilon^2\Xi-2(1-\alpha)\varepsilon\mu\rho]}}{(1-\alpha)\mu[2-(1-\alpha)^2\rho]}, \tag{E.3}$$

where

$$\Xi = \theta[2-(1-\alpha)^2\rho]-\rho.$$

In other words, now the extensive margin has two branches with $\lambda_1^{EH} < \lambda_2^{EH}$. The lower branch λ_1^{EH} is always economically relevant (i.e., $\lambda_1^{EH} \le 1$), whereas the upper branch λ_2^{EH} is economically relevant only if ρ is sufficiently small.

It is a matter of simple algebra to obtain

$$e_E^H|_{\lambda=\lambda_1^{EH}} - \varepsilon = -\sqrt{\frac{(1-\alpha)^2\mu^2\rho + \varepsilon^2\Xi - 2(1-\alpha)\varepsilon\mu\rho}{\Xi}} < 0, \tag{E.4}$$

and

$$e_E^H|_{\lambda=\lambda_2^{EH}} - \varepsilon = \sqrt{\frac{(1-\alpha)^2\mu^2\rho + \varepsilon^2\Xi - 2(1-\alpha)\varepsilon\mu\rho}{\Xi}} > 0. \tag{E.5}$$

This latter inequality demonstrates that, when $\lambda_2^{EH} < 1$, we may have brand enhancement at the extensive margin as claimed in the text surrounding Endnote 21. □

Appendix F. Proof of Proposition 3

The intensive margin is implicitly defined by condition

$$\pi_B^H = \pi_B^L. \tag{F.1}$$

For the purpose of the proof, it is convenient to solve this equation for parameter θ:

$$\theta^I = \frac{2\lambda\rho\{[5-3(2-\alpha)\alpha]\lambda - 4\} - 8\lambda^2 - \rho^2\{[2-(2-\alpha)\alpha]\lambda - 1\}^2}{\rho\{\lambda(\lambda+2)[(1-\alpha)^2\rho - 2] - 2\rho + 2\}}. \tag{F.2}$$

The difference between the efforts on the core product under the two extension modes is

$$e_C^H - e_C^L = (1-\alpha)^2\mu\rho\frac{\lambda\rho[(\alpha-2)\alpha(\theta-1)+\theta-2] + 2\theta(1-\lambda) - 2\theta\rho + 4\lambda + \rho}{\{4-[3-(2-\alpha)\alpha]\rho\}\{\theta[2-(1-\alpha)^2\rho] - \rho\}}. \tag{F.3}$$

Evaluating the difference at $\theta = \theta^I$, we get

$$(e_C^H - e_C^L)|_{\theta=\theta_I} = (1-\alpha)^2\lambda\mu\rho\frac{2-\rho+\lambda\{2-[2-(2-\alpha)\alpha]\rho\}}{\{4-[3-(2-\alpha)\alpha]\rho\}\{\lambda[2-(1-\alpha)^2\rho]+\rho\}}, \tag{F.4}$$

which is positive for all admissible parameter values.

Likewise, the difference between the effort on the extension product under in-house development and licensing

$$e_E^H - e_E^L = (1-\alpha)\mu\left\{\frac{(1+\lambda)\rho}{4-[3-(2-\alpha)\alpha]\rho} - \frac{\lambda[2-(1-\alpha)^2\rho]+\rho}{\theta[2-(1-\alpha)^2\rho]-\rho}\right\}, \tag{F.5}$$

evaluated at $\theta = \theta^I$, becomes

$$(e_E^H - e_E^L)|_{\theta=\theta^I} = -(1-\alpha)\mu\rho\frac{2-\rho+\lambda\{2-[2-(2-\alpha)\alpha]\rho\}}{\{4-[3-(2-\alpha)\alpha]\rho\}\{\lambda[2-(1-\alpha)^2\rho]+\rho\}}, \tag{F.6}$$

which is negative for all admissible parameter values. □

Appendix G. Proof of Proposition 4

Consider first the first part of the proposition. We have

$$\frac{\partial e_E^H}{\partial\lambda} = \frac{(1-\alpha)\mu(2-(1-\alpha)^2\rho)}{\theta[2-(\alpha-1)^2\rho]-\rho} > 0, \tag{G.1}$$

and

$$\frac{\partial e_E^L}{\partial\lambda} = \frac{(1-\alpha)\mu\rho}{4-[3-(2-\alpha)\alpha]\rho} > 0. \tag{G.2}$$

For the second part, we start by evaluating the relative profitability of the two modes of extension at $\lambda = 0$:

$$(\pi_B^H - \pi_B^L)|_{\lambda=0} = \frac{(1-\alpha)^2\mu^2\rho[2\theta(1-\rho)+\rho]}{2[4-(3-2\alpha+\alpha^2)\rho]\{\theta[2-(1-\alpha)^2\rho]-\rho\}} > 0. \tag{G.3}$$

Thus, in-house development is always preferred to licensing at $\lambda = 0$.

Next, notice that the difference $\pi_B^H - \pi_B^L$ has two roots in λ, which are real if $\rho > \frac{2}{\theta}$. However, only one of them lies in the interval $0 \le \lambda \le 1$ provided that $\theta > \frac{\rho[(1-\alpha)^4\rho + 6(2-\alpha)\alpha + 2] + 8}{\rho[4-3(2-\alpha)\alpha\rho - \rho]}$ (if this inequality does not hold, in-house development is always preferred to licensing), and it is

$$\lambda^I = \frac{(1-\alpha)^2\mu\rho\{4-2\theta-\rho[(2-\alpha)\alpha(\theta-1)-\theta+2]\} + (1-\alpha)^2\mu\Theta}{(1-\alpha)^2\mu\{2\rho[5+\theta-3(2-\alpha)\alpha]-8 - \rho^2\{4+\theta-(2-\alpha)\alpha[4+\theta-(2-\alpha)\alpha]\}\}}, \tag{G.4}$$

where

$$\Theta = \sqrt{\rho(\theta\rho-2)[4-(3-(2-\alpha)\alpha)\rho]\{\theta[2-(1-\alpha)^2\rho]-\rho\}}.$$

The slope of the difference of the profit functions, evaluated at $\lambda = \lambda^I$, is

$$\left.\frac{\partial(\pi_B^H - \pi_B^L)}{\partial\lambda}\right|_{\lambda=\lambda^I} = -(1-\alpha)^2\mu^2\sqrt{\frac{\rho(\theta\rho-2)}{[4-(3-2\alpha+\alpha^2)\rho]\{\theta[2-(1-\alpha)^2\rho]-\rho\}}}, \tag{G.5}$$

and, thus, is always negative. This implies that π_B^L cuts π_B^H from below. Therefore, in-house development is preferred to licensing for $\lambda < \lambda^I$, and the opposite is true when $\lambda > \lambda^I$.

Next, consider the choice of whether to develop the extension via licensing or avoid brand extension. Note that π_B^{NE} is independent of λ and

$$\pi_B^L|_{\lambda=0} = \frac{\mu^2(2-\rho)}{4-[3-(2-\alpha)\alpha]\rho} > \pi_B^{NE}.$$

Equation $\pi_B^L = \pi_B^{NE}$ has two roots in λ, which are real if

$$\varepsilon > \frac{2(1-\alpha)\mu\rho}{4-[3-(2-\alpha)\alpha]\rho}.$$

(If this inequality does not hold, it is always profitable to extend the brand.) Under this condition, it is easy to check that $\pi_B^L|_{\lambda=1} < \pi_B^{NE}$. The one root of equation $\pi_B^L = \pi_B^{NE}$ that lies in the interval $0 \le \lambda \le 1$ is

$$\lambda^{EL} = \frac{\varepsilon\{4-[3-(2-\alpha)\alpha]\rho\} - (1-\alpha)\mu\rho - \{4-[3-(2-\alpha)\alpha]\rho\}\sqrt{\varepsilon\left\{\varepsilon - \frac{2(1-\alpha)\mu\rho}{4-[3-(2-\alpha)\alpha]\rho}\right\}}}{(1-\alpha)\mu\rho}. \quad \text{(G.6)}$$

It follows that licensing is preferred to no extension to the left of λ^{EL}, and the opposite is true to the right of λ^{EL}.

Appendix E develops the comparison between π_B^H and π_B^{NE}; if θ is sufficiently large, the relevant margin there is λ_1^{EH}.[33] The extensive margin is $\lambda^E = \min[\lambda^{EL}, \lambda_1^{EH}]$.

Depending on the relative values of λ^I and λ^E, two cases may arise. If $\lambda^E > \lambda^I$, licensing is the optimal extension mode at the extensive margin. This is the case described in the statement of Proposition 4 and depicted in Figure 2. If, instead, $\lambda < \lambda^I$, then the interval in which licensing is optimal vanishes. In this case, in-house development is optimal for $\lambda < \lambda^E$ and no licensing for $\lambda > \lambda^E$. □

Appendix H. Proof of Proposition 5

We have

$$\frac{\partial e_E^H}{\partial \rho} = \frac{2(1-\alpha)\mu(\theta+\lambda)}{\{\theta[2-(1-\alpha)^2\rho]-\rho\}^2} > 0, \quad \text{(H.1)}$$

and

$$\frac{\partial e_E^L}{\partial \rho} = \frac{4(1-\alpha)(1-\lambda)\mu}{\{4-[3-(2-\alpha)\alpha]\rho\}^2} > 0. \quad \text{(H.2)}$$

The proof of the second part of the proposition follows the same steps as that of Proposition 4; details are left to the reader. □

Appendix I. Proof of Proposition 6

We have

$$\frac{\partial e_E^H}{\partial \alpha} = -\mu \frac{\theta\lambda[(1-\alpha)^2\rho-2]^2 + \theta\rho[(1-\alpha)^2\rho+2] + \lambda\rho[3(1-\alpha)^2\rho-2] - \rho^2}{\{\theta[2-(1-\alpha)^2\rho]-\rho\}^2}, \quad \text{(I.1)}$$

and

$$\frac{\partial e_E^L}{\partial \alpha} = -(1+\lambda)\mu\rho\frac{4-[(2-\alpha)\alpha+1]\rho}{\{4-[3-(2-\alpha)\alpha]\rho\}^2}. \quad \text{(I.2)}$$

The second derivative is clearly negative. As for the first, note that the numerator of (G.6) is positive at $\alpha = 1$. Furthermore, using the change of variables $(1-\alpha)^2 = \Psi$, it is easy to see that the numerator is a polynomial of degree 2 in Ψ, the discriminant of which is negative. Therefore, the numerator is always positive, and thus, the derivative is always negative.

The proof of the second part of the proposition follows the same steps as that of Proposition 4; details are left to the reader. □

Appendix J. Proof of Proposition 7

We have

$$\frac{\partial e_E^H}{\partial \theta} = -\frac{(1-\alpha)\mu[2-(1-\alpha)^2\rho]\{\lambda[2-(1-\alpha)^2\rho]+\rho\}}{\{\theta[2-(1-\alpha1)^2\rho]-\rho\}^2} < 0. \quad \text{(J.1)}$$

The proof of the second part of the proposition follows the same steps as that of Proposition 4; details are left to the reader. □

Endnotes

[1] The original brand is also called the parent brand; when stretched to apply to a new product, it gives a brand extension.

[2] The revenues from brand licensing reached $315.5 billion in 2022 with an 8% increase over 2019, according to the 2022 report by Licensing International (see https://licensinginternational.org/, accessed March 13, 2023). The entertainment sector holds the largest share (with the Walt Disney Company as the top global licensor), followed by sports and fashion. Historically, brand licensing dates back to the fashion industry in the 1950s, when Christian Dior, Chanel, and Pierre Cardin started licensing their names. In that industry, brand licensing is still widespread (e.g., Saviolo and Giannelli 2001).

[3] A glaring example is Pierre Cardin—once the epitome of brand extension via licensing with more than 500 licensing agreements for such products as cigarettes, baseball caps, even toilet-seat covers. Another example is Yves Saint Laurent, which managed 60 licensing contracts in 2001 before cutting back to 15 the next year (Corbellini and Saviolo 2014).

[4] In their empirical research on the determinants of the mode of extension, Colucci et al. (2008) propose and test various hypotheses based on transaction cost theory but do not offer any formal model.

[5] As for the extension product, the fact that demand externalities are internalized more fully under internal development has to be weighed against the superior ability of the licensee in developing the extension product. This makes the comparison ambiguous.

[6] See, for example, Tadelis (1999), Cabral (2000, 2009), Choi (2001), Hakenes and Peitz (2008), Miklós-Thal (2012), Rasmusen (2016), and the references therein. The industrial organization literature often refers to brand extension as "umbrella branding."

[7] Integrating rigorous microfoundations of consumer behavior into the analysis is a task for future research.

[8] The litigation between Calvin Klein and its licensee Warnaco Group neatly illustrates the kind of opportunistic behaviors that may arise. In 2000, Calvin Klein sued Warnaco, charging it with brand equity dilution for breaching the jeanswear licensing and distribution contract by distributing products through warehouse clubs that the brand owner considered unacceptable. Warnaco filed a countersuit, accusing Calvin Klein of ineffective brand advertising and, thus, of damaging its business (Fournier and Boer 2002). In this example, the moral hazard is evidently two-sided.

[9] As noted by one of the referees, this assumption may be restrictive when the demand for the extension product depends on the relative status of the core product in its industry.

[10] As a rule, we use Latin letters to denote endogenous variables and Greek for exogenous parameters. The one exception is profits denoted by π.

[11] The possibility that β may be different for the core and the extension products is equivalent, analytically, to changes in the parameters μ and ρ introduced subsequently.

[12] The effect of correlated changes in α and θ can be obtained simply by combining our results on their separate effects.

[13] This implies that the profit function has the property of certainty equivalence, which is why the idiosyncratic shocks mentioned would not affect strategic choices if firms were risk neutral.

[14] A linear specification of the core product demand, similar to (1), would complicate the algebra without adding any insight. The main complication is that the concavity of the profit functions in

effort levels would require more severe parametric restrictions than the rectangular specification. Without such restrictions, corner solutions would arise.

15 Setting the coefficient of e_C to one is an innocuous normalization as any change in that coefficient would be equivalent to changes in μ.

16 Otherwise, firms could attain the efficient solution either by vertical integration or through complete contracts.

17 Two-part tariffs alleviate the problem of double marginalization that arises with royalty contracts but do not alter our main conclusions. Another way of addressing the double-marginalization problem is through revenue-sharing contracts or letting the brand owner set the price of the extension product. But even these more complex contractual arrangements provide an insufficient incentive to exert effort as each party obtains only part of the extra profits generated by higher quality products.

18 The complementarity would be reinforced if the demand for the core product were linear rather than rectangular, which is why, in that case, stronger parametric restrictions would be needed to ensure concavity of the profit functions.

19 Besides guaranteeing concavity, the assumption that ρ is not too large ensures that most of the brand owner's revenue comes from its core business.

20 This is an approximation because the extension also affects e_C. The approximation is exact for $s \approx 0$ when the effect of the extension on e_C is negligible.

21 Intuitively, it arises when the exclusive purpose of the extension is to enhance the value of the brand through a positive reciprocal effect. For this strategy to be profitable, however, the reciprocal effect must be sufficiently strong (high λ) and the market for the extension product must be sufficiently small (low ρ). Appendix E elaborates on this point.

22 In the model with two-sided moral hazard, inequality $e_C^H > e_C^L$ holds always, not only at the intensive margin.

23 Some of these intervals may be empty. For example, licensing may never be optimal if the size of the extension market is very small, and brand extension may never be optimal if ε is very large. Similar considerations apply to Propositions 5–7.

24 This follows by the logic that underlies Proposition 3. If the extension entails brand enhancement at the extensive margin, then the direct effect of the extension on the brand owner's profit, $\pi^M - \frac{1}{2}e_E^2$, must be negative.

25 A case in point is Pirelli's tennis balls. In the 1970s and 1980s, the firm's tennis ball division kept generating losses. But production was never discontinued because the management believed that Pirelli tennis balls helped to maintain and enhance the brand name. More recently, Giorgio Armani has introduced, among its extensions, flowers and chocolates to further strengthen the Armani brand image (Editorial staff, "Giorgio Armani ha aperto uno store a Monaco," *Pambianco News*: see https://www.pambianconews.com/2003/12/18/giorgio-armani-ha-aperto-uno-store-a-monaco-8134/, retrieved February 28, 2022.)

26 The effects of the other parameters are straightforward. An increase in the size of the core market μ increases e_E under both organizational modes. It has a multiplicative effect on all equilibrium profits and, thus, does not affect the relative profitability of the different options. An increase in ε generally reduces the profitability of brand extension without affecting the relative profitability of internal development and licensing.

27 See the discussion paper version of this article (CEPR DP 17216) for a detailed analysis of this case.

28 In the absence of uncertainty, more complex schedules would be redundant: see, for instance, Bhattacharyya and Lafontaine (1995) and Bousquet et al. (1998).

29 One reason for this is that negative royalties might open the door to various kinds of opportunistic behavior. For example, the licensee might inflate volumes by secretly repurchasing the product from its customers.

30 For example, if the demand for the extension product is uncertain and the brand owner sets the fixed fee to the value corresponding to the average demand, the licensee is exposed to losses if the demand turns out to be low. If the licensee is risk-averse, then the fixed fee is a costly means of rent extraction.

31 For example, *The Economist* (March 6, 2004, p. 8) notes that "Mr. Cardin, rolling in his royalties, did not seem to care" that a series of seemingly thoughtless extensions were diluting his brand value. In a similar vein, *The New York Times* more recently (May 14, 2021) made similar claims about Halston, who signed with JC Penney to design home furnishings and other products in what was both hailed as the most significant licensing design agreement in the history of the fashion industry and disparaged as a golden cage for his brand name.

32 Peng et al. (2023) draw similar conclusions from their meta-analysis of the determinants of brand extension success or failure.

33 The condition on θ ensuring the existence of λ^I implies that λ_2^{EH} is larger than one.

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