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Experience Goods, Umbrella Branding, and Reputation

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Abstract
This paper examines umbrella brands—brand stretching or brand extension—in a model of experience goods and an infinite number of periods. A monopoly firm has short-run incentives to compromise on product quality so as to save costs, as buyers can observe quality only ex post. The paper shows that the overlapping structure of product launching strengthens umbrella branding, mitigates moral hazard, and makes easier the building of a good reputation and its maintenance. The overlapping structure generates switching costs between strategies.

Keywords Brands · Bundling · Experience goods · Reputation · Tying

JEL Classification L12 · L14 · L15 · D21 · M31

1 Introduction

Umbrella branding is a practice of labeling more than one product under a single brand name. Without umbrella branding, buyers often do not know which products are produced by the same firm. This paper examines umbrella branding in a moral hazard environment in which a firm has private information about product quality. Good quality is socially optimal, but a profit-maximizing firm may produce bad quality. The major novelty of this paper is to show how the overlapping structure of project launching strengthens the positive impacts of umbrella branding and mitigates moral hazard.

What does the *overlapping structure* mean? Assume that a firm has 20 different products and that the product lifecycle is 20 years. After 20 years of production, the firm needs to discard an old product and replace it with a new one. Consider two alternatives: First, the firm launches 20 new products in years 2000, 2020, 2040, …, forever, In essence, the firm renews the whole product assortment at the same time (every 20 years). Second, instead, the firm launches one new product each year. The

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firm has one new and 19 existing products each year, forever. We label this second pattern the "overlapping structure". We show that umbrella branding is more effective under the second alternative. A firm will not ruin its valuable brand name by launching a bad product if it is already selling 19 good products under the same brand name. This impact does not occur in the first alternative. The overlapping structure motivates the firm to retain the existing good quality and to choose good quality for the initial products even if the firm would prefer bad quality without it.

This paper is most related to Klein and Leffler (1981) and Andersson (2002). Andersson (2002) examines a monopoly firm. It charges the unconstrained monopoly price if the incentive constraint—the incentive to choose high quality—does not bind. If it binds, the price is distorted upwards, and the profit is smaller. Assume now that the firm has two products. As long as the products are *asymmetric* and at least one of the incentive constraints for high quality binds, joint production is profitable for the firm. This means that umbrella branding alleviates the incentive problem and increases profits.

In our model, the firm chooses a production technology—"good" or "bad"—for two periods. The incentive problem prevents production if the firm has only one product or if it produces one product period after period, forever. The option to produce two products does not alleviate the incentive problem if the firm introduces two new production technologies—or launches two new products—at the same time in every second period: Umbrella branding by itself does not alleviate the incentive problem, because the products are *symmetric*, the new-product introductions are *synchronous,* the production process is risk-free, and buyers can observe the quality ex post. Production is impossible without the overlapping structure.

Finally, consider the overlapping structure: A firm introduces one new production technology (launches one new product) in each period. The firm has a new product in the first period, and both a new product and an existing product in the later periods (the new-product introductions are *asynchronous*). The incentive problem is identical in each period, and the overlapping structure alleviates the incentive problem in each period. The firm may prefer good quality with the overlapping structure even if the firm favors bad quality without it. In contrast to Andersson (2002), joint production and umbrella branding alleviate the incentive problem even if the products are *symmetric*.

The paper proceeds as follows. Section 2 reviews the relevant literature; Sect. 3 characterizes the economy; Sect. 4 shows the equilibrium; and Sect. 5 draws conclusions.

2 Related Literature

This paper builds on the literature on experience goods, product quality, and reputations: e.g., Klein and Leffler (1981), Shapiro (1983), Milgrom and Roberts (1986) and Huck et al. (2012, 2016). In particular, the paper is related to research on brands. Tadelis (1999, 2002), for instance, examines trade in brand names, whereas Nilssen (1992, 2000), Gabszewicz et al. (1992), Elzinga and Mills (1998, 1999), Villas-Boas (1999, 2006), Shy (2002, 2011), Gabrielsen and Vagstad (2003, 2008), Chioveanu

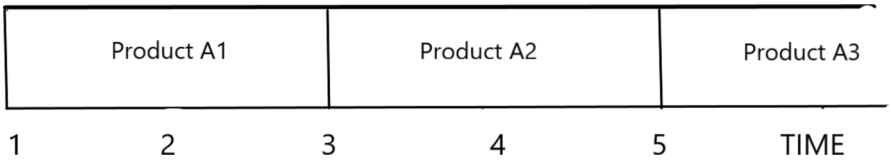

Fig. 1 One production technology and one product in each period

(2008), Doganoglu (2010), Schmidt (2010, 2013) and Niinimaki (2022) investigate brand switching/brand loyalty.

Most of all, our paper adds to literature on umbrella branding. It has been studied in both moral hazard and adverse selection environments. In adverse selection models—e.g., Sappington and Wernerfelt (1985); Wernerfelt (1988); Sullivan (1990); Pepall and Richards (2002); and Choi (2003)—a firm aims to convey to buyers that it belongs to the good-quality firms. In the moral hazard models—e.g., Montgomery and Wernerfelt (1992); DeGraba and Sullivan (1995); Choi (1998); Andersson (2002); Cabral (2009); Miklós-Thal (2012); Dana and Spier (2015, 2018); and Rasmusen (2016)—a firm must convince buyers that it will select good quality.[1]

3 Model

Consider a risk-neutral economy with an infinite number of periods and discount factor $\delta < 1$. The economy has a monopoly firm and identical short-lived buyers in each period. The firm can operate forever, and it maximizes the NPV of its lifetime profits. The firm produces non-durable experience goods. The quality of the products—good or bad—is ex ante unobservable to outsiders, and a buyer learns the quality by purchasing the product. If buyers do not purchase from the firm, both the buyers and the firm get a payoff of zero.

The lifespan of a production technology is two periods. A technology produces one product in a period. The firm can choose from two technologies: A good (bad) technology produces good (bad) products. A good (bad) technology incurs a fixed cost $F_g\left(F_b\right)$ in the introduction period of the technology—$F_g \geq F_b \geq 0$—and a variable cost $C_g(C_b)$, $C_g \geq C_b > 0$, in both periods. We must have either: *i*)$F_g > F_b$ or $C_g > C_b$; or *ii*)$F_g > F_b$ and $C_g > C_b$.

In Fig. 1, the firm introduces the first technology at the start of period 1. If the technology is good, the firm bears the fixed cost of the production F_g in period 1 and a variable cost C_g in periods 1 and 2. The first technology produces Product A1 in periods 1 and 2. It expires at the end of period 2. The firm chooses a new technology, good or bad, at the start of period 3 employs it in periods 3 and 4. If this technology is good (bad), it incurs a fixed cost $F_g(F_b)$ in period 3 and a variable cost $C_g(C_b)$ in periods 3 and 4.

[1] For intertemporal bundling, see DeGraba & Mohammed (1999).

Let P denote the price of the products. The firm receives the selling income P and bears the cost of production at the end of each period. $v_g(v_b)$ shows the value of a good(bad) product to the buyer: $v_g > v_b$. For brevity, we assume that $v_b = 0$. Good quality is assumed to be socially profitable to produce. Since $v_b = 0$, bad quality wastes resources. Buyers will purchase good products; and under perfect information the firm supplies them. In the model, however, the product quality is unobservable to buyers. As a result, the firm is tempted to shirk and supply bad products. If the firm produces bad quality, this information spreads in the economy, and the buyers of the next generations will not buy from the firm again.

The firm selects a production technology or two technologies if it produces two products. The firm selects the sale price at the start of each period. Buyers then choose whether to purchase one unit of the firm's products. At the end of the period, the firm bears the cost of production, buyers pay the firm and receive the products, and the quality of the products becomes public. The next period begins with new buyers and new decisions by the firm about the technologies and prices.

Infinitely repeated moral hazard games have a multiple number of subgame perfect equilibriums. The simplest equilibrium of the present game is a pessimistic equilibrium: Consumers expect low quality and are unwilling to pay anything. In this case, no purchases are made, and the firm does not produce. It is clear that the pessimistic equilibrium is not first-best efficient in terms of total surplus. We focus on the simplest of the equilibriums in which quality is good and the payoff of the firm is maximal (the total surplus is greatest). This equilibrium is a natural one because the firm is a monopoly in each period. The equilibrium is supported by the following equilibrium behavior and beliefs:

The firm maintains a reputation for producing good quality by actually doing so, and buyers switch to the "bad equilibrium"—the equilibrium with low expectations, zero demand, and no scope for building a reputation—if a firm ever produces a bad quality.[2] If buyers anticipate bad quality, they do not buy: Buyers are ready to purchase a product only if the profit-maximizing strategy of the firm is to produce good quality. We will see that a price premium is necessary to induce good-quality supply: *the quality-assuring price*. Buyers know the characteristics of the economy and can deduce the quality-assuring price from the characteristics. Buyers compare the quality-assuring price to the firm's price offer. If the price offer is lower (is not lower) than the quality-assuring price, buyers know that the firm chooses bad (good) quality. A buyer's strategy is simple: He takes the firm's price offer as given and accepts the offer if it does not exceed the value of the product v_g and the price is not below the quality-assuring price.

In each period, the firm makes a take-it-or-leave-it offer to buyers and therefore optimally sets the price equal to the buyer's willingness to pay for the product v_g. Buyers accept the offer only if v_g is at least the same as the quality-assuring price. It is crucial to discover the quality-assuring price in different scenarios and compare it with v_g.

One production technology: The firm produces one product in each period, and it replaces the expiring production technology with a new one in years $1, 3, 5, \ldots$ (Fig. 1).

[2] This is a standard assumption in these models: e.g., Klein & Leffler (1981) and Andersson (2002).

If the firm produces good products forever, the present discounted value of the future profits is

$$\pi_g = \frac{\delta\left(P_{NO} - C_g\right)}{1-\delta} - \frac{\delta F_g}{1-\delta^2}. \tag{1}$$

The sale price is P_{NO} (NO overlapping structure). The firm bears the variable cost of production C_g in each period and the fixed cost F_g in every second period when it introduces a new technology.

If the firm produces bad quality, no buyer will buy from it after the current period. The firm gains one period of high profits and zero profits thereafter

$$\pi_b = \delta\left(P_{NO} - C_b - F_b\right). \tag{2}$$

It is easy to discover the quality-assuring price P^*_{NO} such that the firm will produce good quality: $\pi_g\left(P^*_{NO}\right) \geq \pi_b\left(P^*_{NO}\right)$, or

$$P^*_{NO} = C_g + \frac{F_g}{1+\delta} + \frac{1-\delta}{\delta}\left(C_g - C_b - F_b + \frac{F_g}{1+\delta}\right). \tag{3}$$

Since $\pi_g\left(P^*_{NO}\right) > 0$, the term in the brackets is positive (that is easy to see by inserting (3) into (1)). We utilize this fact in the proof of Lemma 1. If the price is at least P^*_{NO}, buyers know that the firm chooses good quality. Recall that the firm charges v_g. If $v_g \geq P^*_{NO}$, the firm produces good quality.

Alternatively, if we insert $P_{NO} = v_g$ into (1) and (2), we can use them to express the non-deviation constraint $\pi_g(\delta) - \pi_b(\delta) \geq 0$ as

$$\frac{\delta}{1-\delta^2}\left[\delta^2 A + \delta B - D\right] \geq 0, \textit{where} \tag{4}$$

$A = v_g - C_b - F_b > 0, \quad B = v_g - C_g > 0, \quad D = F_g + C_g - C_b - F_b > 0.$

Now (4) provides an alternative threshold value: δ^*_{NO}. If the discount factor δ is at least δ^*_{NO}, the firm chooses good quality,

$$1 > \delta^*_{NO} = \frac{-B + \sqrt{B^2 + 4AD}}{2A} > 0. \tag{5}$$

Two production technologies with umbrella branding: The firm introduces two production technologies in every second period and produces two products in each period (Fig. 2).

The products entail the same costs and have the same reservation utilities as above. It is unprofitable to choose a good production technology for one product and a bad technology for the other product. To avoid this, the firm chooses either two good technologies or two bad technologies. If the firm chooses two good (bad) technologies, it makes profit $2\pi_g(2\pi_b)$. The firm prefers good quality if $2\pi_g \geq 2\pi_b$, or, $\pi_g \geq \pi_b$. The incentive problem is the same as in the case of one product. Selling two similar products doubles future profits, but also doubles the temptation to shirk. The price or the

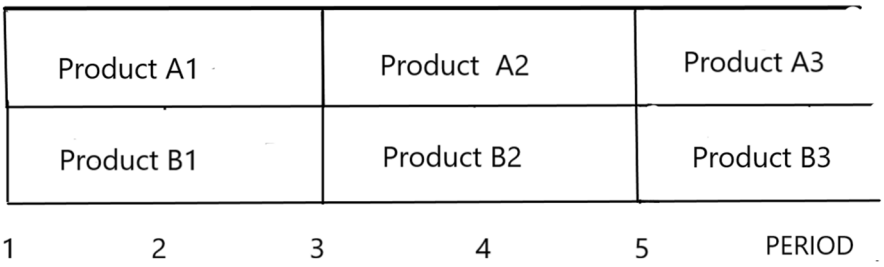

Fig. 2 Two production technologies without the overlapping structure

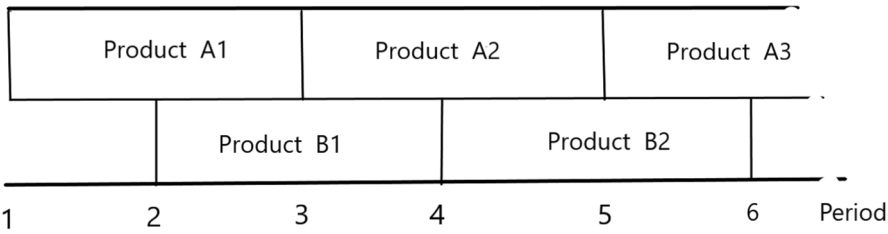

Fig. 3 The overlapping structure

discount factor that sustains high quality is unchanged. Umbrella branding does not alleviate the incentive problem.

Assumption 1 *If* $P^*_{NO} = C_g + \frac{F_g}{1+\delta} + \frac{1-\delta}{\delta}\left(C_g - C_b - F_b + \frac{F_g}{1+\delta}\right) \leq v_g$ or $\delta \geq \delta^*_{NO} = \frac{-B+\sqrt{B^2+4AD}}{2A}$, *we are in the Klein-Leffler world: Whether the firm launches one product or two products simultaneously, it chooses good quality, and the overlapping structure is not needed. In the rest of the paper, we study the opposite scenario* $P^*_{NO} > v_g$ *or* $\delta < \delta^*_{NO}$*: Whether the firm produces one or two products, it chooses bad quality without the overlapping structure. The reservation price* v_g *or the discount factor* δ *are too low to motivate to produce good quality.*

4 Overlapping Structure Under Umbrella Branding

The firm has two production technologies. It introduces the first technology at the start of period 1 and the second one at the start of period 2. The firm employs the first technology (Product A1 in Fig. 3) in periods 1 and 2, and that technology expires at the end of period 2. The firm chooses a new technology at the start of period 3 and uses it during periods 3 and 4.

Consider now the latter technology (product B1 in Fig. 3): The firm introduces it at the start of period 2 and uses it in periods 2 and 3. The technology expires at the end of period 3, and the firm chooses a new technology at the start of period 4. After period 2, the firm replaces 50 percent of its production technologies in each period.

The technologies have the following names: Consider the start of period 3: The technology that produces Product B1 is *ongoing technology*. The technology that produces Product A1 is an *old technology,* which expires. The firm replaces it with a *new technology* that produces Product A2.

Consider the start of period $t, t = 2, 3, 4, \cdots$: Assume that the firm has so far produced good products and decides to change its strategy: It chooses a bad technology for new production. In period t, the firm makes both good and bad products. Its ongoing technology (introduced in period $t-1$) produces good products, and the new technology (introduced in period t) produces bad products. The ongoing technology expires at the end of period t, and the firm can replace this production capacity with a bad new technology at the start of period $t+1$. In periods $t+1, t+2, \ldots$ the firm makes only bad products. We begin with the following result:

Lemma 1 *If the ongoing production technology is good in period 2 (more commonly, in period $t = 2, 3, 4, \ldots$), price P^*_{OVER} ensures that the firm chooses a good new technology, $P^*_{OVER} = C_g + 0.5(1-\delta)\big(C_g - C_b - F_b\big)/\delta + 0.5F_g/\delta$. This quality-assuring price with the overlapping structure is lower than P^*_{NO}, the quality-assuring price without the overlapping structure. The difference $P^*_{NO} - P^*_{OVER}$ increases with C_g and F_g and decreases with C_b, F_b and δ.*

Proof The firm will maintain the existing good strategy under the overlapping structure if

$$\frac{2\delta\big(P_{OVER} - C_g\big) - \delta F_g}{1-\delta} \geq \delta\big(2P_{OVER} - C_g - C_b - F_b\big). \tag{6}$$

The LHS shows the present value of the profits if the firm produces two good products in each period (forever). The RHS reveals the profit if the firm chooses a bad technology for the new production. In this case, the firm produces both a good product and a bad product, because the ongoing technology is good. Since information on bad quality surfaces at the end of the period, the firm can cheat only for one period.

After the bad technology surfaces, the firm has both an ongoing bad technology and an expiring good old technology. The firm should replace the old technology with a new one. However, buyers will punish the firm after the replacement and do not purchase new products. The firm correctly anticipates this and does not introduce a new technology and new products. Therefore, the firm has only one technology—the ongoing bad technology—after the bad technology surfaces. Since bad products are valueless to buyers, the firm does not employ the ongoing bad technology after it surfaces. Now, (7) provides the quality-assuring price:

$$P^*_{OVER} = C_g + 0.5(1-\delta)\big(C_g - C_b - F_b\big)/\delta + 0.5F_g/\delta. \tag{7}$$

We compare this price to the quality-assuring price without the overlapping structure: P^*_{NO}. The difference $P^*_{NO} - P^*_{OVER}$ is $0.5(1-\delta)\big[C_g - C_b - F_b + F_g/(1+\delta)\big]/\delta$.

The term in the square brackets is positive because the term in the bracket of (3) is positive. *Q.E.D*

Alternatively, we can use discount factors to express the idea of Lemma 1.

Lemma 2 *Under the overlapping structure, the threshold value is* $\delta^*_{OVER} = D/(A+B)$. *Here* $A, B,$ *and* D *are defined in (4). If* $\delta < \delta^*_{OVER}$, *then no quality provision equilibrium exists. If* $\delta \geq \delta^*_{OVER}$, *the firm chooses good quality. Since* $\delta^*_{NO} > \delta^*_{OVER}$, *the firm may prefer good quality with the overlapping structure and bad quality without it.*

Proof Replace each P_{OVER} in (6) with v_g. Then, (6) gives the threshold value δ^*_{OVER}, $(A+B)\delta^*_{OVER} = D$. Recall from (4) and (5) the threshold value without the overlapping structure δ^*_{NO}: Without the overlapping structure, we have $\delta^2 A + \delta B - D = 0$, or.

$$-\delta A(1-\delta) + [(A+B)\delta - D] = 0, when\ \delta = \delta^*_{NO}. \tag{8}$$

Since the first term is negative, the term in the square brackets must be positive: $(A+B)\delta^*_{NO} > D$. Since $(A+B)\delta^*_{OVER} = D$, we have $\delta^*_{NO} > \delta^*_{OVER}$. *Q.E.D*

Let us return to the quality-assuring prices (Lemma 1). Corollary 1 says that the buyer's willingness to pay v_g may exceed the quality-assuring price of the overlapping structure P^*_{OVER}.

Corollary 1 *Even if* $v_g < P^*_{NO}$ *it is possible that* $P^*_{OVER} \leq v_g < P^*_{NO}$ *if* v_g *and the cost advantage of the bad strategy* $C_g + F_g - C_b - F_b > 0$ *are sufficient.*

Proof When $v_g < P^*_{NO}$, $P^*_{OVER} \leq v_g < P^*_{NO}$ if v_g and the difference $P^*_{NO} - P^*_{OVER} > 0$ are sufficient. The difference increases with C_g and F_g and decreases with C_b, F_b and δ (Lemma 1) *Q.E.D*

Under the circumstances of Corollary 1, production is possible with the overlapping structure even if it is impossible without it. We assume these kinds of circumstances:

Assumption 2 $v_g \geq P^*_{OVER} = C_g + 0.5(1-\delta)\big(C_g - C_b - F_b\big)/\delta + 0.5F_g/\delta$ or $\delta \geq \delta^*_{OVER} = D/(A+B) = (F_g + C_g - C_b - F_b)/(2v_g - C_g - C_b - F_b)$.

Assume that the ongoing technology is good in period 2: The existing strategy is good. We determine the firm's optimal choice after period 2 and obtain the following result:

Lemma 3 *If the ongoing technology is good in period 2, the firm continues the existing good strategy forever and charges price* v_g *in periods* $t = 2, 3, 4, \ldots$.

Proof Assume that the firm chooses good quality in period 1. Buyers discover it after the period and know that the ongoing technology is good in period 2. The firm

can commit to continue with the good strategy by charging P^*_{OVER} or more in period 2 (Lemma 1). Buyers are ready to pay v_g. Given $v_g \geq P^*_{OVER}$ (Assumption 2), the firm charges v_g and chooses good quality for the new technology in period 2. Owing to this choice, the ongoing technology is good in period 3. As a result, the firm chooses a good new technology in period 3 if the price is at least P^*_{OVER}. Buyers are ready to pay v_g. Given $v_g \geq P^*_{OVER}$ (Assumption 2), the firm charges v_g and chooses good quality for the new technology in period 3. The process continues period after period.

Put differently: The firm charges v_g period after period. In each period, $t = 2, 3, 4, \ldots$, the ongoing technology is good, and price $v_g \geq P^*_{OVER}$ assures that the firm chooses a good new technology. When the firm chooses a good technology in period t, the firm operates so that the ongoing technology is good in the next period. When the firm chooses a good technology in period t, the firm makes the choice of the good technology optimal in the next period. The process continues forever. □

Without the overlapping structure, the firm can reallocate 100 per cent of its production technologies at the same time (in every second period). This makes the strategy change profitable. After the change, 100 per cent of the technologies produces bad products. With the overlapping structure, the firm can reallocate 50 per cent of the production technologies at the same time. This makes the strategy change unprofitable.

If the firm decides to abandon the good strategy in period t and choose a bad technology for new products, only 50 per cent of the technologies produces bad products in period t. The rest of the capacity is tied to the ongoing good technology, which incurs high costs. In both cases, with and without the overlapping structure, the bad quality of the products surfaces after period t, and the firm must stop operations.

Given Lemmas 1–3, the firm charges v_g in periods $t = 2, 3, 4, \ldots$ and produces good quality if the ongoing technology is good in period 2. How can we know that the firm chooses a good technology in period 1 and the ongoing technology is good in period 2?

Lemma 4 *The incentive problem of period 1 is identical to the incentive problem of the later periods. The firm chooses good quality and sets price v_g in period 1.*

Proof. In period 1, the incentive constraint is

$$\delta\left(P - C_g - F_g\right) + \frac{\delta^2\left(2P - 2C_g - F_g\right)}{1-\delta} \geq \delta\left(P - C_b - F_b\right). \tag{9}$$

The firm has one technology in period 1 and two technologies later. This is equivalent to

$$-\delta\left(P - C_g\right) + \frac{\delta\left(2P - 2C_g - F_g\right)}{1-\delta} \geq \delta\left(2P - C_b - C_g - F_b\right) - \delta\left(P - C_g\right). \tag{10}$$

If we add $\delta(P - C_g)$ to both sides and replace each P with P_{OVER}, we get the inventive constraint of period $t = 2, 3, 4, \ldots$(recall (6) in Lemma 1). The incentive problem is identical in each period. The firm charges v_g and chooses good projects in each period. □

The incentive constraint is identical even if the firm has only one product in period 1 and two products in the later periods. To see this, note that the NPV of the future profits is identical in period 1 and in the later periods. The second term in (9) shows these future profits if the firm produces good profits forever. If the firm chooses bad quality, the future profits are zero. The loss of the future profits represents the disadvantage of the bad strategy. The advantage of the bad strategy consists of the cost advantage in the current period: It is less expensive to produce bad quality. This cost advantage is fixed $C_g + F_g - C_b - F_b > 0$ and is independent of the firm size because a deviating firm has one inexpensive, bad technology. Therefore, the cost advantage is identical in period 1 and in the later periods. Since both the cost advantage and the NPV of the future profits are identical in each period, the firm has the same incentive constraint in each period. We can assemble Lemmas 1–4:

Proposition 1 *Under the overlapping structure and Assumption 2, the following is the profit-maximizing equilibrium for the firm and maximizes the surplus of the economy: The firm charges monopoly price v_g and selects good quality in each period. Buyers purchase products if and only if the firm has provided high quality in the past.*

Offer v_g yields no consumer surplus to a buyer. By denying the offer, he receives no surplus. He will not deviate. The firm could deviate in price or in quality. Deviating to the higher price $P > v_g$ would lead to zero sales and zero profits, because buyers pay at most v_g. Deviating to a lower price is not optimal. Any deviation to $0 < P < P^*_{OVER}$, will result in zero sales regardless of quality, because buyers take that to indicate low quality. Any deviation $P^*_{OVER} \leq P < v_g$ decreases the profits even if buyers anticipate good quality, because buyers are ready to pay more, v_g. A deviation to low quality is unprofitable because $v_g \geq P^*_{OVER}$.

We can draw the following conclusions. If $\delta^*_{NO} \leq \delta$ (or $P^*_{NO} \leq v_g$), the firm will choose good quality without the overlapping structure, and the overlapping structure is unnecessary. If $\delta^*_{OVER} \leq \delta < \delta^*_{NO}$ (or $P^*_{OVER} \leq v_g < P^*_{NO}$), the overlapping structure and umbrella branding are needed to motivate the firm to choose good quality. If $\delta < \delta^*_{OVER}$ (or $v_g < P^*_{OVER}$), the overlapping structure does not motivate the firm to choose good quality and the firm cannot produce.

Without umbrella branding, buyers do not observe which products are produced by the same firm. Therefore, the overlapping structure is useless.

5 Conclusions

This paper provides a repeated moral hazard model to examine a firm's incentives to produce good quality when quality is unobservable to buyers. The overlapping structure of product launching makes it more profitable for the firm to increase quality, and the firm can overcome a market failure. In the model, the product lifecycle is two periods. The findings can be generalized to longer lifecycles.

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