Is brand alliance always beneficial to firms?

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ABSTRACT

In this research, we develop a fresh analytical model to examine the impact of brand quality on the firms' performances when two firms selling substitute products form a brand alliance. Our results indicate that when two products have equal brand qualities, brand alliance is always a beneficial strategy for two firms to employ. However, when two products have different brand qualities, brand quality differential shows a positive relationship with the profit of the firm with the low-quality brand but demonstrates a negative relationship with the profit of the firm with the high-quality brand in the brand alliance. Our results also show that brand quality differential has a greater effect on the profit of the firm with the high-quality brand than on that of the firm with the low-quality brand. In addition, we find that brand alliance becomes much more valuable to the firm with the high-quality brand when the brand quality differential decreases, but the value of brand alliance has a concave relationship with the profit of the firm with the low-quality brand when the brand quality differential increases.

1. Introduction

The combination of two or more individual brands into a brand alliance (Rao and Ruekert, 1994) becomes increasingly popular in the business market. The case of complementary products (i.e., consumers buy more than one product at the same time to get the full utility of the goods) to form a brand alliance has been studied in the literature (e.g., Yue et al., 2006; Cao and Sorescu, 2013). However, research on the case of marketing substitutable products (i.e., consumers choose between the competing products depending on their preferences and the marketing strategy of the firms) to form a brand alliance is scarce in the literature. This case has recently gained giant interest. For example, HP and Canon formed a brand alliance for printers (Lewis, 1999). Other well-known brand alliances include Taco Bell and Doritos's popular Doritos Locos Tacos, and Quaker Oats and Tyson (Conroy and Narula, 2010). Another example is the co-branding agreement between the Babybel and the Aldi's "Be light" in UK in order to capitalize on the power of supermarkets (Potter and Jones, 2009). The marketing paradigm of competitive products is different from that of complementary products in that the products of one firm lose sales to the other firm rather than benefit from each other's sales. In this paper, we focus on competitive products and develop a new model to derive optimal strategies for business managers when they plan to form a brand alliance to develop the cobranded products.

Normally, firms in building alliance brands achieve more than they can on their own (Lewis, 1999). However, how and when two firms

benefit from a brand alliance is not well understood, particularly given that the brand quality is considered. Current brand alliance research focuses on consumer responses to cobranded products and partner brands. For example, cobranded ingredients can facilitate a consumer's acceptance of brand expansion (Desai and Keller, 2002); Park et al. (1996) and Simonin and Ruth (1998) found positive consumer perception spillover from the participating brands to the cobranded products, and vice versa. Rao et al. (1999) showed that entering an alliance with a secondary brand may provide a signal of higher quality that the original brand could not offer by itself to marketplace and may command a premium price. Washburn et al. (2004) found that brand alliances transfer the positive brand equity of two or more partner brands to the newly created joint brand. Lafferty (2005) studied the cause-brand alliances and showed that brand alliance always has a positive effect on the brand attitudes regardless of the degree of cause familiarity. Li and He (2013) examined the reaction of native consumers to international brand alliance between a foreign brand and a native brand. Their results showed that when the partner brand appears first rather than second in the international brand alliance, the effect of the partner brand attitude on the attitude towards an international brand alliance becomes stronger.

However, consumer responses cannot directly be translated into profit, which is significantly important to the survival and development of a firm. We thus study the firm's profit associated with the brand alliance through novel analytical modeling with the consideration of brand quality. Given that most studies have merely analyzed consumer

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response to brand alliances, the extant literature would benefit from analytical research focusing on firm's profit obtained by brand alliance partners.

Specifically, our research studies the following questions: when two firms selling substitute products form a brand alliance and the product brand qualities are considered, is brand alliance always beneficial to two firms? If not, what is the condition under which brand alliance can generate higher profits for the partner firms? How does the brand quality differential between the two products affect the value of the brand alliance for each partner firm? What are the optimal marketing strategies for business managers to employ when they plan to form a brand alliance to develop the cobranded products?

Our research makes substantial contributions to the extant literature, since only a few analytical models studied the value of brand alliance for two partner firms. Venkatesh and Mahajan (1997) analytically modeled the optimal price of cobranded products and estimated the impact of the revenue gain or loss for the branded component involved in a partnership. Geylani et al. (2008) employed analytical models to study the influence of cobranding on the images of two brands and found that co-branding may increase the expected value of the brand attributes. However, our research diverges significantly from these studies, because we focus on competing firms to form the brand alliance, investigate the effect of the value of brand alliance on the firm's profit, and address how the value of brand alliance is influenced by the brand quality differential between the two brands. To the best of our knowledge, our research is the first one to consider the brand quality's free-riding effect in the analytical model, address how the competing firms form a brand alliance, and examine the important role the brand quality plays on the value of brand alliance to firms in the extant literature.

Generally, to obtain a more comprehensive understanding of how firms gain from brand alliances, our research examines the effect of a brand alliance on firm's profit through a novel utility model. Through the utility model, we show that brand quality has an important influence on the profits of two partner firms when they form a brand alliance. When two products have equal brand qualities, brand alliance is always a beneficial strategy for two firms to employ. However, when two products have different brand qualities, brand quality differential shows a positive relationship with the profit of the firm with the low-quality brand but demonstrates a negative relationship with the profit of the firm with the high-quality brand in the brand alliance. Our results also show that brand quality differential has a greater effect on the profit of the firm with the high-quality brand than on that of the firm with the low-quality brand. In addition, we find that brand alliance becomes much more valuable to the firm with the high-quality brand when the brand quality differential decreases, but the value of brand alliance has a concave relationship with the profit of the firm with the low-quality brand when the brand quality differential increases.

The rest of our paper is organized as follows. In Section 2, we develop the model framework and derive the key results for unequal brand quality. Model development and analysis for equal brand quality is addressed in Section 3. Section 4 present numerical examples to illustrate our findings. Conclusions and managerial implications are presented in the final section.

2. Model framework with different brand qualities

We consider a setting where two independent firms 1 and 2 have different capacities to produce different quality products. Specifically, firms 1 and 2 produce substitute brands 1 and 2 with different qualities respectively and sell them to the same market. The consumer will decide to purchase the brand that maximizes his utility based on the brand price and quality. Due to brand competition, the quality differential between brands 1 and 2 is important and impacts the consumer evaluation of the brand (i.e., amount willing to pay). We assume the quality of brand 1 is q_1 and the quality of brand 2 is q_2, and

the brand 1 has a lower quality than the brand 2 ($q_2 > q_1$). Hence, the valuation of the brand 1 is vq_1 and thus the consumer surplus is: $U_1 = vq_1 - p_1$. v is denoted as the consumer valuation of the brand (i.e., amount willing to pay), and for analytic simplicity, we assume that it is uniformly distributed from 0 to 1 (Yan and Bhatnagar, 2008; Yan, 2010; Yan et al., 2016). The valuation of the brand 2 is vq_2 and thus the consumer surplus is: $U_2 = vq_2 - p_2$. The marginal valuation $v^1 = \frac{p_1}{q_1}$ shows that the consumer is indifferent to buy the brand 1. The marginal valuation $v^2 = \frac{p_2}{q_2}$ shows that the consumer is indifferent to buy the brand 2. Since consumers can buy either brand, they would prefer to buy the brand where they can derive more surpluses. Thus, consumers will compare the consumer surplus derived through the brand 2 with the consumer surplus derived through the brand 1 (i.e., $vq_2 - p_2$ versus $vq_1 - p_1$) when they make purchase decision. If $vq_2 - p_2 > vq_1 - p_1$, then the brand 2 would be preferred over the brand 1. If $vq_2 - p_2 < vq_1 - p_1$, then the consumer would like to buy the brand 1. The consumer would be indifferent between the brands 1 and 2 if the marginal valuation is $v^{21} = \frac{p_2 - p_1}{q_2 - q_1}$.

Furthermore, it can be shown that when $v^1 < v^2$, then $v^1 < v^2 < v^{21}$. Hence, all consumers with marginal consumption value in the interval $[v^1, v^{21}]$ prefer to buy the brand 1. All those in the interval $[v^{21}, 1]$ prefer to buy the brand 2. Finally, all consumers whose marginal valuation in the interval $[0, v^1]$ will not buy any brand. Let D_2 and D_1 denote the demands of the brands 2 and 1, respectively, then we have

$$D_2 = 1 - \frac{p_2 - p_1}{q_2 - q_1} \tag{1}$$

$$D_1 = \frac{p_2 - p_1}{q_2 - q_1} - \frac{p_1}{q_1} \tag{2}$$

where $q_i (i = 1, 2)$ is the quality of respectively the brands 1 and 2 ($q_i \geq 0$) and $p_i (i = 1, 2)$ is the price of respectively the brands 1 and 2 ($p_i \geq 0$).

When $v^1 > v^2$, then $v^1 > v^2 > v^{21}$ and no any consumer will buy the brand 1 but all consumers whose marginal consumption values are in the interval $[v^2, 1]$ would buy the brand 2. Let d_2 and d_1 denote the demands of the brands 2 and 1, respectively, then we have

$$d_2 = 1 - \frac{p_2}{q_2} \tag{3}$$

$$d_1 = 0 \tag{4}$$

$v^2 < v^1$ indicates that only the brand 2 is sold in the whole market, thus this context is not the focus of our paper. Hence, we focus solely on the option where $v^2 > v^1$. Furthermore, the quality of the brand 2 is defined as q and the quality of the brand 1 is defined as $gq (0 < g < 1)$. The parameter g effectively catches the quality differential between the brands 1 and 2 (i.e., larger value of g means higher quality of the brand 1 and also less quality differential between the brands 1 and 2, and vice versa). As a result, the demand functions developed in our paper are given as

$$D_2 = 1 - \frac{p_2 - p_1}{(1 - g)q} \tag{5}$$

$$D_1 = \frac{p_2 - p_1}{(1 - g)q} - \frac{p_1}{gq} \tag{6}$$

where D_2 and D_1 denote the demands of the brands 2 and 1, respectively. In the next sections, we first analyze the scenario in which two firms behave independently. Then we analyze the scenario in which two firms form a brand alliance to develop a cobranded product. Consequently, a unified and centralized price solution is sought to maximize the joint profits of the two firms in the brand alliance. In this research, our interest is to examine the value of a brand alliance when two firms behave cooperatively rather than independently to develop cobranded products. Here we assume the Bertrand mode where two firms make their decisions simultaneously, rather than sequentially, to

maximize their respective profits. The Bertrand mode makes sense because more often than not, neither of the two firms would like to be the follower or the second mover in the market (Yan and Pei, 2013).

2.1. Independent behavior

In this setting, two firms produce their own brands and act on their own interest to sell their individual brands. Each firm sets an optimal price to maximize its own profit. We also assume the production costs for brands 1 and 2 are s_1 and s, respectively. However, higher (lower) quality product normally has a higher (lower) production cost. In order to catch the lower production cost for a lower quality brand, the production cost of the brand 1 is assumed as gs $(0 < g < 1)$. As a result, the profit functions for each firm can be written as follows

$$R_1^I = (p_1 - gs)(\frac{p_2 - p_1}{(1 - g)q} - \frac{p_1}{gq}) \qquad (7)$$

$$R_2^I = (p_2 - s)(1 - \frac{p_2 - p_1}{(1 - g)q}) \qquad (8)$$

where R_1^I and R_2^I denote the firm 1's profit and the firm 2's profit, respectively, as the two firms behave independently. Given the above structure, the optimal prices and profits for the two firms are derived in Theorem 1. Proofs are given in Appendix A.

Theorem 1. *When two firms behave independently, the equilibrium pricing strategies are given as.*

$$p_1^I = \frac{g(q(1 - g) + 3s)}{4 - g} \text{ and } p_2^I = \frac{2q(1 - g) + s(2 + g)}{4 - g}$$

The corresponding profits are given as

$$R_1^I = \frac{g(1 - g)(q - s)^2}{q(4 - g)^2} \text{ and } R_2^I = \frac{4(1 - g)(q - s)^2}{q(4 - g)^2}$$

Next, we examine how the brand quality impacts each firm's performance when two firms behave independently to maximize their respective profits. Based on our results, we have the proposition as follows. Proofs are given in Appendix B.

Proposition 1. *When two firms behave independently to maximize their respective profits, (a) the profit of the firm with a high-quality brand has a positive relationship with its own brand quality but has a negative relationship with the quality of low-quality brand; (b) the profit of the firm with a low-quality brand has a negative relationship with the quality of high-quality brand but has a concave relationship with its own brand quality.*

The results in Proposition 1 show that when two firms compete, the profit of the firm with a high-quality brand increases with its own brand quality because higher quality can bring more consumers to buy (i.e., increased market demand) and thus helps increase firm's profit. However, the profit of the firm with a high-quality brand decreases as the quality of the low-quality brand increases. The rationale is that when the quality of the low-quality brand becomes stronger, the low-quality brand would take away more consumers from the high-quality brand as its quality becomes stronger. Hence, the profit of the firm with a high-quality brand decreases with the quality of low-quality brand. Furthermore, the profit of the firm with a low-quality brand decreases with the quality of high-quality brand due to brand competition. However, it first increases and then decreases with its own brand quality. The reason is that to the low-quality brand, as its quality becomes stronger (before its quality reaches a threshold value), it benefits from the increased demand. However, when its quality is higher than the threshold value, it leads to a very serious and intense competition with the high-quality brand. Since now the low-quality brand becomes a serious alternative to the high-quality brand, the high-quality brand would have to dramatically cut its retail price, and the low-quality brand also has to respond by cutting its price, too,

which leads to a decreased profit to the low-quality brand.

2.2. Brand alliance

In this setting, two independent firms (firms 1 and 2) team up and form a brand alliance to develop a cobranded product, instead of developing their own products. When the two firms form a brand alliance to develop the cobranded product, they act together to maximize their joint profits. The brand alliance is a cooperation which aims for a synergy where each firm's benefits from the alliance will be greater than what it can achieve from individual effort, but each firm still remains as an independent organization (Mowery et al., 1996). The brand alliance is of particular interest because many firms are entering an alliance for the purpose of benefiting from each other's resources, capabilities, and core competencies. However, when a high-quality brand and a low-quality brand form a brand alliance, there are some downsides. Lukovitz (2009) showed that combining two distinct brands into one brand could be detrimental because it confuses consumer perception. Since a lower quality brand has been shown to be less vulnerable to consumer confusion (Aaker, 1996), the failure of the cobranding strategy is more likely occur to the high-quality brand (Washburn et al., 2000). In other words, the co-branding strategy posits a greater risk to the high-quality brand rather than to the low-quality brand, and the low-quality brand raises more risks to the high-quality brand. Thus we assume that the negative effect of low-quality brand 1 on high-quality brand 2 is equal to $(1 - g)q$ $(0 < g < 1)$. When the quality differential increases, the risks the low-quality brand brings to the high-quality brand increase, which reduces the market demand of high-quality brand. In the meantime, when brands 1 and 2 form a brand alliance, the low-quality brand takes advantage of its association with the high-quality brand and boosts its goodwill (Keller and Aaker, 1992). Further, Cooke and Ryan (2000) showed that when the reputation of one company is superior to that of the other in a brand alliance, the inferior company benefits from the established prestige of the superior company. In other words, the low-quality brand 1 takes a quality's free-ride from the high-quality brand 2, which helps improve its market demand. When the quality differential increases, the low-quality brand also benefits more free-riding from the high-quality brand (i.e., the free-riding effect increases). Following the same assumption as in Caminal and Vives (1996), we also assume the brand quality differential has a linear and symmetric effect on the demands of two brands. As a result, the demand functions in the brand alliance appear as follows

$$D_1^B = \frac{p_2 - p_1}{(1 - g)q} - \frac{p_1}{gq} + (1 - g)q \qquad (9)$$

$$D_2^B = 1 - \frac{p_2 - p_1}{(1 - g)q} - (1 - g)q \qquad (10)$$

where D_1^B and D_2^B denote the demands of the brands 1 and 2, respectively, in the brand alliance. When firms form a brand alliance, they would work together to make the price decisions to maximize their joint profits as follows

$$R_1^B + R_2^B = (p_1 - gs)D_1^B + (p_2 - s)D_2^B \qquad (11)$$

where R_1^B and R_2^B denote firm 1's profit and firm 2's profit, respectively, in the brand alliance. Given the above structure, the optimal prices and profits for two firms are derived in Theorem 2. Proofs are given in Appendix C.

Theorem 2. *When two firms behave cooperatively in the brand alliance, the equilibrium pricing strategies are given as.*

$$p_1^B = \frac{g(q + s)}{2} \text{ and } p_2^B = \frac{(q - q^2(1 - g)^2 + s)}{2}$$

The corresponding profits are given as

$R_1^B = \dfrac{gq(1-g)(q-s)}{4}$ and R_2^B

$= \dfrac{(q - q^2(1-g) - s)(q - q^2(1-g)^2 - s)}{4q}$

Next, we examine the effect of brand quality on the firm's performance when two firms behave cooperatively in the brand alliance. Based on our results, we have the proposition as follows. Proofs are given in Appendix D.

Proposition 2. *When two firms with different brand qualities behave cooperatively in a brand alliance, (a) the profit of the firm with a high-quality brand has a positive relationship with both its own and partner's brand qualities; (b) the profit of the firm with a low-quality brand has a positive relationship with its partner's brand quality but has a concave relationship with its own brand quality; (c) the effect of a change in brand quality differential on the profit of the high-quality brand is larger than the effect of the same change in brand quality differential on the profit of the low-quality brand.*

Proposition 2 reveals some important results. When two firms form a brand alliance, the profit of the firm with a high-quality brand increases with its own and its partner's brand qualities; however, the profit of the firm with a low-quality brand always benefits from the high-quality brand partner but first increases and then decreases with its own brand quality. The rationale is that when two firms form a brand alliance to behave cooperatively, the stronger quality from the high-quality brand would increase its demand in the market and thus enhance its profit. In the meantime, brand alliance turns the competition between two brands into cooperation. Consequently, as its partner's brand quality (i.e., the low-quality brand) becomes stronger, the quality of the alliance increases, which creates higher profit for the firm with the high-quality brand. Hence, the profit of the firm with the high-quality brand increases with its own and partner's brand qualities. However, to the low-quality brand, it always benefits from partnering with a high-quality brand due to quality's free-riding effect. As a result, when its quality is lower (before its quality reaches a threshold value), it benefits more from the brand alliance due to a larger free-riding effect; when its quality is higher than the threshold value, it will benefit less from the brand alliance due to a smaller free-riding effect.

The concave relationship between the low-quality brand and its firm's profit shows that the low-quality brand always likes to partner with the high-quality brand to form a brand alliance. Particularly if the quality of low-quality brand is lower, it will benefit more. However, the positive relationship between the high-quality brand and its partner's brand quality shows that the high-quality brand expects to partner with a similar high quality brand. Also, the brand quality differential shows a greater impact on the profit of the high-quality brand than on the profit of the low-quality brand. It has been suggested that partners with similar strengths and a similar degree of resources are more likely to have a good strategic fit and share congruent objectives and synergies (Child et al., 2005); brand image consistency of the two partner brands is positively related to brand alliance evaluations (Simonin and Ruth, 1998). As a result, the important managerial implication is that two partner firms with close qualities to form a brand alliance could be mutually profitable, because brands with similar qualities are likely to share similar brand images and strategy positioning. For example, Starbucks cooperated with PepsiCo in 1996 to offer bottled Starbucks Frappuccino drink in shops and supermarkets. Both firms profited from each other's customer base and facilities that were brought by their high brand qualities. The AMC Jeep and Levi's partnership in 1970's is another example of a successful brand alliance. Both are high quality brands – Jeep was four-wheel drive manufacturer with a rugged image and Levi's represented an equally well-known rugged brand.

Next, the important question is how close the high- and low- quality brands should be, thus both of them can achieve a win-win result from the brand alliance. In other words, how the brand quality differential

influences the firms' decisions to form a brand alliance. We thus investigate this question through comparing the firms' profits in Theorem 2 with their profits in Theorem 1. Based on the results, we have the proposition as follows. Proofs are given in Appendix E.

Proposition 3. *If two brands have different qualities and form a brand alliance, (a) the firm with a low-quality brand always benefits from the brand alliance; however, (b) the firm with a high-quality brand benefits from the brand alliance strategy only if the negative effect of brand quality differential,$(1-g)q$, is less than H, where.*

$$H = \dfrac{\begin{aligned}&8gq - 16q + 16s - g^2q + 16q^2 - 24gq^2 + 9g^2q^2 - g^3q^2\\ &+ (4-g)\sqrt{16(1-g)(q-s)^2 + (4-g)^2(q - q^2(1-g) - s)^2}\end{aligned}}{2q(4-q)^2}$$

Proposition 3 reveals some important and fresh results, which are contrary to prior research (Yue et al., 2006) which shows that brand alliance is always a beneficial strategy for two partner firms to employ. The reason is that the inclusion of the important factor of brand quality in our analytical model changes the conclusion of prior research. Our results show that the high- and low- quality brands can benefit from a brand alliance only if the brand quality differential is not large. The rationale is that large brand quality differential would hurt the high-quality brand and the firm with the high-quality brand would suffer profit loss. Thus, when two brands have quite different qualities, firms should be cautious of the negative effect of the low-quality brand on the high-quality brand. The rationale is that if one partner brand is thought to be inferior, it may bring down the quality perception of the other partner brand (Levin et al., 1996). Furthermore, Lukovitz (2009) indicated that combining a high-end positioning with a low-end positioning in the same brand could erode the core values perceived by consumers and the mismatched cobranding may send out confusing signals about the brands' positioning and negatively change consumers' attitudes toward the partner brands. For example, the cobranding strategy Burger King and Häagen-Dazs has failed because of the different perceived qualities (Grewal and Levy, 2012).

For a firm with a high-quality brand, if the increased profit due to brand alliance cannot offset the decreased profit due to the negative effect of the low-quality brand, a brand alliance may not be a beneficial strategy for the high-quality brand to employ: when the negative effect of the low-quality brand on the high-quality brand is large, as the low-quality brand erodes the reputation of high-quality brand, the cobranding between the distinct brands hurts consumers' trust for the high-quality brand and thus the brand alliance, which consequently leads to profit loss for the firm with a high-brand quality. Only if the negative effect of the low-quality brand on the high-quality brand is small can brand alliance help both partner firms achieve a higher profit (i.e., a Pareto result) compared to when two firms act independently. Thus, in order to benefit from a brand alliance, participating firms should first obtain accurate information about their own and the partner's brand quality through active interaction with consumers, frequent consumer feedbacks, and application of the TQM (Total Quality Management) practice to their businesses, and then choose partner brands that have close qualities. When the partner has a low-quality brand, the high-quality firm also needs to analyze other brand characteristics of the partner to understand if the negative impact of low brand quality can be compensated by the overall success of the brand alliance.

Next, we examine how the value of a brand alliance will be influenced by the brand quality differential when two firms form a brand alliance. Based on our results, we have the proposition as follows. Proofs are given in Appendix F.

Proposition 4. *If two brands have different qualities and form a brand alliance, (a) the value of brand alliance to the firm with high-quality brand increases as the brand quality differential decreases; (b) but the value of brand alliance to the firm with low-quality brand*

has a concave relationship with the brand quality differential.

Proposition 4(a) shows that after forming the alliance, if two firms have a brand quality differential, the brand quality differential has a liner relationship with the value of the brand alliance for the firm with the high-quality brand. Its profit increases as the brand quality differential decreases. The reason is given as follows. In the brand alliance, the brand quality differential decreases the profitability of the firm with a high-quality brand due to the negative effect of the low-quality brand. As the brand quality differential decreases, its negative effect on the profitability of the high-quality brand's firm also decreases, which improves the firm's profitability. As a result, the value of the brand alliance to the firm with the high-quality brand increases as the brand quality differential decreases. To the firm with a low-quality brand, it benefits more from an increasing quality (i.e., before the low-quality brand's quality reaches a threshold value) due to the free-riding effect of brand alliance. However, when its quality is higher than the threshold value, it benefits less from the free-riding effect of brand alliance. As a result, the value of the brand alliance for the firm with a low-quality brand increases first and then decreases as the brand quality differential decreases.

Thus the important managerial implication is that 1) if the firm with a high-quality brand expects to have an optimum profit increase, it should find a firm with a close brand quality to be a partner. 2) Since there is a linear relationship between the brand quality differential and its impact on the profitability of the firm with a high-quality brand, the firm with a high-quality brand should try to minimize the quality gap between the partner and itself through a rigorous partner selection process, and should be cautious of the potential negative effect on its profitability if its partner has a low-quality brand. 3) The firm with the high-quality brand can urge the firm with the low-quality brand to improve its brand quality through a profit sharing contract (e.g., Yan and Wang, 2012; Yan and Pei, 2013).

3. Model framework with equal brand quality

In this setting, we assume that brands 1 and 2 have equal qualities and thus no quality differential. To obtain the demand functions for substitute brands, we adopt the elegant framework established by Vives (1984) and employ a similar utility function for a representative consumer to maximize: $U(d_1, d_2) - \sum_{i=1}^{2} p_i d_i$, and $U(d_1, d_2) = \alpha(d_1 + d_2) - \frac{1}{2}(\beta d_1^2 + 2\gamma d_1 d_2 + \beta d_2^2)$ with $\alpha > 0, \beta > \gamma \geq 0$, where, d_1 and d_2 denote the demands of the brands 1 and 2, respectively. As a result, we have

$$p_1 = \alpha - \beta d_1 - \gamma d_2 \qquad (12)$$

$$p_2 = \alpha - \beta d_2 - \gamma d_1 \qquad (13)$$

Letting $a = \alpha/(\beta + \gamma), 1 = \beta/(\beta^2 - \gamma^2)$, and $c = \gamma/(\beta^2 - \gamma^2)$, then we obtain

$$d_1 = a - p_1 + c p_2 \qquad (14)$$

$$d_2 = a - p_2 + c p_1 \qquad (15)$$

When two brands have equal qualities, they thus have equal unit production costs. Following the similar model development and analysis in Section 2, we obtain the optimal results in Table 1. Proofs are given in Appendix G.

Based on the profit comparison in Table 1, we have the proposition as follows.

Proposition 5. *When two brands have equal qualities and form a brand alliance, both of them always can achieve a Pareto result.*

Proposition 5 shows when two brands have equal qualities and form a brand alliance, they always benefit from their cooperation. The important managerial implication is that when the brands of two firms have equal qualities, it is beneficial for them to develop a brand alliance, which helps alleviate the brand competition and thus bring higher profits to both of them. In the business market, Cisco and HP, Taco Bell and Doritos's popular Doritos Locos Tacos, etc., are actively applying this strategy to their businesses.

4. Numerical examples

In this section we perform a numerical analysis to verify our results and to illustrate the strategic importance of brand quality on firms' profits when two firms are forming a brand alliance. First, we fix the values of the parameters (q and s) and allow the value of g to vary. Then, we derive the firms' profits under different scenarios to examine the impact of g on firms' profits when g varies from 0 to 0.99. The values we used for the various parameters are shown in Table 2. The numerical analysis will complement our analytical results and provide us with more managerial insights.

Fig. 1 shows that the profit of the firm with the low-quality brand always increases with the value of g and has a concave relationship with g, no matter this firm is behaving independently or cooperatively. Furthermore, Fig. 2 demonstrates that the profit of the firm with the high-quality brand decreases with the value of g under the condition of independent behavior, but its profit increases with the value of g in the brand alliance. The results are consistent with our Propositions 1 and 2. Furthermore, Figs. 1 and 2 demonstrate that the profit of the firm with the low-quality brand under the brand alliance is always higher than its profit under the independent behavior. In other words, the firm with the low-quality brand always benefits from partnering with the high-quality brand. However, the profit of the firm with the high-quality brand under the brand alliance is larger than its profit under the independent behavior only if the value of g is higher than some certain value. In other words, the firm with the high-quality brand must be very careful about its partner's brand quality. In addition, once two firms form a brand alliance, the value of brand alliance has a concave relationship with the profit of the firm with the low-quality brand but always increases as the brand quality differential increases. The results are consistent with our Propositions 3 and 4. Figs. 3 and 4 show that when two firms have equal qualities, they always benefit from implementing a brand alliance strategy. This result is consistent with our Proposition 5.

5. Conclusions and managerial implications

Brand alliance is theoretically interesting in the literature and economically important in the business world. Our findings shed light on the value of brand alliance and the influence of brand quality on each partner firm's profit. The contributions of this study are both theoretical and substantive.

In this research, we consider a scenario very often encountered in

Table 1
Profit comparison between brand alliance and independent behavior.

Profit	Independent behavior	Brand Alliance	Profit comparison
R_1	$\frac{(a - 2(1-c)s)^2}{4(2-c)^2}$	$\frac{(a - 2(1-c)s)^2}{16(1-c)}$	> 0
R_2	$\frac{(a - 2(1-c)s)^2}{4(2-c)^2}$	$\frac{(a - 2(1-c)s)^2}{16(1-c)}$	> 0

Table 2
Parameter values and range of values used in the numerical examples.

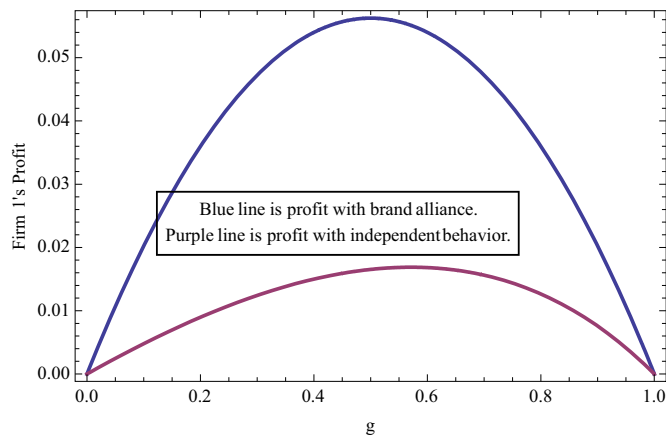| Parameters	Definitions	Values
q	The quality of brand 2	1
s	The unit production cost of brand 2	0.1
g	The quality differential between brands 1 and 2	0–0.99
c	The degree of brands 1 and 2 substitute	0–0.99

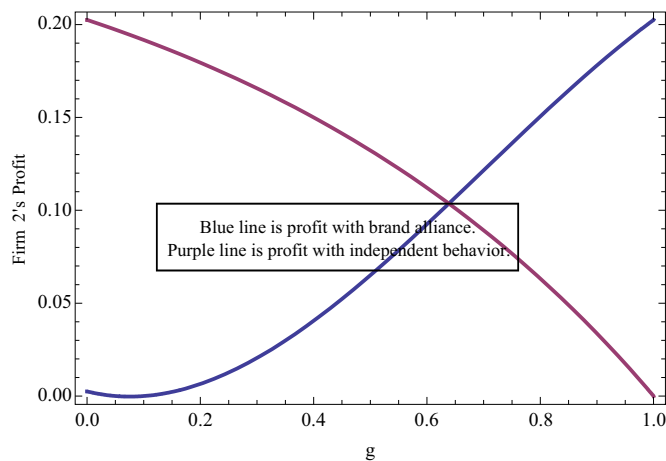**Fig. 1.** Firm 1's profit comparison between brand alliance and independent behavior.
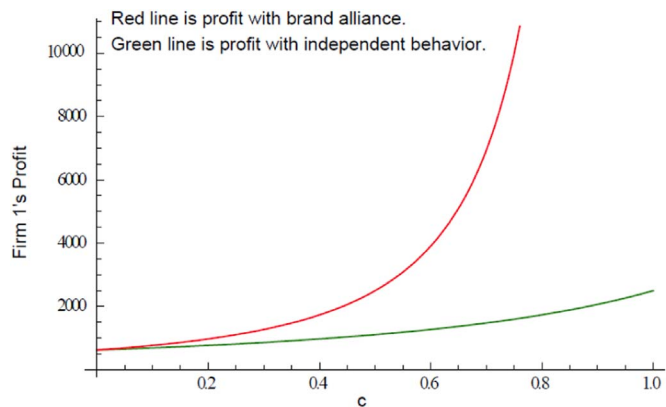

Fig. 2. Figure 2 caption

Fig. 3. Figure 3 caption

Fig. 4. Figure caption 4

firm with the low-quality brand but demonstrates a negative relationship with the profit of the firm with the high-quality brand in the brand alliance. Our results also show that brand quality differential has a greater effect on the profit of the firm with the high-quality brand than on that of the firm with the low-quality brand. In addition, we find that brand alliance becomes much more valuable to the firm with the high-quality brand when the brand quality differential decreases, but the value of brand alliance has a concave relationship with the profit of the firm with the low-quality brand when the brand quality differential increases.

Our results also provide valuable managerial implications for managers to improve profits from developing and managing brand alliances. In today's business market, brand competition between the substitute products becomes more and more intense. It is managerially important to develop a mechanism of cooperation between competing firms to alleviate the brand competition and achieve a win – win result. In our paper, we use an analytical model to show that brand alliance may be an effective mechanism to achieve this goal for competing firms, given the consideration of brand quality. We prove that when two firms are planning to form a brand alliance, brand quality difference between two partners is an important factor to be considered for achieving an optimum profit. Both firms can increase their profitability in a brand alliance by partnering with a brand that has equal or close brand quality and it would be better if the partner brand is a high-quality brand. However, it could be beneficial for a high quality brand to partner with a low-quality brand when the quality of low-quality brand is not large. Meanwhile, firms may be lured to find highest quality partner, but they should be cautious of the risks caused by brand quality differential - the mismatch between two partners could confuse consumers and mitigate the positive influence of brand quality. The gains from the high brand quality of their partner may be reduced by this misfit.

As this paper explores a new area - analytically modeling the value of brand alliance for the profits of two partner firms, it may be further explored in a number of ways by future research. First, our analytical model can be extended by investigating whether the qualitative implications derived in our paper can be generalized to other analytical models. Second, another direction for future research is to examine what other strategies, such as cooperative advertising, information sharing, etc., can help the success of a brand alliance. Finally, this research can be empirically tested in the future research if appropriate data is available. Future researchers can use performance data such as the product-level profits and brand quality data to examine the impact of the brand quality differential of two partners on their profits. In other words, when the data set has sufficient variation in brand quality between two partners, future research can identify the firm as a high quality brand partner and a low quality brand partner, and examine how the brand quality differential between the high- and low- quality

the retail industry: two firms selling substitute products form a brand alliance to develop the cobranded products. We derived the equilibrium prices and the corresponding profits for two partner firms and studied how the their brand qualities impact the profits of both firms and which firm can benefit or benefit more from the brand alliance. We also examined how the value of brand alliance to firms is moderated by the brand quality differential. We found that brand quality has an important influence on the profits of two partner firms when they form a brand alliance. When two products have equal brand qualities, brand alliance is always a beneficial strategy for two firms to employ. However, when two products have different brand qualities, brand quality differential shows a positive relationship with the profit of the
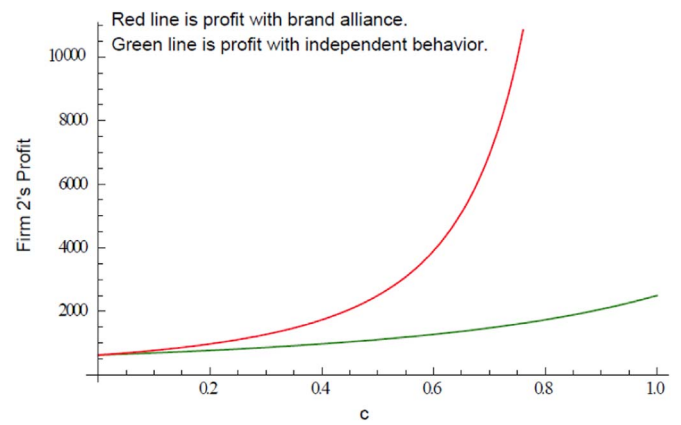
brands influences the profits of the partner firms behaving in the   alliances.

Appendix A

When two firms behave independently,

$$R_1^I = (p_1 - gs)\left(\frac{p_2 - p_1}{(1 - g)q} - \frac{p_1}{gq}\right)$$

$$R_2^I = (p_2 - s)\left(1 - \frac{p_2 - p_1}{(1 - g)q}\right)$$

When two firms behave independently in the Bertrand mode, we find the equilibrium prices through FOC (first of condition): $\frac{\partial R_1^I}{\partial p_1} = 0$ and $\frac{\partial R_2^I}{\partial p_2} = 0$
Thus after some computations and simplifying, we have

$$p_1^I = \frac{g((1 - g)q + 3s)}{4 - g} \text{ and } p_2^I = \frac{2q(1 - g) + s(2 + g)}{4 - g}$$

Then substituting prices into profit functions, after some computations, then we obtain $R_1^I = \frac{g(1 - g)(q - s)^2}{q(4 - g)^2}$

$$R_2^I = \frac{4(1 - g)(q - s)^2}{q(4 - g)^2}$$

Thus, Theorem 1 is proved.

Appendix B

Through taking the differentiation of R_1^I and R_2^I with respect to g, respectively, we can prove $\frac{\partial R_1^I}{\partial g^2} = -\frac{2(8 + 7g)(q - s)^2}{q(4 - g)^4} < 0$ and $\frac{\partial R_2^I}{\partial g} = -\frac{4(2 + g)(q - s)^2}{q(4 - g)^3} < 0$
Similarly, we can prove that $\frac{\partial R_1^I}{\partial q} > 0$ and $\frac{\partial R_2^I}{\partial q} < 0$
Thus, Proposition 1 is proved.

Appendix C

$$D_1^B = \frac{p_2 - p_1}{(1 - g)q} - \frac{p_1}{gq} + (1 - g)q$$

$$D_2^B = 1 - \frac{p_2 - p_1}{(1 - g)q} - (1 - g)q$$

When two firms form a brand alliance, they work together to maximize their joint profits

$$T = R_1^B + R_2^B = (p_1 - gs)D_1^B + (p_2 - s)D_2^B$$

Then we find the equilibrium prices:

$$\frac{\partial T}{\partial p_1} = 0 \text{ and } \frac{\partial T}{\partial p_2} = 0$$

After some computations, we obtain

$$p_1^B = \frac{g(q + s)}{2}$$

$$p_2^B = \frac{(q - q^2(1 - g)^2 + s)}{2}$$

Further, we substitute the prices into profits functions of each firm, and after some computations, we obtain the corresponding expected profits as follows:

$$R_1^B = \frac{gq(1 - g)(q - s)}{4}$$

$$R_2^B = \frac{(q - q^2(1 - g) - s)(q - q^2(1 - g)^2 - s)}{4q}$$

Thus, Theorem 2 is proved.

Appendix D

Through taking the differentiation of R_1^B and R_2^B with respect to g, respectively, we can prove $\frac{\partial R_1^B}{\partial g^2} = -\frac{2(8 + 7g)(q - s)^2}{q(4 - g)^4} < 0$ and

$\frac{\partial R_2^B}{\partial g} = \frac{q(q-s)(3-2g) + 3q^3(1-g)^2)}{4} > 0$

Similarly, we can obtain $\frac{\partial R_1^B}{\partial q} > 0$ and $\frac{\partial R_2^B}{\partial q} > 0$

Furthermore, we can prove that $|\frac{\partial R_2^B}{\partial g}| > |\frac{\partial R_1^B}{\partial g^2}|$

Thus, Proposition 2 is proved.

Appendix E

$$R_1^I = \frac{g(1-g)(q-s)^2}{q(4-g)^2} \tag{A1}$$

$$R_2^I = \frac{4(1-g)(q-s)^2}{q(4-g)^2} \tag{A2}$$

$$R_1^B = \frac{gq(1-g)(q-s)}{4} \tag{A3}$$

$$R_2^B = \frac{(q-q^2(1-g)-s)(q-q^2(1-g)^2-s)}{4q} \tag{A4}$$

Through comparing (A1) with (A3), it is easy to prove $R_1^B > R_1^I$. When we compare (A2) with (A4), we can find that only if the negative effect of lower quality brand, $(1-g)q$, on higher quality brand is less than H, then $R_2^B > R_2^I$, where.

$$H = \frac{8gq - 16q + 16s - g^2q + 16q^2 - 24gq^2 + 9g^2q^2 - g^3q^2}{2q(4-q)^2} + (4-g)\sqrt{16(1-g)(q-s)^2 + (4-g)^2(q-q^2(1-g)-s)^2}$$ Thus, Proposition 3 is proved.

Appendix F

When two firms form a brand alliance and benefit from it, $R_1^B > R_1^I$ and $R_2^B > R_2^I$.

Following the same proof procedures as in Appendix B, we can prove.

$\frac{\partial(R_1^B - R_1^I)}{\partial g^2} < 0$ and $\frac{\partial(R_2^B - R_2^I)}{\partial g} > 0$

Thus, Proposition 4 is proved.

Appendix G

Following the same procedures as in Appendices A and C, we obtain the results summarized in Table 1.

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