The launch of store brands when retailers compete

Abstract

In this paper, we consider retailers' decision of introducing store brands in a competitive environment. Our findings demonstrate that the retailer should introduce a store brand, when the demand of the store brand is high and the competition among store brands and the national brand is fierce enough. Moreover, the wholesale prices of the national brand for both retailers are identical, when either retailer introduces a store brand. Furthermore, the manufacturer may increase the wholesale price of the national brand.

Keywords: Store Brand; National Brand; Retailing; Competition

1 Introduction

Many retailers provide several store brands for consumers in a number of categories. For example, Walmart launches Great Value for many food items, and owns Parent's Choice for baby products. Store brands penetrate major retail chains and surge in market share (Ailawadi et al. 2008, and Kumar et al. 2007). As demonstrated by Nielsen (2014), 41% of sales come from store brands in the U.K., and 17% of sales in the U.S. come from store brands. With store brands, retailers have more control over product quality and marketing activities. Besides, retailers may gain better contract terms from manufacturers, since store brands can be a formidable force in the competition among store brands and national brands (Hoch 1996).

Along with the aforementioned benefits and prosperity, store brands also bring in fierce competition. First, national-brand manufacturer adopts various strategies to retaliate, including price adjustments, promotional activities and product innovation (Quelch and Harding 1996, and Ward 2002a). Then, many retail chains offer store brands and compete in identical categories, such as 7-Eleven and FamilyMart in the following examples. 7-Eleven introduces the 7-Select beer "The Beer" with Suntory in Taiwan, where 7-Select is his store brand for food, drinks and personal care. Then, consumers in Taiwan swarm into 7-Eleven stores to buy the beer. Facing this, FamilyMart launches the beer with Harboe in his FamilyMart collection. Furthermore, their another contest is in the ice cream category. In 2013, FamilyMart starts to sell its Fami soft ice-cream in stores. Then, 7-Eleven launches its store brand Hokkaido soft ice-cream which is made from milk produced in Tokachi. Until June 2015, the sales of the soft ice-cream in 7-Eleven stores is about 1 billion Taiwan New Dollar, and FamilyMart sells a number of more than 50 million soft ice-cream. Then, Hi-Life also launches the soft ice-cream in 2015.

In the aforementioned examples, the retailers may sell national brands and

launch store brands. They may be excited by the possible demand of store brands, but also have to deal with the competition between national brands and store brands. To characterize retailers' decisions of launching store brands in a competitive environment, we build a stylized model in which a national brand (NB hereafter) manufacturer sells his NB products through two retailers, and each retailer can sell a store brand (SB for short). Then, we study the competition between SBs in this analytical model, since the competition is quite fierce and makes great influence on the profit. Through the way we model SB competition, we can highlight the role of the cross-price sensitivity between SBs.

First, we characterize the wholesale prices and find that the wholesale prices of the NB for both retailers are identical, when one of them introduces a SB. Hoch (1996) demonstrates that the introduction of SB enables the retailer to obtain better contract terms. Intuitively, when the retailer sells a SB, the manufacturer may offer the NB at a lower wholesale price. However, our finding shows that there is no need for the manufacturer to tilt trade terms towards the retailer with a SB. Otherwise, another retailer may also have incentive to introduce a SB. Moreover, when the demand of SB is high enough, the introduction of SB may make substantial negative influence on the sales of NB. Then, the manufacturer increases the NB's wholesale price to counterbalance the loss due to the introduction of SB. Facing this, the retailer who introduces the SB offers the NB at a higher retail price and may also increase the profit margin of NB after introducing the SB.

Then, we analyze retailers' optimal strategies by numerical experiments. Our results show that the retailer should introduce a SB, when the demand of SB is high and the competition is fierce enough. Specifically, when the demand of the SB is higher than that of the NB, the fiercer the competition between the SB and the NB is, the more likelihood there is that the retailer provides both the SB and the NB. Moreover, the fiercer the competition between SBs, the more likelihood there is that the retailer provides both the SB and the NB. In the extreme case, the retailer may only sell the SB, when the demand of SB is high enough.

There is a vast literature on NBs and SBs. Some researchers discuss retailers' decisions on the introduction of SBs. Raju et al. (1995) discuss whether a retailer should introduce a SB in a channel structure with multiple manufacturers and a retailer. They find that the retailer is better off launching a SB when the cross-price sensitivity between NBs and the SB is high and the cross-price sensitivity among NBs is low. Sayman et al. (2002) adopt the channel structure in Raju et al. (1995), and investigate the positioning of SBs in a channel with two NBs and a SB. In their framework, they choose the cross-price sensitivities between each NB and the SB to maximize the retailer's profit. Their finding indicates that the SB should be positioned as close as possible to the stronger NB, when a set of conditions are satisfied. In

contrast with these studies, we discuss whether both or either retailer should introduce a SB when two retailers compete. Our findings demonstrate that the retailer is more likely to introduce a store brand, when the cross-price sensitivity between SBs is larger.

Our research also relates to the literature on price competition and channel coordination (e.g., Choi 1991, and Ingene and Parry 1995). Iyer (1998) analyzes the channel coordination with a manufacturer and two retailers, when consumers are heterogeneous with respect to their spatial locations and valuations for retail services. Choi (1996) provides a stylized model to analyze price competition in a channel with duopoly manufacturers and duopoly common retailers. His finding shows that manufacturers and retailers have a conflict of interest, regarding to product differentiation and store differentiation. These studies focus on the competition between NBs, although SBs have already taken considerable proportions of sales nowadays. In contrast with these studies, we consider the competition between the NB and SBs and investigate whether retailers should introduce SBs. Moreover, our findings may help the manufacturer to coordinate the selling channel by adjusting the wholesale prices.

The rest of paper is organized as follows. First, we introduce our model setting and characterize equilibriums in Sections 2 and 3 respectively. Moreover, we conclude in Section 4, and relegate all the proofs to the appendix.

2 Model

We consider a market in which a NB manufacturer sells his NB products through two retailers R1 and R2. Each retailer can sell a SB, and outsource the manufacturing. Let SB1 denote the SB of retailer R1 and SB2 denote R2's SB. We assume that SBs have identical qualities with the NB, which simplifies our analysis of demands. These scenarios are common in many consumer packaged goods. Take the fluid milk product category as an example. Quality differences among brands are minimized by the milk grading standards from the U.S. Department of Agriculture, as stated by Chen et al. (2010). Moreover, Chen et al. (2010) indicate that many product categories (e.g., orange juice) in which there are lots of SBs fit the assumption.

Specifically, retailer R1 faces the following three strategies. (1) SB1: selling only the SB, (2) NB: selling only the NB, (3) NB & SB1: selling both the NB and the SB. Similarly, retailer R2 chooses her strategy among SB2, NB and NB & SB2. Therefore, there are nine candidate equilibriums as in Table 1, when each retailer chooses one among three strategies.[1] Specifically, when both retailers choose to sell the NB, the

[1] The optimal equilibrium is one of the candidate equilibriums and varies along with changes of market parameters. More details are shown in Figures 1, 2, 3 and 4.

equilibrium is denoted as (N,N). In contrast, (S1, S2) represents the case in which two retailers only sell their own store brands, respectively. Moreover, in the candidate equilibrium (S1, B), retailer R1 only offers SB1, and retailer R2 provides both the NB and SB2. Similarly, we can obtain other candidate equilibriums in Table 1.

		R2		
	Strategy	NB	SB2	NB & SB2
R1	NB	(N,N)	(N,S2)	(N,B)
	SB1	(S1,N)	(S1,S2)	(S1,B)
	NB & SB1	(B,N)	(B,S2)	(B,B)

Table 1 Candidate equilibriums

Following the study of Sayman et al. (2002), we obtain the demand function of each retailer in each candidate equilibrium. In the candidate equilibrium (B,B), both R1 and R2 sell both the SB and the NB. Then, the demand functions of NB and SB1 of R1 are formulated as follows.

$$q_{\mathrm{n1}} = \frac{1}{a_{s1}+a_{s2}+1+1}\left\{1 - p_{n1} + \frac{1}{3}[\delta_1(p_{s1} - p_{n1}) + (p_{n2} - p_{n1}) + \delta_2(p_{s2} - p_{n1})]\right\},$$

$$q_{\mathrm{s1}} = \frac{1}{a_{s1}+a_{s2}+1+1}\left\{a_{s1} - p_{s1} + \frac{1}{3}[\delta_1(p_{n1} - p_{s1}) + \delta_1(p_{n2} - p_{s1}) + \theta(p_{s2} - p_{s1})]\right\}.$$

Moreover, R2's demand functions are the following expressions.

$$q_{\mathrm{n2}} = \frac{1}{a_{s1}+a_{s2}+1+1}\left\{1 - p_{n2} + \frac{1}{3}[(p_{n1} - p_{n2}) + \delta_1(p_{s1} - p_{n2}) + \delta_2(p_{s2} - p_{n2})]\right\},$$

$$q_{\mathrm{s2}} = \frac{1}{a_{s1}+a_{s2}+1+1}\left\{a_{s2} - p_{s2} + \frac{1}{3}[\delta_2(p_{n1} - p_{s2}) + \theta(p_{s1} - p_{s2}) + \delta_2(p_{n2} - p_{s2})]\right\}.$$

where a_{s1}, a_{s2} are base levels of demand for R1 and R2's store brands. Moreover, base levels of demand for the NB for both retailers are normalized to be 1. Furthermore, R1 determines the retail prices for the SB and the NB as p_{s1} and p_{n1}. Similarly, p_{s2} and p_{n2} are the retail prices for SB2 and the NB decided by R2.

Furthermore, δ_1 denotes the cross-price sensitivity representing the degree of price competition between NB and SB1, where $0 < \delta_1 < 1$. If δ_1 is small, NB and SB1 attract different consumers and their sales are not highly correlated. However, when δ_1 is large, the competition between two brands for an identical retailer is fierce. The increase in sale of a brand indicates that the sale of another brand decreases. Similarly, δ_2 is the cross-price sensitivity between NB and SB2, where $0 < \delta_2 < 1$. Moreover, θ denotes the cross-price sensitivity between SB1 and SB2, where $0 < \theta < 1$. Since θ is affected by δ_1 and δ_2, we consider the influence in

the numerical analysis, when choosing the parameters.[2] Furthermore, when both R1 and R2 sell the NB, the cross-price sensitivity of NB of two retailers is 1. Similarly, we can obtain the demand functions in other candidate equilibriums.

If a retailer sells a SB, she outsources the manufacturing. The manufacturer produces either the SB or the NB at cost 0. Then, he decides the wholesale prices for both the NB and the SB, and obtains the payoffs from manufacturing both brands. For R1, let w_{s1} and w_{n1} denote the wholesale prices for the SB and the NB. Similarly, w_{s2} and w_{n2} are the wholesale prices for R2. In the Walmart example, food corporations release products under their own brands and manufacture food items for Walmart's store brands. Specifically, Cott Corporation produces beverages under multiple brands, such as Sam's Cola and Dr. Thunder for Walmart. Simultaneously, many beverages of Cott's own brands (e.g., Vintage and Cott) are also sold in Walmart. As demonstrated by Quelch and Harding (1996), more than a half of NB consumer packaged goods manufacturers also produce SB goods in U.S.. Moreover, Chen et al. (2010) also observe that many NB manufacturers produce SBs as well. In Table 2, we summarize all the notations.

NB	National brand
SB	Store brand
R1, R2	Retailers
SB1, SB2	Store brands of R1 and R2
a_{s1}, a_{s2}	Base levels of demand for R1 and R2's store brands
q_{xy}, p_{xy}, w_{xy}	The demand, the retail price and the wholesale price of brand x of retailer y; x∈{n, s}, where n and s denote the national brand and the store brand; and y∈{1, 2} represents R1 or R2
δ_1	The cross-price sensitivity between NB and SB1
δ_2	The cross-price sensitivity between NB and SB2
θ	The cross-price sensitivity between SB1 and SB2

Table 2 Notations

[2] For example, in Figures 1 and 2, both δ_1 and δ_2 are relatively small (i.e., $\delta_1 < 0.5$ and $\delta_2 < 0.5$). Then, we are able to obtain optimal equilibriums, when θ changes from 0 to 1. Moreover, in Figure 4, θ is relatively small. Then, when both δ_1 and δ_2 are large, the candidate equilibriums are infeasible. Therefore, the cases with $\delta_1 > 0.5$ and $\delta_2 > 0.5$ are labeled as "X"(i.e., no equilibrium).

The sequence of events is summarized as follows. (1) R1 and R2 decide whether to sell either or both brands (i.e., a SB and the NB). (2) The manufacturer determines the wholesale prices for each retailer. For simplicity, we assume that the manufacturer only decides the wholesale prices for the NB and SBs. In this decision process, he is able to offer a low wholesale price to induce a retailer to launch a SB, or make a retailer to abandon a SB by supplying products at a high enough wholesale price. This assumption is appropriate when large, diversified manufacturers offer SBs and the NB (e.g., Cott Corporation and Conagra Brands). (3) R1 and R2 decide the corresponding retail prices, and obtain their demand functions.

3 Analysis

Now, we focus on the candidate equilibrium (S1,N). In this equilibrium, R1 only sells SB1 and R2 only sells the NB. Similarly, we can characterize other eight candidate equilibriums. Thereafter, we illustrate the optimal equilibriums in Figures 1, 2, 3 and 4, in the numerical analysis. To avoid redundancy, the details are omitted here.

In equilibrium (S1,N), R1 only sells SB1 and R2 only sells the NB. We apply the backward induction to characterize the equilibrium. In period 3, given the retail prices, R1 and R2's demand functions q_{s1} and q_{n2} are shown as follow.

$$q_{s1} = \frac{1}{a_{s1}+1}[a_{s1} - p_{s1} + \delta_1(p_{n2} - p_{s1})],$$

$$q_{n2} = \frac{1}{a_{s1}+1}[1 - p_{n2} + \delta_1(p_{s1} - p_{n2})].$$

Furthermore, given wholesale prices w_{s1} and w_{n2}, the retailers' payoffs can be expressed as $\pi_{R1} = (p_{s1} - w_{s1})q_{s1}$ and $\pi_{R2} = (p_{n2} - w_{n2})q_{n2}$. Then, substituting the demand functions into the retailers' payoff, we obtain the optimal retail prices by first-order conditions.

$$p_{s1}^* = \frac{2a_{s1}(1+\delta_1)+2w_{s1}(1+\delta_1)^2+\delta_1[1+w_{n2}(1+\delta_1)]}{4+8\delta_1+3\delta_1^2},$$

$$p_{n2}^* = \frac{2+(2+a_{s1}+w_{s1})\delta_1+w_{s1}\delta_1^2+2w_{n2}(1+\delta_1)^2}{4+8\delta_1+3\delta_1^2}.$$

Moreover, the demand functions can be rewritten as follows.

$$q_{s1} = \frac{(1+\delta_1)[2a_{s1}(1+\delta_1)-w_{s1}\left(2+4\delta_1+\delta_1^2\right)+\delta_1(1+w_{n2}+w_{n2}\delta_1)]}{(1+a_{s1})(2+\delta_1)(2+3\delta_1)},$$

$$q_{n2} = \frac{(1+\delta_1)[2+(2+a_{s1}+w_{s1})\delta_1+w_{s1}\delta_1^2-w_{n2}(2+4\delta_1+\delta_1^2)]}{(1+a_{s1})(2+\delta_1)(2+3\delta_1)}.$$

In period 2, the manufacturer determines wholesale prices. In equilibrium (S1,N), the manufacturer's payoff includes the profit of selling the SB and the NB. Therefore, the manufacturer's payoff is written as $\pi_M = w_{s1}q_{s1} + w_{n2}q_{n2}$. Having substituted the demands, the optimal wholesale prices are given by the first-order conditions. Specifically, from $\frac{\partial \pi_M}{\partial w_{s1}} = \frac{\partial \pi_M}{\partial w_{n2}} = 0$, we obtain the optimal wholesale prices.

$$w_{s1}^* = \frac{\delta_1+a_{s1}(1+\delta_1)}{2+4\delta_1},\ w_{n2}^* = \frac{1+(1+a_{s1})\delta_1}{2+4\delta_1}.$$

Furthermore, we can obtain retailers' payoffs in equilibrium (S1,N): $\pi_{R1} = \frac{(1+\delta_1)[\delta_1+2a_{s1}(1+\delta_1)]^2}{4(1+a_{s1})(2+\delta_1)^2(2+3\delta_1)^2}$ and $\pi_{R2} = \frac{(1+\delta_1)[2+(2+a_{s1})\delta_1]^2}{4(1+a_{s1})(2+\delta_1)^2(2+3\delta_1)^2}$. Following the procedure above, we characterize other candidate equilibriums.

Next, we characterize the wholesale prices in Propositions 1 and 2, and the proofs are relegated to the appendix. Then, we implement numerical experiments and obtain Observations 1 and 2, Proposition 3 and Corollary 1.

Proposition 1: The wholesale prices of the NB for both retailers are identical, when one of them introduces a SB. (i.e., $w_{n1}=w_{n2}$ in equilibriums (B,N) or (N,B)). Moreover, the retailer who introduces a SB offers the NB at a higher retail price.

Proposition 1 demonstrates that the introduction of SB cannot enable the retailer to obtain products of the NB at a lower wholesale price, compared with her competitor. Intuitively, when the retailer sells the SB, the manufacturer may offer the NB at a lower wholesale price to induce the retailer to sell the NB. Specifically, when the manufacturer reduces the wholesale price, the retail price of the NB is lower as well. However, the retailer not only reduces the retail price of the NB, but also reduces that of the SB. Consequently, the sales volume of the NB does not change much. Therefore, the manufacturer incurs a loss due to the reduction of wholesale price. Moreover, if the manufacturer reduces the wholesale price, another retailer may also have incentive to introduce a SB. Then, the loss of the manufacturer's profit further enlarges. Therefore, we can conclude that there is no need for the manufacturer to tilt trade terms towards the retailer with a SB.

Then, to increase the sale of SB, the retailer increases the retail price of NB. This finding is consistent with the literature (e.g., Bontemps et al. 2005, Gabrielsen et al. 2006, and Ward et al. 2002b). Their empirical findings show that NBs may increase their prices, when they face SBs. Specifically, although the increase in the retail price of NB indicates that the sales volume of NB decreases, the sales volume of SB may

increase simultaneously, due to the cross-price effect between the NB and the SB.

Proposition 2: When retailer R1 introduces SB1 and the demand of SB1 is high enough (i.e., a_{s1} is large enough), the manufacturer increases the NB's wholesale price. Then, retailer R1 may also increase the profit margin of NB after introducing the SB.

When the demand of SB is high enough, the introduction of SB may impose large and negative influence on the sale of NB. Then, the manufacturer increases the NB's wholesale price to counterbalance the loss due to the introduction of SB. In this case, the retail price of NB increases as well and loyal consumers may continue to purchase the NB, as demonstrated by Gabrielsen and Sørgard (2007). Some literature indicates that the introduction of SB enables the retailer to obtain better contract terms (e.g., Hoch 1996). However, our finding shows that the reduction of the wholesale price may only happen, when the demand of SB is not too high.

After the manufacturer increases the NB's wholesale price, the retailer may offer the NB at a higher retail price to increase the profit margin. Our finding echoes the empirical study of Ward et al. (2002b), which demonstrates that retail prices of NBs rise, when the share of the private-label goods increases (i.e., the demand increases). The price adjustment makes positive influence on the sale of SB, due to the substitutability between the NB and the SB. Therefore, the retailer is able to obtain more profit after launching the SB.

In the sequel, we illustrate optimal equilibriums in Figures 1, 2, 3 and 4, when market parameters change.

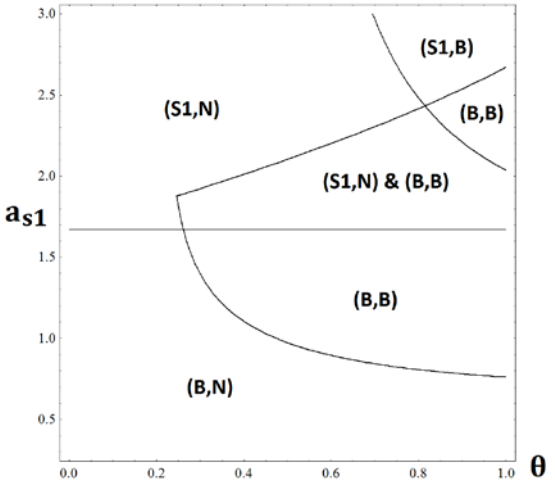


Figure 1. Optimal equilibriums

(parameters: a_{s2}=0.3, δ_1= 0.2, δ_2=0.4)

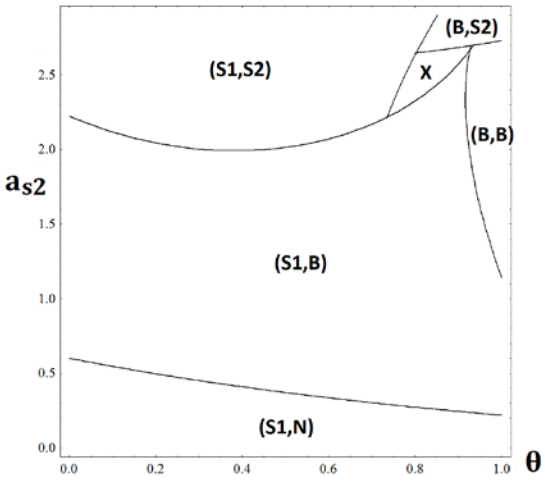


Figure 2. Optimal equilibriums[3]

(parameters: a_{s1}=2.9, δ_1=0.2, δ_2=0.4)

[3] There is no feasible equilibrium in region X.

Observation 1: A retailer may only sell a SB, when the demand of SB is high enough (e.g., a_{s1} is large enough). On the contrary, if the demand of SB is low enough, the retailer may only provide the NB.

From Figures 1 and 2, we can conclude that retailers may choose a single product between a SB and the NB. They make their choices, concerning the demand levels. In Figure 1, given $\theta = 0.1$, when the demand of SB1 is high enough (e.g., $a_{s1} > 2$), retailer R1 only sells SB1. Specifically, when the demand of SB1 is high enough, the share of SB1 is large. Thereafter, the retailer makes a tradeoff between providing the NB and increasing the sales quantity of SB1 further, and decides to only offer SB1. This may provide explanation for Trader Joe's product strategy. In several categories (e.g., ice cream), some Trader Joe's grocery stores provide only SBs.

On the contrary, in Figure 2, given $\theta = 0.6$, retailer R2 only provides the NB, if the demand of SB2 is low enough (e.g., $a_{s2} < 0.2$). In this case, if R2 introduces a SB, much fiercer competition among SBs and the NB arises. In the competition, R2 takes a disadvantageous position, since the demand of SB2 is low and the substitutability between SBs is high. Moreover, the manufacturer may increase the wholesale price of the NB, due to the entry of SB2. Thus, it is not profitable for R2 to introduce SB2. There are many retailers selling only NBs in several categories. For example, Costco does not have SBs in electric toothbrushes.

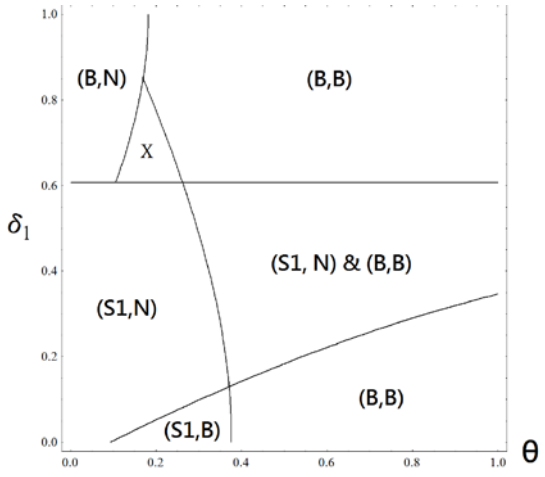


Figure 3. Optimal equilibriums

(parameters: a_{s1}=2, a_{s2} = 0.4, δ_2=0.5)

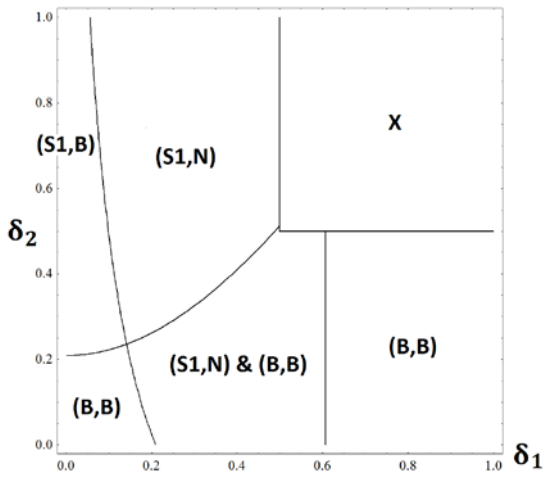


Figure 4. Optimal equilibriums

(parameters: a_{s1}=2, a_{s2} = 0.4, θ=0.3)

Observation 2: When the demand of SB1 is high enough, the demand of SB2 is low enough, and the cross-price sensitivity between NB and SB1 is moderate (i.e., δ_1 is moderate), two retailers distinguish their products to the largest extent (e.g., equilibrium (S1, N)).

From Figure 3, when the SB is relatively competitive (i.e., δ_1 is moderate), retailer R1 intends to offer only SB1 to share the market with the NB from retailer R2. Then, two retailers benefit from distinguishing their products. In Figure 3, (S1, N) may be an equilibrium when $\delta_1 = 0.4$. First, retailers choose to sell either a SB or the NB, with consideration of their demand levels, as shown in Observation 1. Moreover, their choices are also influenced by the substitutability between brands. (S1, N) is optimal for both retailers when the substitutability between NB and SB1 is moderate. For example, in the category of maple syrup, Costco offers only Kirkland Signature products, while Walgreens only sells products of Good & Delish in the stores. In contrast, when the substitutability between SB1 and the NB is high enough, it becomes more profitable for retailer R1 to offer the NB as well. Take Walmart as an example, it provides maple syrup of Great Value and other brands.

Proposition 3: The impacts of competition level among SB1, SB2 and the NB on retailers' strategy choices are shown as follows.

- **When the cross-price sensitivity between the NB and the high-demand SB or between SBs (i.e., θ) is larger, the more likelihood there is that the retailer provides both the NB and the high-demand SB.**
- **When the cross-price sensitivity between the NB and the low-demand SB is smaller, the more likelihood there is that the retailer provides both the low-demand SB and the NB.**

Proposition 3 demonstrates that the retailers decide whether to sell both a SB and the NB, after considering the demand and the degree of competition. Specifically, in Figure 3, given $\theta = 0.35$, when $\delta_1 > 0.65$, the competition between the SB1 and the NB is less fierce than that between NB products. Moreover, the demand of SB1 is relatively larger. Therefore, retailer R1 is able to obtain more profit by selling both SB1 and the NB. In this scenario, the position of SB1 should be closer to either the NB or SB2, by adjusting the following extrinsic cues: package design, labeling/color, shelf placement and shelf talkers (Richardson et al. 1994, and Sayman et al. 2002). It may explain Walmart's strategy of offering pure maple syrup of Great Value and Maple Grove Farms.

Moreover, in Figure 3, given $\delta_1 = 0.2$, retailer R1 may sell both brands, when θ is large enough. Since the degree of competition between SB1 and the NB is low, retailer R1 is likely to sell only SB1. However, the situation changes, due to the high substitutability between SBs. When there is high substitutability between SBs, SB1 has to face fierce price rivalry from SB2. Then, retailer R1 intends to take more market share by offering the NB. This case may correspond to the selling of milk in

many retailing stores. Generally, the differences among milk of SBs are low and their cross-price effects are large. Therefore, many retailers sell the NB and launch their own SBs for milk.

In Figure 4, given $\delta_1 = 0.4$, retailer R2 may provide both brands when δ_2 is small enough. Thus, we can conclude that retailer R2 sells both brands, when the competition between SB2 and the NB is not fierce. In this case, retailer R2 offers two brands to differentiate consumers, and her total share is increased by adopting two-product strategy.

Corollary 1: As the presence of a SB with high demand in the market, a SB with lower demand is more likely to be offered, when the cross-price sensitivity between SBs is larger.

Corollary 1 indicates that the SB with lower demand should be positioned as close as possible to the existing SB, when there is a SB with high demand in the market. As suggested by the studies of Richardson et al. (1994) and Sayman et al. (2002), the retailer may target one particular brand by imitating in the following extrinsic cues: package design, labeling/color, shelf placement and shelf talkers. Moreover, it is also important for the retailer to build strong brand equity, since about 2 in 5 consumers place confidence in SBs from retailers they trust, according to Nielsen (2011).

When the substitutability between two SBs is high, consumers of the existing SB may purchase the new SB instead. The retailer becomes stronger in the selling competition, after the launch of a new SB. As in Figure 3, given $\delta_1 = 0.05$, retailer R2 may offer both SB2 and the NB, when θ is large enough (e.g., $\theta = 0.3$). Facing this change, retailer R1 offers the NB as well, if the cross-price effect between two SBs is substantial (e.g., $\theta = 0.8$). Then, both retailers offer both brands in stores. For example, Walmart and Lucky sell NBs and launch their own SBs for milk, since the difference between milk of SBs is small and their cross-price effect is large.

4 Conclusion

We consider the retailer's decision of introducing a SB in a competitive environment. Our findings demonstrate that the retailer should introduce a SB when the demand of SB is high and the competition is fierce enough. Specifically, for a strong SB (i.e., the demand is relatively high), the retailer should launch the SB and offer the NB as well, when the substitutability among SBs and the NB is high (i.e., the cross-price sensitivity among brands is high). In the extreme case, the retailer may only sell the SB, when the demand of SB is high enough. On the contrary, when a SB's demand is low, the retailer is more likely to sell both the SB and the NB, when the degree of competition between two brands is low.

Furthermore, if the retailer launches a SB, instead of receiving preferential treatment during the negotiation with the manufacturer, the manufacturer may become harsher and increase the wholesale price of the NB. Confronting with this, the retailer

may offer the NB at a higher retail price to fight back. The price adjustment not only promises the retailer a higher profit margin, but also makes positive influence on the sale of SB, due to the substitutability between the NB and the SB. Owing to these, the retailer is able to obtain more profit after launching the SB.

Our work has the following limitations. First, there are only two competing retailers in our context. In reality, the market contains more competing retailers and manufacturers. Then, the analysis is more complicated and intriguing. Moreover, the manufacturer produces both the NB and SB products in our model. We may also consider the scenario in which retailers obtain products of SBs from another manufacturer, rather than the manufacturer who produces NB products. In this scenario, retailers may obtain SB goods at lower wholesale prices, due to the competition between manufacturers. Then, retailers are more likely to introduce SBs. We believe that most of our results concerning the decisions of introducing SBs still hold. This scenario needs to be further investigated and can be compared with our findings in this paper.

Appendix

Proof of Proposition 1

Following the procedure in Section 3, we can characterize the equilibriums and obtain the wholesale prices. The wholesale prices in the equilibriums are shown in Table 3.

Equilibriums	Wholesale prices
(N,N)	$w_{n1}=\frac{1}{2},\ w_{n2}=\frac{1}{2}.$
(S1,N)	$w_{s1}=\frac{\delta_1+a_{s1}(1+\delta_1)}{2+4\delta_1},\ w_{n2}=\frac{1+(1+a_{s1})\delta_1}{2+4\delta_1}.$
(B,N)	$w_{n1}=\frac{2+(2+a_{s1})\delta_1}{4+6\delta_1},\ w_{s1}=\frac{2\delta_1+a_{s1}(2+\delta_1)}{4+6\delta_1},\ w_{n2}=\frac{2+(2+a_{s1})\delta_1}{4+6\delta_1}.$
(N,S2)	$w_{n1}=\frac{1+(1+a_{s2})\delta_2}{2+4\delta_2},\ w_{s2}=\frac{\delta_2+a_{s2}(1+\delta_2)}{2+4\delta_2}.$
(S1,S2)	$w_{s1}=\frac{(1+\theta)a_{s1}+\theta a_{s2}}{2+4\theta},\ w_{s2}=\frac{\theta a_{s1}+(1+\theta)a_{s2}}{2+4\theta}.$
(B,S2)	$w_{s1}=\frac{1}{8(1+\theta)+(8+6\theta)\delta_2+\delta_1(8+6\theta+6\delta_2)}\{2\delta_1+\theta\delta_1+\theta\delta_2+\delta_1\delta_2+a_{s2}[\theta(2+\delta_2)+\delta_1(\theta+\delta_2)]+a_{s1}[2(2+\theta)+(4+\theta)\delta_2+\delta_1(2+\theta+\delta_2)]\},$ $w_{s2}=\frac{1}{8(1+\theta)+(8+6\theta)\delta_2+\delta_1(8+6\theta+6\delta_2)}\{\theta\delta_1+2\delta_2+\theta\delta_2+\delta_1\delta_2+a_{s1}[\theta(2+\delta_2)+\delta_1(\theta+\delta_2)]+a_{s2}[(2+\theta)(2+\delta_2)+\delta_1(4+\theta+\delta_2)]\},$

	$w_{n1}=\frac{1}{8(1+\theta)+(8+6\theta)\delta_2+\delta_1(8+6\theta+6\delta_2)}\{4(1+\theta)+[\theta a_{s1}+(2+\theta)(1+a_{s2})]\delta_2+\delta_1[2+\theta+\delta_2+a_{s2}(\theta+\delta_2)+a_{s1}(2+\theta+\delta_2)]\}$.
(N,B)	$w_{n1}=\frac{2+(2+a_{s2})\delta_2}{4+6\delta_2}$, $w_{n2}=\frac{2+(2+a_{s2})\delta_2}{4+6\delta_2}$,$w_{s2}=\frac{2\delta_2+a_{s2}(2+\delta_2)}{4+6\delta_2}$.
(S1,B)	$w_{s1}=\frac{1}{8(1+\theta)+(8+6\theta)\delta_2+\delta_1(8+6\theta+6\delta_2)}\{2\delta_1+\theta\delta_1+\theta\delta_2+\delta_1\delta_2+a_{s2}[\theta(2+\delta_2)+\delta_1(\theta+\delta_2)]+a_{s1}[2(2+\theta)+(4+\theta)\delta_2+\delta_1(2+\theta+\delta_2)]\}$, $w_{s2}=\frac{1}{8(1+\theta)+(8+6\theta)\delta_2+\delta_1(8+6\theta+6\delta_2)}\{\theta\delta_1+2\delta_2+\theta\delta_2+\delta_1\delta_2+a_{s1}[\theta(2+\delta_2)+\delta_1(\theta+\delta_2)]+a_{s2}[(2+\theta)(2+\delta_2)+\delta_1(4+\theta+\delta_2)]\}$, $w_{n2}=\frac{1}{8(1+\theta)+(8+6\theta)\delta_2+\delta_1(8+6\theta+6\delta_2)}\{4(1+\theta)+[\theta a_{s1}+(2+\theta)(1+a_{s2})]\delta_2+\delta_1[2+\theta+\delta_2+a_{s2}(\theta+\delta_2)+a_{s1}(2+\theta+\delta_2)]\}$.
(B,B)	$w_{s1}=\frac{1}{2[9+6\theta+(9+4\theta)\delta_2+\delta_1(9+4\theta+8\delta_2)}\{a_{s2}[\theta(3+\delta_2)+\delta_1(\theta+2\delta_2)]+2[\theta\delta_2+\delta_1(3+\theta+2\delta_2)]+a_{s1}[3(3+\theta)+(9+\theta)\delta_2+\delta_1(3+\theta+2\delta_2)]\}$, $w_{s2}=\frac{1}{2[9+6\theta+(9+4\theta)\delta_2+\delta_1(9+4\theta+8\delta_2)}\{2[(3+\theta)\delta_2+\delta_1(\theta+2\delta_2)]+a_{s1}[\theta(3+\delta_2)+\delta_1(\theta+2\delta_2)]+a_{s2}[(3+\theta)(3+\delta_2)+\delta_1(9+\theta+2\delta_2)]\}$, $w_{n1}=\frac{1}{2[9+6\theta+(9+4\theta)\delta_2+\delta_1(9+4\theta+8\delta_2)}\{9+6\theta+[\theta a_{s1}+(3+\theta)(2+a_{s2})]\delta_2+\delta_1[a_{s2}(\theta+\delta_2)+2(3+\theta+2\delta_2)+a_{s1}(3+\theta+\delta_2)]\}$, $w_{n2}=\frac{1}{2[9+6\theta+(9+4\theta)\delta_2+\delta_1(9+4\theta+8\delta_2)}\{9+6\theta+[\theta a_{s1}+(3+\theta)(2+a_{s2})]\delta_2+\delta_1[a_{s2}(\theta+\delta_2)+2(3+\theta+2\delta_2)+a_{s1}(3+\theta+\delta_2)]\}$.

Table 3. Wholesale prices in the equilibriums.

From Table 3, we can find that $\mathbf{w_{n1}}=\mathbf{w_{n2}}$ in equilibriums (B,N) and (N,B). In addition, $p_{n1}(B,N)-p_{n2}(B,N)=\frac{\delta_1[3\delta_1+a_{s1}(5+2\delta_1)]}{140+236\delta_1+78\delta_1^2+6\delta_1^3}>0$ and $p_{n2}(N,B)-p_{n1}(N,B)=\frac{\delta_2[3\delta_2+a_{s2}(5+2\delta_2)]}{140+236\delta_2+78\delta_2^2+6\delta_2^3}>0$. Therefore, we obtain Proposition 1.

Proof of Proposition 2

Next, we analyze the wholesale price of the NB for retailer R1. Specifically, we characterize the change of the NB's wholesale price after retailer R1 introduces SB1, and divide our analysis into three cases.

(1) Equilibrium (N, N) to (B, N) .

We assume that both retailers only sell NB products currently. Then, if retailer R1 introduces a SB, the manufacturer may change the wholesale price of the NB as follows.

$$w_{n1}(B,N) - w_{n1}(N,N) = \frac{\delta_1(a_{s1}-1)}{4+6\delta_1}.$$

Then, we find that $w_{n1}(B,N) > w_{n1}(N,N)$ when $a_{s1} > 1$.

Furthermore, when $a_{s1} > 1 > \frac{-14+10\delta_1+12\delta_1^2+3\delta_1^3}{3\delta_1(13+4\delta_1)}$, $[p_{n1}(B,N) - w_{n1}(B,N)] > [p_{n1}(N,N) - w_{n1}(N,N)]$ holds.

(2) Equilibrium (N, S) to (B, S) .

Similarly, we find that $w_{n1}(B,S) > w_{n1}(N,S)$, when the following condition is satisfied.

$$\begin{aligned} a_{s1} > \frac{1}{(1+2\delta_1)[\theta\delta_2 + \delta_1(2+\theta+\delta_2)]}\{&\delta_2[-2(1+\theta)+\theta\delta_2 \\ &+ a_{s2}(2+3\theta+\theta\delta_2)] \\ &+ \delta_1[2(1+\theta)+(2+\theta)\delta_2+\delta_2^2+a_{s2}(-2\theta+3\delta_2+\theta\delta_2+\delta_2^2)]\}. \end{aligned}$$

(3) Equilibrium (N, B) to (B, B) .

Finally, we obtain that $w_{n1}(B,B) > w_{n1}(N,B)$, when

$$\begin{aligned} a_{s1} > \frac{1}{(2+3\delta_2)[\theta\delta_2 + \delta_1(3+\theta+2\delta_2)]}\{&\delta_2[-3-2\theta+2\theta\delta_2 \\ &+ a_{s2}(3+4\theta+\theta\delta_2)] \\ &+ \delta_1[6+4\theta+2(4+\theta)\delta_2+4\delta_2^2+a_{s2}(-2\theta+5\delta_2+\theta\delta_2+2\delta_2^2)]\}. \end{aligned}$$

Then, we conclude in Proposition 2.

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