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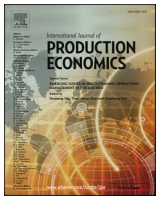

Mail-in-rebate and coordination strategies for brand competition

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ABSTRACT

This research investigates the strategic value of combining mail-in-rebate (MIR) and branding coordination strategies in the context of a supply chain composed of a national brand's manufacturer and a traditional retailer. The retailer offers two competing brands: the national brand and his own store brand. As a first step, we examine which party should bear the cost of the MIR promotional strategy and its role as a coordination mechanism to alleviate the brand competition. When there is close positioning of NB and SB's quality and a decent ratio of MIR redemption, our results show that both parties prefer the total control of the retailer over managing the national brand in his store by supporting all the costs of the promotional strategy. As a second step, we examine the role of various structures of coordination mechanisms, and we found that the "combined branding-promotion coordination" is the best option to boost the performance of all supply chain parties at the highest levels.

1. Introduction

Nowadays the competition between store brands and national brands is becoming increasingly intensive in business markets. According to Consumer Connect (2017), between 60% and 75% of consumers consider store brands as a good opportunity to save money and a good value-for-money option compared to competing national brands. In addition, Amazon total private label sales exceeded $4 billion in 2017 (IRI, 2017, www.iriworldwide.com). Further, according to the latest Nielson study Total Consumer Report in March 2018 (Watson, 2018), private labels (mainly premium ones) presented a growth of three times the one of national brands in the last year. Facing the increasing pressure from store brands, manufacturers resort to effective promotional strategies to increase their national brand's sales, alleviate the competition between both brands, and ultimately enhance customer loyalty. Mail-in-rebate (MIR) is one of these promotional strategies. Recent research showed that 95 percent of consumers are interested in products using rebates (Promotion Fulfillment Center, 2019).

Apart from inciting more consumers to visit stores and purchase the product, MIRs also are very valuable to manufacturers and retailers. These rebates make consumers 75.4% more likely to make a purchase which helps a fast turnover of products on the shelves and incites manufacturers to continue their use (Incentive Insights, 2019). These programs also help gather data about consumers such as demographics, consumer satisfaction, type of purchase, and reviews (Incentive Insights, 2017). These data allow manufacturers to adjust inventory, pricing, promotional strategies, reward and loyalty programs, and allow also to better segment the market based on price sensitivity.

Next to coupons, rebates are the most common promotion used by retailers offering tech products (Lanctot, 2002). When MIR is offered, the amount, format, and directions are attached to the product with the listed full price. Consumers need to pay the full price for the product at the time of purchase, and after purchase, they submit the rebate to the actual manufacturer/retailer to process. Once the rebate is processed, consumers receive the rebate either by check, store voucher, or a debit/credit card. There are tons of examples in the business market for various products such as kitchen wares at Macy's, Goodyear, and Bridgestone tires at Discount Tire Direct, CooperVision and Air Optix at Menards, KPOP Korean Sauce and Coca-Cola with Coffee at Freebie Depot, Purex Crystals ScentSplash at Passion for Savings, and Taco Marine products at West Marine, among many others. Manufacturers trigger consumers into purchases via these promotional programs in order to offset many challenges such as disruption of risks, information uncertainty, inventory management, and logistical difficulties (Kleindorfer and Saad, 2005; Xu and Beamon, 2006). Reviewing the extant literature, research fell short in addressing how the MIRs could be used as an effective strategy to mitigate the brand competition in the context of a manufacturer-traditional retailer.

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According to the supply chain management literature, manufacturers have an array of coordination mechanisms. These mechanisms could be based on pricing (such as quantity discount, pricing discount, and two-part tariff), on cost sharing (such as cooperative advertising and cooperative sales promotion), on information sharing (such as demand information, inventory information, and POS data), on performance sharing (such as revenue sharing and profit or trade policy sharing), or on other forms (such as buy back, sales rebate, and reservation policy). Arshinder et al. (2011) offered a detailed review of various types of coordination mechanisms.

In our paper, we examine the effect of a pricing coordination mechanism we call "branding coordination". The branding coordination is a pricing mechanism customized to the brand competition context and requires the maximization of the whole supply chain and thus each player. Such coordination mechanism puts pressure on the wholesale price and is intended to reduce the double marginalization problem between the parties of the supply chain (Ho and Zhang, 2008). Considering the gap in the extant literature, our paper makes contributions by answering the following key and pressing questions: 1) Is the national brand's MIR an efficient promotional strategy for the manufacturer when a retailer is competing with him by selling his store brand? 2) Should it be the manufacturer or the retailer who bears the cost of the promotional strategy for the national brand? 3) Is sharing the cost of the MIR promotion for the national brand between the manufacturer and the retailer a more effective coordination mechanism as is usually the case of shared promotional strategies? 4) If the cost-sharing mechanism does not offer more effectiveness, would it be better to use the branding coordination? Does it improve the marketing decisions of each player in the context of brand competition where the manufacturer is the supplier of the retailer and at the same time his competitor in the market? 5) If that branding coordination is not optimal, is there an innovative coordination mechanism to be utilized in the specific context of brand competition?

To have practitioners' insights into the importance of sales promotions and coordination mechanisms, we also surveyed manufacturers and retailers in the US market as an exploratory study. We received 21 responses (24% manufacturers and 81% retailers where one respondent is a manufacturer and a retailer). The respondents are from various industries: ice cream and frozen dessert, bakeries and tortilla manufacturing, coffee and tea, soft drink and ice, medical equipment, bookstore, apparel, furniture and home accents, automotive, custom tumblers, and apparel accessories. Varieties of promotional tools are being used by the respondents including the highly important mail-in-rebates at 19%. Other tools are used such as contests and games, coupons, frequent users' incentives, point-of-purchase displays, free samples, demonstrations, cents-off offers, money refund, premiums, sweepstakes, customized pricing, buy more save more, volume discounts, etc. In addition, 57.1% of respondents use coordination in their business relationship with other parties in the channel.

Interestingly 62% of respondents prefer to share the costs of the offered MIRs because they think it is more profitable. Most respondents (62%) don't think that MIRs intensify brand competition. In addition, 42.9% of respondents don't think that branding coordination is the solution for brand competition while 28.6% believe it is helpful to reduce conflicts, and 28.6% are unsure. However, 47.6% of respondents agree with the statement that branding coordination is better than MIRs for competing brands while 33.3% are unsure. Most respondents (81%) believe that combining both tools (branding coordination with MIRs) is effective to improve profitability for each party (the manufacturer and the retailer).

To address our research questions and to validate the practitioners' opinions, our paper investigates analytically the role of mail-in-rebate, considered of high importance for practitioners, and banding coordination in the context of brand competition. For that purpose, we study the context of a single manufacturer acting as a Stackelberg leader and selling his national brand via a traditional retailer acting as a follower. The latter also offers his store brand to compete against the manufacturer's national brand and boost the store sales by providing a variety of brands on the shelves. Our work is the first to provide comparisons among the following six scenarios: The benchmark brand competition (Scenario 1); The brand competition with the manufacturer paying fully the NB's MIR (Scenario 2); The brand competition with the retailer paying fully the NB's MIR (Scenario 3); the brand competition with the manufacturer and the retailer sharing the NB's MIR costs (Scenario 4); The brand competition with the use of the branding coordination (Scenario 5); The brand competition with the branding coordination in combination with the retailer paying fully the NB's MIR called "combined branding-promotion coordination" (Scenario 6). Examining all scenarios, our paper sheds light on: 1/whether the manufacturer and the retailer could benefit from the usage of two formats of strategies namely a promotional strategy (MIRs) and a coordination strategy (branding coordination), 2/demonstrates the best circumstances to offer each one of these strategies separately or via an interactional effect, and 3/proves which mechanism can create an optimal win-win result.

Through profit comparisons, we show that, surprisingly, both players (i.e., the manufacturer and the retailer) prefer the full support of the retailer for the MIR's cost of the national brand when there is close positioning of NB and SB's quality and a decent ratio of MIR redemption. In other words, the retailer would like to have total control over managing the national brand in his store not only by deciding on the shelf space assortment between both brands and the retail pricing of each brand, but also by supporting all the costs of the promotional strategy. The total control of the national brand's MIR promotional program by the retailer outweighs even the cost sharing option by providing higher supply chain payoffs. Our research shows that although the branding coordination helps coordinate such competition, it is a less efficient mechanism compared to the retailer's full payment of the national brand's MIR. Finally, we examine the combined branding-promotion coordination as a novel coordination approach composed of a promotional strategy (MIR for the national brand paid fully by the retailer) and a coordination strategy (branding coordination as a pricing incentive to the retailer). We find that it is the best option to boost the performance of all supply chain players in this brand competition.

2. Literature review

2.1. National and store brand competition

We summarize in Table 1 the main papers investigating the topic of national and private brands competition.

Our paper examines the context of one manufacturer and one traditional retailer, however, it differentiates itself from prior works as we study multiple decisions simultaneously (i.e., pricing, promotional strategies, and coordination mechanisms) and investigate, for the first time, the impact of the MIRs and the branding coordination in the context of brand competition. Furthermore, the papers in Table 1 that focused on determining optimal marketing strategies and solved static game theory models, did not use the demand function based on consumer's valuation in the context of brand competition. They used the regular linear demand that maximizes the utility function (i.e., demand as an additive linear function of baseline sales, retail prices and other marketing efforts). In addition, their focus was on pricing, advertising, shelf space assortment, or local promotions, but we focus on pricing, mail in rebates and coordination mechanisms for brand competition. In addition, different from Raju et al. (1995), Corstjens and Lal (2000), and Choi and Coughlan (2006), we model the quality of each brand as the benefit of buying the brand (either the store brand or the national brand). Thus, this quality parameter affects the perceived valuation of consumers about each brand and reflects a relative value importance of each brand to the other. In other words, the quality parameter represents a measure of how much the consumer values each brand.

To summarize, our first contribution is to use a demand function

Table 1
Review of research related to national and store brands competition.

References	Research issues addressed
Rothe and Lamont (1973); Dhar and Hoch (1996); Narasimhan and Wilcox (1998); Ailawadi and Keller (2004)	Examined the determinants of store brands' success
Cunningham (1982); Richardson et al. (1994); Sayman et al. (2002); Erdem et al. (2004); Choi and Coughlan (2006)	Examined the consumers' perceptions and attitudes toward store brands
Sethuraman et al. (1999); Putsis and Dhar (2001); Chintagunta et al. (2002)	Focused on empirical analyses of different marketing efforts for the store brands such as pricing, advertising and various other promotional decisions
Rao (1991); Abe (1995); Corstjens and Lal (2000); Horowitz (2000); Soberman and Parker (2006); Kurata et al. (2007); Groznik and Heese (2010a); Chen et al. (2011)	Focused on one manufacturer and one retailer to tackle various marketing efforts such as advertising, pricing, and shelf space decisions
Lal (1990); Raju et al. (1995); Sayman et al. (2002); Wu and Wang (2005); Choi and Coughlan (2006)	Focused on multiple national brands and one retailer to study various marketing efforts such as advertising, pricing, and shelf space decisions
Groznik and Heese (2010b)	Focused on one manufacturer and two retailers to limit only to pricing decisions due, most likely, to the analytical intractability when adding more decisions
Sayman and Raju (2004); Cohen and Cotterill (2011); Draganska et al. (2010)	Focused on multiple manufacturers and multiple retailers to limit only to pricing decisions due, most likely, to the analytical intractability when adding more decisions
Kumar et al. (2010); Amrouche and Yan (2017)	Used the demand function based on consumer's valuation to study the context of brand competition
Corstjens and Lal (2000); Choi and Coughlan (2006)	Included store brand quality in the intercept, or as a proportion of consumers trying the store brand, or as an additional parameter to the usual demand derived from the utility function

derived from the consumer's valuation function. The demand function includes pricing decisions, the perception of consumers about the MIR advantage, and a quality parameter that represents the consumer's valuation about each brand. The addition of the MIR as a decision variable and the brands' quality as a parameter in this specific type of demand function are novels to the branding literature. A second contribution is to investigate simultaneously a promotional strategy (MIR to boost the sales) and a coordination mechanism (branding coordination to coordinate the distribution channels) that have never been examined in this type of brand competition. A third contribution is to determine which supply chain player should support the promotional cost. While cost sharing is expected to potentially coordinate the brand competition under (at least) some conditions as has been shown in the past literature for some cooperative strategies such as cooperative advertising (Huang et al., 2002; Karray and Zaccour, 2006; Yan, 2010), the result does not hold when MIR is used for competing brands. A fourth contribution is to prove the limitation of the branding coordination as an optimal coordination tool in the supply chain system characterized by brand competition. Our findings show that this mechanism is not the optimal solution for brand competition. A new agreement must take place to settle this competition, enhance their dual performances, and foster a better collaboration.

2.2. Mail-in-rebate (MIR)

A substantial number of papers studied the topic of MIRs are summarized in Table 2.

While the studies in Table 2 contributed to the literature about MIR either empirically or analytically, none of these papers studied the usage

Table 2
Review of research related to mail-in-rebate (MIR).

References	Research issues addressed	
Avila et al. (1989)	Focused on supply chain players' motives to offer MIR.	
Tat and Schwepker (1998); Brown (1999)	Focused on consumers' motives to redeem MIR.	
Jolson et al. (1987); Hunt et al. (1995); Brown (1999); Mccall et al. (2009)	Studied the consumers' perception and satisfaction about the MIR experience.	
Khouja et al. (2008)	Focused on the conditions underlying a profitable MIR program	Studied the context of a heterogeneous market divided into three segments in terms of rebate usage level and found that two factors affect rebate effectiveness namely the distribution of consumers among the market segments and the reference value.
Khouja and Zhou (2010)		Demonstrated that the rebate is profitable for the manufacturer if the rebate valuation is independent from the redemption probabilities. They also proposed incentive mechanisms to prevent the retailer to increase the retail price when the manufacturer's rebate is offered, and such incentives seem to be Pareto improving for the whole supply chain.
Choi et al. (2010)		Conducted an experimental study to indicate that prior successful redemption experiences will attract customers to choose the MIR offer compared to an immediate cash reward.
Pyone and Isen (2011)		Demonstrated that consumers are willing to increase their wait time if they know that they will benefit more from a MIR.
Geng and Mallik (2011)		Showed that the manufacturer prefers to offer a MIR when the wholesale price is high, while it is the opposite for the retailer to offer his own MIR program. They also found that the manufacturer, the retailer, and the consumers could be weakly better off when the MIR is offered simultaneously compared to exclusively by each player.
Ha et al. (2017)		Studied the context of competing manufacturers selling a product via a single retailer and determined optimal manufacturers' MIR decisions based on the market size, the consumers' sensitivity to rebates, the intensity of the competition between both manufacturers, the costs of the MIR programs, and the redemption rate.
Lu and Moorthy (2007)	Focused on comparing MIR program to other promotional tools	Considered the optimal choice between rebates and coupons. They showed that offering rebates are optimal for large gap between consumers' valuation of the reservation price and the redemption cost, while offering coupons is

(*continued on next page*)

Table 2 (*continued*)

References	Research issues addressed
	better for small gap. Moreover, they argued that consumers' risk aversion and the time to process the rebates' redemption decrease the appeal of offering rebates.
Yang et al. (2015)	Used analytical models to compare the offering of MIR versus EDLP (Every Day Low Price) and determined optimal strategies to implement each program. They showed that the price sensitivity, the regular retail price, and the rebate costliness are key parameters affecting the choice of which program to offer. The choice is not purely based on pricing decisions but rather on the marketing positioning of the product.

of MIR in the context of brand competition between the national and store brand. Besides, no prior research ever addressed how MIR can be utilized to coordinate the brand competition and alleviate such rivalry. Hence, our paper contributes to the literature about MIR by assessing which player should offer the MIR program, how to offer this program, and which coordination scheme is the most profitable in such context.

2.3. Coordination mechanisms for brand competition

Coordination mechanisms should provide to each supply chain player at the minimum what they have been gaining without implementing these mechanisms. In addition, they add a surplus of profit that makes the coordination a win-win strategy for all players of the supply chain system and guarantee the balance of the system budget (Mas-Colell et al., 1995). Using coordination mechanisms to manage this competition in the literature has been scarce. Only few studies addressed branding coordination by investigating the role of some mechanisms in such context. Table 3 summarizes prior studies related to coordination mechanisms.

Different from prior studies in Table 3 focusing mainly on coordination mechanisms, our research examines both formats: promotional and coordination strategies simultaneously. Specifically, we examine which coordination mechanism is effective in reducing the brand competition and achieving a Pareto situation by considering a promotional strategy (the MIR costs) and a pricing coordination contract customized to the brand competition (we call "branding coordination"). To our knowledge, no prior research ever addressed the use of these two types of mechanisms when the store brand competes against the national brand. Surprisingly, we found that neither one of these mechanisms is the optimal option for the supply chain. Thus, we initiate a novel coordination scheme we call "combined branding-promotion coordination" (i.e., a combination of promotional and branding coordination strategies) that proves to be more effective in alleviating the competition between both brands.

3. Models and results

We consider a supply chain composed of one manufacturer and one traditional retailer. We propose a game-theoretic model where the leading manufacturer is offering his national brand (NB) via a single traditional retailer. The latter is also offering his store brand (SB) and we assume that he purchases his SB from an independent manufacturer considered a non-strategic player. The assumption is widely used in

Table 3
Review of research related to coordination mechanisms for brand competition.

References	Research issues addressed
Karray and Zaccour (2006)	Conducted analytical research to show that cooperative advertising can mitigate the competition of a store brand and a national brand when both brands compete strongly.
Amrouche and Zaccour (2009)	Studied the brand competition with the consideration of shelf-space allocation for both brands and a wholesale-price incentive related to the proportion allocated to the national brand on the shelves. They showed that the manufacturer will offer such incentive if the wholesale price is at most moderate depending on the private label concept.
Chen et al. (2011)	Studied the brand competition and investigated the role of internally producing the private label as a coordination mechanism. They showed that when the private label development costs are low enough, the whole supply chain benefits from the vertical supply of the private label instead of procuring the brand from a separate private label manufacturer.
Shen et al. (2014)	Studied the brand competition in the fashion industry and showed that the coordination is profitable for all parties if the costs of the sales effort are shared between the supplier and the retailer.
Amrouche and Yan (2015)	Investigated the values of the national brand's advertising and revenue sharing in the brand competition and revealed that when the private label is highly differentiated from the national brand, the national brand's revenue sharing is always a better strategy. Otherwise, the national brand's revenue sharing performs better only if the sharing percentage is high.
Mai et al. (2017)	Studied how to use three extended warranty contracts to coordinate the brand competition: 1/ the fixed fee as a wholesale price contract where the transferred revenue from the warranty is initially negotiated and independent from its price, 2/the proportional sharing as a revenue sharing contract where the transferred revenue from the warranty is proportional to its price, and 3/the manufacturer direct contract where the wholesale price equals the retail price and the transferred revenue from the warranty is collected totally by the manufacturer. They found that these three contracts all motivate the manufacturer to improve the store brand quality. The manufacturer direct is the best contract to be utilized to achieve the highest payoff for all parties.
Amrouche and Yan (2017)	Investigated the use of profit sharing as an effective mechanism to motivate the retailer in implementing a higher level of local advertising for brand competition. They showed that all parties can benefit from information asymmetry between the manufacturer and the retailer.
Li et al. (2021)	Studied capacity reservation contract and quantity flexibility contract impact on system profit compared to contracts with less flexibility when supply chain coordination is not achieved. When these two contracts are compared, the results demonstrate that it is in the retailer's interest to employ the quantity flexibility contract under coordination.
Shi and Geng (2021)	Investigated the effect of information accuracy about national brand sales on the retailer's decision to sell a store brand and how information sharing mitigates this effect. They showed that information accuracy and the introduction of store brand have a negative relationship even if there is an intensive brand competition.
Balasubramanian and Maruthasalam (2021)	Examined the substitution effect of retailer store brand and manufacturer encroachment and showed that the store brand's substitution effect can stop the manufacturer encroachment; the

(*continued on next page*)

Table 3 (*continued*)

References	Research issues addressed
	coexistence of store brand and manufacturer encroachment can create a Pareto situation for all parties which include the manufacturer, the retailer, and the consumers.

previous literature, and the rationale is that the retailer negotiates a long-term contract with the SB's manufacturer allowing the retailer to get the SB at very good deals (e.g., Cotterill and Putsis, 2001). We assume that the NB has a higher quality than the SB. While q is the quality of the NB (positive parameter), $q_S = gq$ is the quality of the SB where $0 < g < 1$ refers to the relative quality level of the SB compared to the NB (excluding the super-premium private labels). The manufacturer will gain a profit M while selling a demand d_2 for his NB. The retailer will gain the profit R while selling the demands d_1 for his SB and d_2 for the NB. The manufacturer decides on the wholesale price w and then the retailer decides on the retail price p_1 for his SB and p_2 for the NB. We also assume that consumers purchase only one brand. Table 4 summarize all the symbols that will be used throughout the paper for the different models.

We configure the interplay between the manufacturer and the traditional retailer into six scenarios. We develop a benchmark scenario where the retailer sells simultaneously the NB and the SB, and each supply chain player decides solely about his prices (wholesale price at the manufacturer level and retail prices at the retailer level) without implementing any strategies. Then, we examine the implications of various strategies (different MIR options as a promotional strategy and the branding coordination) on the decisions and performances of the retailer and the manufacturer. We investigate an array of scenarios implying the use of a single MIR program for the NB. Then we extend our model to a competition of MIR programs (one for the NB and one for the SB) depending on who bears the costs of those programs. We summarize the optimal strategies and profits for all scenarios in Appendices 2-3 and present graphically all scenarios in Fig. 1:

- S1: Benchmark competition between the national brand and the store brand based on pricing decisions without any additional strategies.
- S2: Brand competition with the manufacturer paying fully the NB's MIR.
- S3: Brand competition with the retailer paying fully the NB's MIR.

Table 4
Summary of symbols in the models.

Symbols	Interpretation	Type
q_s	SB product quality	Parameter
q	NB product quality	Parameter
g	The quality differential between the NB and the SB	Parameter
Q	The number of consumers redeeming the offered mail-in-rebate (MIR)	Parameter
d_1	SB demand	Function
d_2	NB demand	Function
p_1	SB price	Decision variable
p_2	NB price	Decision variable
w	Wholesale price	Decision variable
u	The offered MIR amount	Decision variable
f	The MIR redemption ratio given the offered MIR (e.g., 200customers/5$ MIR amount)	Parameter
t	The percentage of shared MIR cost	Decision variable
e	The shared profit from the retailer	Function
M	The manufacturer's profit	Function
R	The retailer's profit	Function
T	The whole supply chain profit	Function

- S4: Brand competition with the manufacturer and the retailer sharing the NB's MIR costs.
- S5: Brand competition with the use of the branding coordination.
- S6: Brand competition combining scenarios S5 and S3.

3.1. Scenario 1: the benchmark scenario

To explore the effectiveness of using promotional and coordination strategies, we start with a benchmark scenario where only pricing decisions are made. This scenario is a reference scenario to any additional strategy that might be used by supply chain players. Structurally, the manufacturer offers his NB via a distinct traditional retailer to consumers and seeks to maximize his profit. The retailer also sells his SB along with the NB to consumers in order to provide variety of choices on his shelves and seeks to maximize his category profit. Hence, both players are seeking their individual interests disregarding the benefit for the whole supply chain.

The retail price of the NB is p_2 and its quality is assumed to be q. The retail price of the SB is p_1 and its quality is q_s where $q_S = gq$ and g represents the quality differential between the NB and the SB (where $0 < g < 1$). We note v the brand valuation of the NB. For analytic simplicity, we assume that v is uniformly distributed from 0 to 1 (as assumed in Chiang et al., 2003). As a result, the valuation of SB is vq_S and the valuation for the NB is vq thus we have the consumer surplus for each brand as follows: $U_S = vq_S - p_1$ and $U_N = vq - p_2$. Hence, a consumer utility is the result of a tradeoff between quality valuation and the cost paid to acquire the brand (i.e., $vq - p_2$ versus$vq_S - p_1$) when consumers make their purchase decision. We focus on the case where there is co-existence of both brands. Hence, let d_2 and d_1 denote the demands of the NB and SB respectively, we obtain the following demand functions (see Appendix 1 in supporting information for details):

$$d_1 = \frac{p_2 - p_1}{(1-g)q} - \frac{p_1}{gq} \quad \text{and} \quad d_2 = 1 - \frac{p_2 - p_1}{(1-g)q}$$

According to Moorthy (1984), Banker et al. (1998), and Chen et al. (2015), the quality-related cost has a quadratic function $\frac{q^2}{2}$. As a result, the profit functions can be written as follows:

$$M = \left(w - \frac{q^2}{2}\right) d_2 \quad \text{and} \quad R = (p_2 - w)d_2 + \left(p_1 - \frac{(gq)^2}{2}\right) d_1$$

where, M and R are defined respectively as the manufacturer's profit and the retailer's profit. For simplicity, we assume from now on that the quality q is normalized to 1.

The sequence of events is that the manufacturer is the leader to decide the wholesale price. Then, the retailer is the follower to decide the national and store brand prices. As a result, the optimal strategies for both players in this benchmark scenario are:

$$w = \frac{3 - g}{4},\ p_1 = \frac{3g}{4},\ \text{and}\ \ p_2 = \frac{7 - g}{8}$$

Inserting these optimal strategies into the profit functions, we obtain the optimal profits that both players could generate: $M = \frac{1-g}{32}$ and. R $= \frac{1+3g}{64}$

In each of the following subsections, we add to the benchmark scenario a new feature in the model to single out the effect of the new addition compared to the reference scenario. A comparative analysis is then performed across scenarios.

3.2. Single MIR program for the NB

3.2.1. Scenario 2: the manufacturer paying the MIR for the NB

In this scenario, the manufacturer offers a mail-in-rebate (MIR) program for consumers who purchase his NB. The promotional strategy

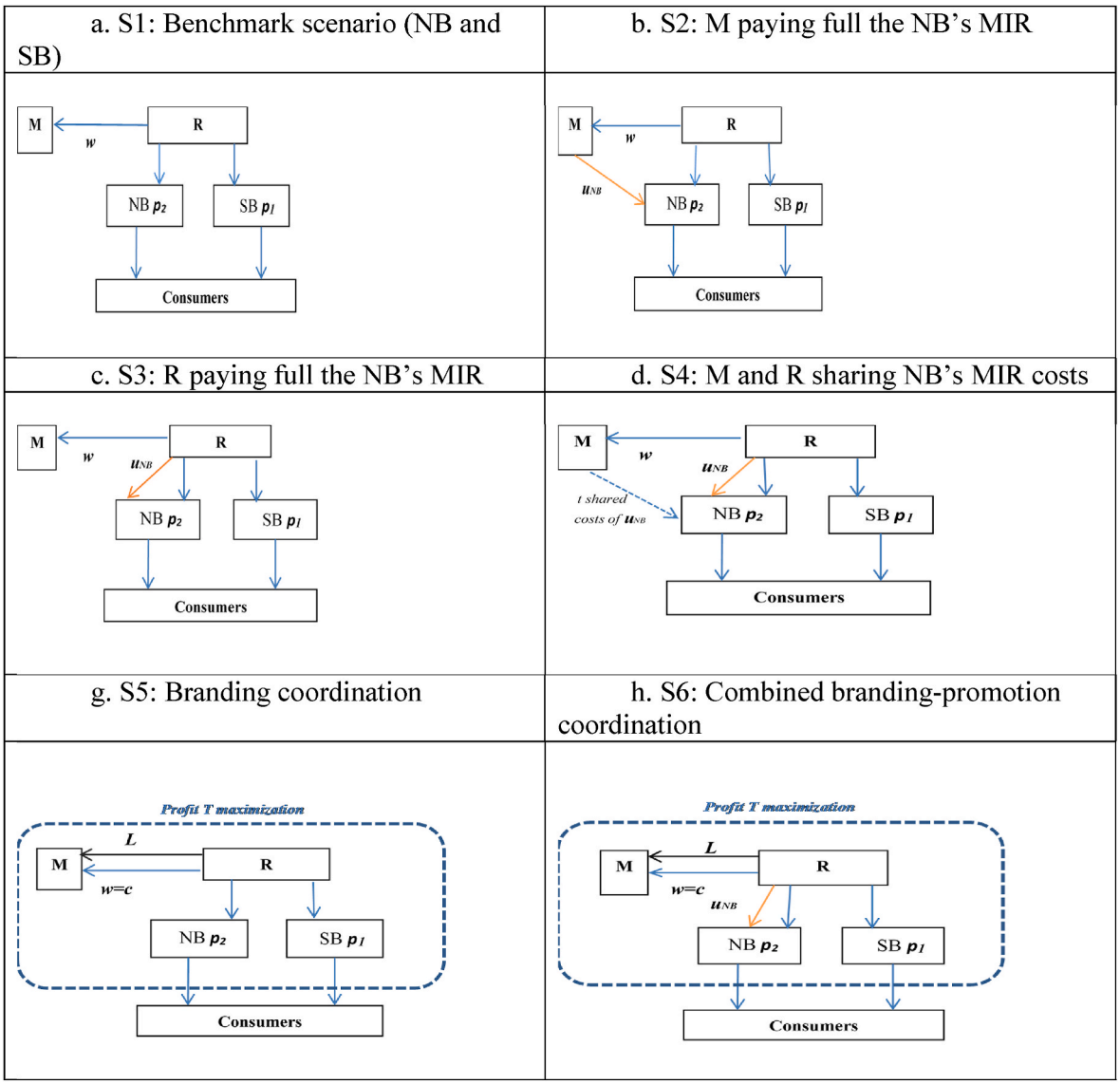

Fig. 1. Graphical summary of all scenarios.

is intended to attract more sales for his brand which is expected to incite the retailer to increase his inventory in that brand. When the mail-in rebate is offered, the consumers have the full information about the product full price and the rebate amount. As a result, the consumers have a good motivation to buy the product in order to benefit from the offered rebate. Thus, the NB's consumers perceive a new utility for the NB as $q - p_2 - u$ where u represents the amount of the MIR that they perceive as a gain when purchasing the NB. The utility for the SB remains the same as in the benchmark scenario and is $gq - p_1$.

Greenman (1999) showed that manufacturers have high motivation using rebates because they attract consumers into the stores, however, only a proportion of consumers will redeem the rebates due to various reasons. Lanctot (2002) further demonstrated that rebates are popular because they can be used to differentiate between consumers (users versus nonusers). As a result, not all consumers will redeem their MIR due to many reasons (e.g., forgetting to redeem the rebate, the time and effort needed to reclaim the MIR, missed due dates, lost mails, missed documents, the complexity to do it, etc.). However, larger rebate amounts motive more consumers to redeem (Silk, 2005).

For tractability reason, we assume that the total number of consumers redeeming the rebates Q is modeled as $Q = fu$ where f is the redemption ratio (for example 200customers/5$ MIR amount) and u is the offered rebate amount. This assumption means that the redemption ratio is an exogenous parameter. In other words, this parameter is given by the retailer.

In this scenario, the M supports fully the MIR costs, and these costs consist of Qu. Hence, we obtain:

$$d_1 = \frac{p_2 - p_1 - u}{1-g} - \frac{p_1}{g},\ d_2 = 1 - \frac{p_2 - p_1 - u}{1-g},\ \text{and}\ \ Q = fu$$

$$M = \left(w - \frac{1}{2}\right)d_2 - Qu \ \text{ and } \ R = (p_2 - w)d_2 + \left(p_1 - \frac{g^2}{2}\right)d_1$$

The sequence of events is that the manufacturer is the leader to decide the wholesale price and the amount of MIR. Then, the retailer is the follower to decide the national and store brand prices. The optimal strategies are summarized in Table 6 of the Appendix. The optimal profits for both players in this scenario 2 are:

$$M = -\frac{f(1-g)^2}{4(1+8f(-1+g))} \ \text{ and } \ R = \frac{g+16f(-1+g)g+16f^2(-1+g)^2(1+3g)}{16(1+8f(-1+g))^2}$$

We compare scenarios by performing simulations. We vary the parameters levels g and f in the interval [0; 1]. We consider the parameters low for any level between [0; 0.4], moderate between [0.5; 0.7], and

high [0.8; 0.9]. Then, we perform pairwise comparison of profits between each two scenarios by verifying the conditions of positivity for the demands, strategies and profits, in addition to the upper-level limit for all strategies (not higher than 1). We have the following proposition below.

PROPOSITION 1. Compared to the benchmark scenario, a NB's MIR paid by the manufacturer helps all supply chain players achieve higher profits for low and moderate level of quality *differential g and for moderate to high levels of redemption ratio f. That means,* $M^{(S2)} > M^{(S1)}$ *and* $R^{(S2)} > R^{(S1)}$.

Consistent with the majority of the practitioners' perceptions (i.e. 62% of surveyed practitioners don't think that MIRs intensify brand competition), PROPOSITION 1 shows that when the manufacturer pays fully the NB's MIR as an incentive strategy, he is successful in boosting the sales to a level exceeding all costs (i.e., the cost of the MIR and the loss from price reduction) as long as the SB and the NB are positioned closely in terms of quality and a decent number of consumers are redeeming their MIR per offer. Moreover, the derivatives of the optimal profits $\frac{\partial M}{\partial g} = -\frac{1}{32}$ and $\frac{\partial R}{\partial g} = \frac{3}{64}$ show that the SB's relative quality influences the manufacturer's profit negatively and the retailer's profit positively. Thus, the SB quality is still considered a threat for the manufacturer and a higher SB quality could induce a downward pressure on the manufacturer's performance. The NB's MIR program is not powerful enough to counter such threat.

3.2.2. Scenario 3: the retailer paying the MIR for the NB

In this scenario, the retailer offers MIR for consumers who purchase the NB and this MIR is fully covered by the retailer. By paying the NB's rebate, the retailer has total control on the NB in his store in terms of shelf-space management, retail pricing, and promotional program for the NB. We use the same demands as in scenario 2 and then the profit functions become:

$$M = \left(w - \frac{1}{2}\right)d_2 \quad \text{and} \quad R = (p_2 - w)d_2 + \left(p_1 - \frac{g^2}{2}\right)d_1 - Qu$$

The sequence of events is that the manufacturer is the leader to decide the wholesale price. Then, the retailer is the follower to decide the national and store brand prices and the amount of MIR. The optimal strategies are summarized in Table 6 of the Appendix. The optimal profits for both players in this scenario 3 are:

$$M = -\frac{f(1-g)^2}{4(2+8f(-1+g))} \quad \text{and} \quad R = \frac{g + f(-1-2g+3g^2)}{16(1+4f(-1+g))}$$

scenario and the benchmark scenario, we find that both players always benefit from the MIR paid by the retailer and get higher payoffs compared to the benchmark scenario as long as the NB and the SB are closely positioned in terms of quality and there is a decent number of consumers redeeming their MIR per offer, which validates the majority of practitioners' perceptions (i.e., MIRs would not intensify brand competition). Hence, the retailer's payment of the NB's MIR program is another agreement option for the supply chain in order to boost the overall and the individual performances. Moreover, both players are enjoying even higher payoffs compared to scenario 2 when the manufacturer was supporting the cost of the MIR program under the same conditions (close positioning of NB and SB in terms of quality and decent ratio of MIR redemption). The result highlights the importance and benefits for the retailer to take over the control of all decisions related to the brands' management in his store even if he has to bear the full costs of the NB's promotional decisions. Ultimately, the result is Pareto improving and the strategy enhances the profitability leverage for all supply chain players. However, a sensitivity analysis of the manufacturer's profit shows again the continuous threat of the SB quality negatively affecting this profit and working in the opposite direction than the MIR program. To offset such controversial effects, we investigate as a next step the possibility for both players (the manufacturer and the retailer) to settle for a sharing cost of the promotional program. By doing so, the manufacturer and the retailer are hoping to achieve an ideal bargaining solution that not only boost the performances to higher levels but also cancel the negative effect of SB quality on the manufacturer's profit.

3.2.3. Scenario 4: sharing the costs of the MIR for the NB

In this scenario, the manufacturer and the retailer decide to share the cost of the MIR promotional program for the NB. Usually, in previous game-theoretic papers, costs sharing such as cooperative advertising and local promotions has been shown to be efficient for the supply chain and is a Pareto improving (e.g., Huang et al., 2002; Yan, 2010). We have the same demand functions as in scenario 2, and then the profit functions can be written as (where t represents the shared proportion of the MIR costs): $M = \left(w - \frac{1}{2}\right)d_2 - tQu$ and. $R = (p_2 - w)d_2 + \left(p_1 - \frac{g^2}{2}\right)d_1 - (1-t)Qu$

The sequence of events is that the manufacturer is the leader to decide the wholesale price and the shared portion of the MIR. Then, the retailer is the follower to decide the national and store brand prices. The optimal strategies are summarized in Table 6 of the Appendix. The optimal profits for both players in this scenario 4 are:

$$M = -\frac{f(1-g)^2}{9+32f(-1+g)} \quad \text{and} \quad R = \frac{81g + 256f^2(1-g)^2(1+3g) + 96f(-1-4g+5g^2)}{16(9+32f(-1+g))^2}$$

PROPOSITION 2. *We obtain two important results for low quality differential g and for moderate to high levels of redemption ratio f:*

(1) Compared to the benchmark scenario, a NB's MIR paid by the retailer helps all supply chain players achieve higher profits. That means, $M^{(S3)} > M^{(S1)}$ *and* $R^{(S3)} > R^{(S1)}$;
(2) Compared to the scenario where the manufacturer pays fully for the NB's MIR, a NB's MIR paid by the retailer helps all supply chain players achieve higher profits. That means, $M^{(S3)} > M^{(S2)}$ *and* $R^{(S3)} > R^{(S2)}$.

PROPOSITION 2 reveals that comparing the profits between this

PROPOSITION 3. *We obtain the following important results for low quality differential g and for moderate to high levels of redemption ratio f:*

(1) Compared to the benchmark scenario, the profits of the manufacturer and the whole supply chain in the scenario of NB's MIR shared costs are higher, although the retailer's profit in the latter scenario is lower. That means, $M^{(S4)} > M^{(S1)}$ *and* $R^{(S4)} > R^{(S1)}$ *and* $T^{(S4)} > T^{(S1)}$;
(2) *Compared to the scenario where the* manufacturer pays fully for the NB's MIR, the profits of the manufacturer and the whole supply chain in the scenario of shared costs are higher, although the

retailer's profit in the latter scenario is lower. That means, $M^{(S4)} > M^{(S2)}$ *and* $R^{(S4)} < R^{(S2)}$ *and* $T^{(S4)} > T^{(S2)}$.

(3) Compared to the scenario where the retailer pays fully for the NB's MIR, the profits of the manufacturer and the whole supply chain in the scenario of shared costs are lower, although the retailer's profit in the latter scenario is higher. That means, $M^{(S4)} > M^{(S3)}$ *and* $T^{(S4)} < T^{(S3)}$.

Sharing the costs of NB's MIR program is plausible only when the NB is closely positioned to the SB in terms of quality, and when there is a high redemption ratio. Under those conditions, sharing the cost of the NB's MIR program is better for the manufacturer compared to his full support for the program and compared to the retailer full support. However, the cost sharing is not considered the best coordination scheme for the supply chain in the context of brand competition because the full support of the retailer leads to much higher payoffs for both players in terms of supply chain profit. The cost sharing of promotional programs (such as cooperative advertising) has been proven effective in previous literature to coordinate the channel distributions in the context of brand competition under specific circumstances (e.g., Karray and Zaccour, 2006). While we find that sharing the NB's MIR program costs leads to higher supply chain profits compared to the benchmark scenario and to scenario 2, it is not the best mechanism option because scenario 3 outweighs it in terms of whole supply chain profit. As a result, the cost sharing of the promotional program is not a guarantee for a better profitability when the SB competes against the NB. The specific case of using MIR program denotes a different picture than cooperative advertising, which is contrary to most practitioners' preconceptions (i.e., 62% of respondents prefer to share the costs of the offered MIRs). Our research provides new insights to practitioners and sheds light on the specificity of brand competition context.

3.2.4. Scenario 5: the usage of pricing coordination mechanism (case of branding coordination)

As the SB threat is still imminent on the manufacturer's profit, the latter is inclined to use a pricing contract that could eliminate completely the sensitivity of his profit to the parameters controlled by the retailer such as the SB quality and the redemption ratio. Here, we investigate what we newly call "branding coordination" as a strategy to coordinate the brand competition between the retailer's SB and the manufacturer's NB. In this scenario, the manufacturer decides to use the branding coordination strategy by offering the lowest wholesale price to the retailer and requesting, in return, that the retailer shares a portion of his profit e with him. To maximize his profit, the manufacturer sets up the wholesale price to maximize the supply chain profit instead of his own profit (i.e., when the whole supply chain profit is maximized, the retailer can share a larger portion of its profit with the manufacturer), but the retailer sets the retail prices to maximize his own profit. There is no MIR program for any of the brands in this scenario in order to isolate the effect of the pricing contract. We have the same demand functions as in scenario 1 and thus the profit functions become:

$$M = \left(w - \frac{1}{2}\right)d_2 + e(p_2 - w)d_2 \quad \text{and} \quad R = (1-e)(p_2 - w)d_2 + \left(p_1 - \frac{g^2}{2}\right)d_1$$

The sequence of events is that the manufacturer is the leader to decide the wholesale price to maximize the whole supply chain profit. Then, the retailer decides the national and store brand prices to maximize his own profit. The manufacturer and the retailer like to implement the branding coordination strategy only if the profits of both players (the manufacturer and the retailer) are higher than those of scenario 1. Thus, to maximize their respective profits, both players split the increased profit equally since no party would accept less profit. As a result, the optimal strategies are summarized in Table 6 of the Appendix. The optimal profits for both players in this scenario 5 are:

$$M = \frac{5(1-g)}{128} \quad \text{and} \quad R = \frac{3+5g}{128}$$

PROPOSITION 4. We obtain the following important results:

(1) Compared to the benchmark scenario, the profits of all parties are higher for any level of parameters. That means, $M^{(S5)} > M^{(S1)}$ and $R^{(S5)} > R^{(S1)}$ and $T^{(S5)} > T^{(S1)}$;

(2) Compared to the scenario where the retailer pays fully for the NB's MIR, the profits of all parties in the branding coordination scenario are lower for low quality differential g and for moderate to high levels of redemption ratio f. That means, $M^{(S5)} < M^{(S3)}$ and $T^{(S5)} < T^{(S3)}$.

There are two important findings in this scenario:

1/The demand for the SB is equal to 0 no matter what are the levels of the parameters, and this means that when a branding coordination is offered, the manufacturer is trying to use a minimal wholesale price to push the SB out of the market. In other words, the manufacturer is trying to use the lowest wholesale price to induce the retailer to give up the sales of SB. This result provides valuable insights for practitioners since 42.9% of respondents don't think that branding coordination is the solution for brand competition while only 28.6% believe it is helpful to reduce conflicts, and 28.6% are unsure.

2/Using the branding coordination is not the best coordination mechanism when the SB competes against the NB because scenario 3 is still better for the total payoff when there is close quality differential positioning of both brands and when there is a decent ratio of MIR redemption. While the whole supply chain profit is better than the benchmark scenario for any levels of parameters, it is lower than the one in scenario 3 for specific instances. Hence, the full support of the retailer seems to be a better alternative for the whole supply chain specifically when the NB and the SB have close quality differential positioning and a decent number of consumers redeem their NB's MIR. This full support of the retailer boosts the supply chain surplus at higher levels and alleviates the brand competition. This result provides new managerial insights to practitioners given that 47.6% of respondents agree with the statement that branding coordination is better than MIRs for competing brands while 33.3% are unsure.

Though the result about the SB demand seems counterintuitive, there is a managerial explanation to the manufacturer's behavior. The manufacturer uses the branding coordination as an incentive to reduce his wholesale price and to monitor the retail prices. In addition, he forces the retailer to sacrifice the SB sales in order to maximize the whole supply chain profit (compared to the benchmark scenario). However, our findings state that the branding coordination is not the best option to coordinate the brand competition. There is another alternative (full payment of the retailer for the NB's MIR program) that could better coordinate the brand competition and boost the supply chain profit at higher levels. The rationale to this result is twofold. First, the retailer will never accept to expose his SB just as a visibility tool to bring customers in the store while he will be selling only the NB. Second, the retailer will rather prefer to totally control the promotional strategy rather than sacrificing his own SB.

Our research shows that although the branding coordination helps coordinate the brand competition, it is less efficient as coordination mechanism compared to the retailer's full payment of the MIR depending on the quality differential positioning and the redemption ratio. Hence, the branding coordination is not the optimal mechanism to coordinate a supply chain composed of two brands in the setting of one manufacturer-retailer channel and when MIR is used for the NB. We demonstrate that there is another option leading to better payoffs for specific instances.

Knowing the continuous predominance of scenario 3 over all

previous scenarios in terms of supply chain payoff, in the next subsection, we explore the effect of the combined branding-promotion coordination (MIR program for the NB paid fully by the retailer combined with branding coordination). Each of these strategies has specific influences on the game behavior. While the branding coordination successfully counters the threat of the SB, it does not lead to higher profitability of the whole supply chain. At the opposite end, the retailer's control over the NB's MIR program does not undermine the threat of the SB completely but provides higher possible total payoff. A complex interaction between these two strategies will be key to examine next.

3.2.5. Scenario 6: the usage of the combined branding-promotion coordination

In this scenario, the manufacturer uses the branding coordination strategy to coordinate the brand competition and, simultaneously, the retailer pays fully for the NB's MIRs. We investigate in this scenario the combination of these two strategies. We have the same demand functions as in scenario 2 and thus the profit functions become:

$$M = \left(w - \frac{1}{2}\right)d_2 + e(p_2 - w)d_2 \quad \text{and} \quad R = (1-e)(p_2 - w)d_2 + \left(p_1 - \frac{g^2}{2}\right)d_1 - Qu$$

The optimal strategies are summarized in Table 6 of the Appendix. The optimal profits for both players in this scenario 6 are:

$$M = \frac{1 - 5g - 20f(1-g)^2}{128(1 + 4f(-1+g))} \quad \text{and} \quad R = \frac{5g - 1 - 4f(3 + 2g - 5g^2)}{128(1 + 4f(-1+g))}$$

PROPOSITION 5. We obtain the following important results:

(1) Compared to the benchmark scenario, the profits of all parties are higher for any parameter. That means, $M^{(S6)} > M^{(S1)}$ and $R^{(S6)} > R^{(S1)}$ and $T^{(S6)} > T^{(S1)}$;
(2) Compared to the scenario where the retailer pays fully for the NB's MIR, the profits of all parties are higher for low quality differential g and for moderate to high levels of redemption ratio f. That means, $M^{(S6)} > M^{(S3)}$ and $R^{(S6)} > R^{(S3)}$ and $T^{(S6)} > T^{(S3)}$.

Similar to using the branding coordination strategy alone, this double mechanism is again helping the manufacturer to control the retailer in terms of pricing and SB's demand by keeping the retail prices at levels that neutralize the SB's demand in order to boost the whole supply chain profit. It is also clear that using the combined branding coordination with the full support of the retailer to the NB's MIR program is the best coordination mechanism for this branding context. It is leading to higher supply chain profit compared to the benchmark scenario in addition to generating better total payoff compared to scenario 3 for close quality differential positioning between the national and store brands and for a decent number of consumers redeeming their MIR per offer. In other words, the difference between scenario 5 and 6 is that the addition of a second mechanism to the branding coordination augments and leverages the profit-return power of the supply chain. While the branding coordination alone can only enhance the supply chain profit compared to no coordination (i.e., the benchmark scenario), the addition of the full payment of the retailer for the NB's MIR program boosts the supply chain profit even higher than scenario 3 and provides a surplus to be shared fairly between both players. This result validates the perceptions of most practitioners given that 81% respondents believe that combining both tools (branding coordination with MIRs) is effective to improve profitability for each party (the manufacturer and the retailer).

In the business market, it is intuitive that offering a variety of brands to consumers seems to be a successful strategy. However, our results in scenarios 5 and 6 provide a new insight suggesting that offering a variety of brands on the shelf, while mainly selling only one brand, may be a better strategy to achieve higher profits. Doing so would become a category management issue for the retailer and a tradeoff must be made between Option 1: selling both brands and having total control over the promotional program or Option 2: using his SB as a visibility tool only by adding the branding coordination and getting a higher profitability.

In both scenarios 5 and 6, the manufacturer would like to use the lowest wholesale price to induce the retailer to give up the SB sales or minimize the SB sales, thus, the NB could still remain the dominant brand in the market. By doing so, the retailer has a good motivation to invest in the NB's MIR in order to increase the sales for that brand and, ultimately, obtain higher profits for each supply chain player. From a retailer side, he needs to use the SB as a negotiating tool (by using the SB mainly for visibility and reducing its sales to minimal levels) in order to put pressure on the manufacturer and to keep seeking efficient coordination mechanisms. The purpose of the manufacturer and the retailer's negotiations become then to alleviate the brand competition via profit concession and wholesale price compromise. If the manufacturer is not receptive to the idea of concession and compromise, the SB's sales and the SB's quality level become a threat and could imply stealing market share from the NB. Consequently, the competitive environment could push the NB out of the market to the disfavor of the manufacturer.

4. Managerial discussions

A number of retailers are selling their SBs in order to compete with manufacturers' NBs. Retailers sell their own brands in order to offer more brand variety for consumers on their shelves, to put more pressure on manufacturers and push them to reduce their wholesale price, to gain more incremental sales, to increase their power as a bigger retailer format, among other reasons. Following such practice, conflicts between the manufacturers and the retailers intensify. Previous studies proposed a number of counterstrategies for the manufacturers and some cooperative mechanisms in order to reach a Pareto situation in the context of brand competition.

In our paper, we first propose two coordination approaches widely used in practice namely the support of the promotional MIR cost (various promotional strategies depending on who supports the cost) and a pricing contract customized to brand competition called "branding coordination". We then examine the novel coordination mechanism "combined branding-promotion coordination". None of these schemes have been studied for the specific context of brand competition in the extant literature. We summarize our results in Table 5.

Hence, we offer a list of valuable managerial insights:

- Although the manufacturer's full investment in the MIR program for the NB is a feasible way to counter the threat of the SB, it seems to be beneficial not only to the manufacturer but also to the retailer if the SB and the NB are positioned closely in terms of quality and a decent number of consumers are redeeming their MIR per offer. The manufacturer's investment boosts the profits of all supply chain players compared to the scenario where no promotional programs have been implemented.
- Our analysis suggests that it is better to have the retailer invest fully in the MIR program of the NB rather than to have the manufacturer invest fully in this promotional strategy when there is close positioning of NB and SB's quality and a decent ratio of MIR redemption. Indeed, both supply chain parties get higher payoffs when the retailer has total control over both brands in his store by, not only managing the retail pricing and placing the brands over the shelves, but also by fully promoting the NB via the MIR program. This could explain the refrain of some manufacturers from countering the SB. They rather accept the retailer's control over many decisions related to his category management practices.
- Promotional cost sharing has been shown in previous studies to be a beneficial incentive scheme to coordinate the supply chain including the case of brand competition. Our study demonstrates that it is also

Table 5
Summary of profits' results for promotional and coordination strategies[a].

Type of Profit	Promotional strategy	Coordination strategy	Combination of promotional and coordination strategies
***M* profit**	$M^{(S1)} < \boldsymbol{M}^{(S2)} < \boldsymbol{M}^{(S3)} < \boldsymbol{M}^{(S4)}$	$\boldsymbol{M}^{(S5)} < M^{(S1)} < M^{(S3)}$	$\boldsymbol{M}^{(S6)} < M^{(S1)} < M^{(S3)}$
***R* profit**	$R^{(S1)} < \boldsymbol{R}^{(S4)} < \boldsymbol{R}^{(S2)} < \boldsymbol{R}^{(S3)}$	$R^{(S1)} < R^{(S3)} < \boldsymbol{R}^{(S5)}$	$R^{(S1)} < R^{(S3)} < \boldsymbol{R}^{(S6)}$
***T* profit**	$T^{(S1)} < \boldsymbol{T}^{(S2)} < \boldsymbol{T}^{(S4)} < \boldsymbol{T}^{(S3)}$	$T^{(S1)} < \boldsymbol{T}^{(S5)} < T^{(S3)}$	$T^{(S1)} < T^{(S3)} < \boldsymbol{T}^{(S6)}$

[a] The corresponding strategies are highlighted in bold.

the case when the NB's MIR is offered in such a competition context when there is close positioning of NB and SB in terms of quality and when there is a decent ratio of MIR redemption. However, this cost sharing is outweighed by the retailer's full payment for the NB's MIR program because it provides higher total payoffs. Hence, we advise retailers and manufacturers to avoid such MIR program sharing when they compete head to head with their respective brands, and rather opt for retailer's total control over that specific promotional decision.

- Our research shows that although the branding coordination helps coordinate the brand competition for any level of parameters, it is less powerful as a coordination mechanism compared to the full investment of the retailer in the NB's MIR program under the following conditions: when there is close quality positioning of both brands and when there is a decent ratio of MIR redemption. Thus, we propose a novel cooperation mechanism by combining the branding coordination with a promotional strategy (the full retailer's investment in the NB's MIR program). We find that all supply chain parties have higher payoffs when they apply this interactive coordination because they could share fairly the excess of the whole supply chain surplus. This surplus is higher compared to scenario 3 for close quality positioning and moderate or high redemption ratio. However, it is up to the retailer to make a tradeoff between controlling fully the promotional program of the NB (scenario 3) or using his SB as a visibility tool and adding the branding coordination in order to gain a higher profit (scenario 6).
- Using the branding coordination alone or combining it with the full retailer's payment of the NB's MIR program is not only used as a coordination mechanism but also as a monitoring system for the manufacturer. In other words, the manufacturer utilizes this mechanism in order to control the retail prices and the SB's demand with the ultimate goal of boosting the whole supply chain profit.

5. Conclusions

To conclude, this paper investigates the benefit of some incentive mechanisms in order to coordinate a supply chain composed of one manufacturer and one retailer. The latter sells his SB along with the NB which makes him not only the carrier of the NB but also his direct competitor. Such context requires optimal coordination mechanisms in order to alleviate the supply chain conflict and maximize the payoffs for all parties.

Specifically, we first examine the role of the MIR programs and the branding coordination in reducing such competition and solving the conflict issue. To our surprise, none of these widely used schemes (i.e., promotional cost sharing and branding coordination) seems to be the optimal coordination solution to the issue. Hence, we initiate a new mechanism called "combined branding-promotion coordination" which is the branding coordination combined with the retailer full support for the NB's MIR program, in order to mitigate the brand competition and boost the whole supply chain performance. Our result highlights the complexity of the bargaining power between both players when various factors are considered. While the total control of the NB's promotional program gives the retailer an edge over the manufacturer, the latter will monitor all pricing decisions (the wholesale price and the retail prices) via the branding coordination to maximize the total payoff. But such control could lead to the neutralization of the SB's demand. Hence, a tradeoff between power control and profitability must lead to optimal decisions for both players.

A number of extensions could be done in future works. For instance, using a dynamic game rather than a static one to study the role of coordination mechanisms in the brand competition can yield interesting results. In addition, other pricing schemes (e.g., wholesale price discount) could be studied as an extension to this work. Another idea is to evaluate the benefit of discriminating between consumers in terms of MIR programs and having a variety of utility functions for each segment. Finally, a meta-analysis comparing various types of coordination mechanisms in the context of brand competition would be very beneficial and a great contribution to the research stream about NB and SB's competition. The literature is not well documented in the context of coordination schemes for specifically brand competition, and hence, a major research step will be to fulfill this role and close the gap.

Appendix 1. Proof of scenarios

Proof of the demands in scenario 1

The marginal valuation $v^N = \frac{p_2}{q}$ means that the consumer is indifferent to buy the NB. The marginal valuation $v^S = \frac{p_1}{q_s}$ means that the consumer is indifferent to buy the SB. The marginal valuation comparing the NB and the SB is $v^{NS} = \frac{p_2 - p_1}{(1-g)q}$ (the consumer is indifferent to buy the NB or the SB). When $v^S < v^N$ then we have $v^S < v^N < v^{NS}$ where $v^s = p_1/gq$ and $v^N = p_2/q$. We obtain: $p_2 > p_1/g$.

This implies $gp_2 > p_1$. We add p_2 to both sides, we have $(1-g)p_2 < p_2 - p_1$. We divide both sides by $1-g$ to obtain $p_2 < \frac{p_2 - p_1}{1-g}$. Because $v^{NS} = \frac{p_2 - p_1}{(1-g)q}$ and $v^N = p_2/q$, we obtain $v^{NS} > v^N$. Therefore, we have $v^S < v^N < v^{NS}$ when $v^N > v^S$.

Similarly, we can prove $v^N > v^{NS}$ when $v^S > v^N$. Hence, all consumers with marginal valuation in the interval $[v^S, v^{NS}]$ prefer to buy the SB and that leads to the demand function: $d1 = \frac{p2-p1}{(1-g)q} - \frac{p1}{qq}$.

All consumers with marginal valuation in the interval $[v^{NS}, 1]$ prefer to buy the NB and that leads to the demand function: $d2 = 1 - \frac{p2-p1}{(1-g)q}$.

We also have $v^S > v^N > v^{NS}$ when $v^N < v^S$ and, using the same reasoning leads to the demand functions $d1 = 0$ and $d2 = 1 - \frac{p2}{q}$. In other words, there is no brand competition with the store brand which is not the focus of our research. Therefore, we focus on the case where $v^S < v^N$ and we study the co-existence of both brands.

Proof of the optimal strategies in scenario 2

$$d_1 = \frac{p_2 - p_1 - u}{(1-g)q} - \frac{p_1}{g} \quad , \quad d_2 = 1 - \frac{p_2 - p_1 - u}{(1-g)} \quad , \quad Q = fu \quad , \quad M = \left(w - \frac{1}{2}\right) d_2 - Qu \quad ,$$

$$R = (p_2 - w)d_2 + \left(p_1 - \frac{g}{2}\right) d_1$$

We first examine if the retailer's profit function has a concave relationship with its retail prices about store and national brands, thus optimal results exist for the retailer. As a result, we obtain $\frac{\partial^2 R}{\partial p_1^2} < 0$ and $\frac{\partial^2 R}{\partial p_2^2} < 0$. Thus we prove that there is a concave relationship between the retailer's profit function and its retail prices. Then we obtain the values of p_1 andp_2. Next, substituting the values of p_1 andp_2 into$M$, we examine if the manufacturer's profit function has a concave relationship with its wholesale price and offered mail-in-rebate, respectively, thus optimal values do exist. As a result, we obtain $\frac{\partial^2 M}{\partial w^2} < 0$ and $\frac{\partial^2 M}{\partial u^2} < 0$. Thus the manufacturer's profit function is strictly concave with its decision variables and has unique maxima. Hence, equilibrium exists for optimal wholesale price and offered mail-in-rebate.

Proof of the optimal strategies in scenario 3

Following the similar proofs as in appendix 1, we determine the optimal reaction functions of the retailer (p_1 (w), p_2(w), u(w)) in terms of the wholesale price by maximizing the retailer's profit. Then, we solve for the manufacturer optimal wholesale price by maximizing his profit.

Proof of the optimal strategies in scenario 4

Following the similar proofs as in appendix 1, we determine the optimal reaction functions of the retailer (p_1 (w,t), p_2 (w,t), u (w,t)) in terms of the wholesale price and the shared proportion of the NB's MIR costs by maximizing the retailer's profit. Then, we solve for the manufacturer optimal wholesale price and shared percentage of NB's MIR costs by maximizing his profit.

Proof of the optimal strategies in scenario 5

Following the similar proofs as in appendix 1, we determine the optimal reaction functions of the retailer (p_1 (w), p_2(w)) in terms of the wholesale price by maximizing the retailer's profit. Then, we solve for the manufacturer optimal wholesale price by maximizing the whole supply chain profit. Then, the manufacturer and the retailer split the increased profit equally.

Proof of the optimal strategies in scenario 6

Following the similar proofs as in appendix 1, we determine the optimal reaction functions of the retailer (p_1 (w), p_2(w), u(w)) in terms of the wholesale price by maximizing the retailer's profit. Then, we solve for the manufacturer optimal wholesale price by maximizing the whole supply chain profit.

Proof of the retailer profit as function of p_2 in scenarios 5 and 6

Scenario 5: For $d_1 = 0$, we have $p_1 = g\,p_2$. We replace the retail price p_1 in d_2 and in the retailer profit R and after some computations, we obtain the corresponding results in Table 3.

Scenario 6: For $d_1 = 0$, we have $p_1 = g\,(p_2\text{-}u)$. We replace the retail price p_1 in d_2 and in the retailer profit R and after some computations, we obtain the corresponding results in Table 3.

Appendix 2

Table 6
The optimal strategies in each scenario

Scenario 1: Benchmark scenario	**Scenario 2:** MIR for NB paid fully by M	**Scenario 3:** MIR for NB paid fully by R
$w = \frac{3-g}{4}$ $p_1 = \frac{1+g}{4}$ $p_2 = \frac{7-g}{8}$	$w = \frac{-4f\,(-1+g)^2 + \frac{1}{2}(1+4f(-1+g)^2)}{1+8f\ (-1+g)}$ $u = \frac{g-1}{(2(1+8f\ (-1+g))}$ $p_1 = \frac{3g}{4}$ $p_2 = \frac{g - 4f(3-4g+g^2) + \frac{1}{2}(2-g+4f(-1+g^2))}{2(1+8f\ (-1+g))}$	$w = \frac{3-g}{4}$ $u = \frac{g-1}{2(2+8f\ (-1+g))}$ $p_1 = \frac{3g}{4}$ $p_2 = \frac{1-2f(3-4g+g^2) + \frac{1}{2}(1+2f(-1+g^2))}{2+8f\ (-1+g)}$
Scenario 4: Shared NB's MIR costs	**Scenario 5:** Branding coordination	**Scenario 6:** Combined branding-promotion coordination
$w = \frac{-(3+16f(-1+g))\left(-1+g+\frac{1}{2}(3(2+g)+16f(-1+g^2))\right)}{9+32f(-1+g)}$ $t = \frac{1}{3}$	$w = \frac{1}{2}$ $e = \frac{5(1-g)}{8}$	$w = \frac{1}{2}$ $p_1 = \frac{3g}{4}$

(*continued on next page*)

Table 6 (*continued*)

Scenario 1: Benchmark scenario	**Scenario 2:** MIR for NB paid fully by M	**Scenario 3:** MIR for NB paid fully by R
$p_1 = \frac{3g}{4}$ $p_2 = \frac{3(2+g) - 16f(3-4g+g^2) + \frac{1}{2}\left(-3(-4+g) + 16f(-1+g^2)\right)}{18 + 64f(-1+g)}$	$p_1 = \frac{3}{4}$ $p_2 = \frac{3g}{4}$	$e = \frac{3 + 4f(1-g)^2 + g}{128(4f(1-g) - 1)}$ $p_2 = \frac{1 + 6f(-1+g) + g - \frac{g}{2}}{2 + 8f(-1+g)}$ $u = \frac{g-1}{2(1+4f(-1+g))}$

Appendix 3

Table 7
The optimal profits in each scenario

Scenario 1: Benchmark scenario	**Scenario 2:** MIR for NB paid fully by M	**Scenario 3:** MIR for NB paid fully by R
$M = \frac{1-g}{32}$ $R = \frac{1+3g}{64}$	$M = -\frac{f(-1+g)^2}{4(1+8g(-1+g))}$ $R = \frac{64f^2(1+3g)) + (g+16f(-1+g)g}{16(1+8f(-1+g))^2}$	$M = -\frac{f(-1+g)^2}{4(2+8f(-1+g))}$ $R = \frac{g+f(-1-2g+3g^2)}{16(1+4f(-1+g))}$
Scenario 4: Shared NB's MIR costs	**Scenario 5:** Branding coordination	**Scenario 6:** Combined branding-promotion coordination
$M = -\frac{f(-1+g)^2}{9+32f(-1+g)}$ $R = \frac{81g + 256f^2(1-g)^2(1+3g) + 96f(-1-4g+5g^2)}{16(9+32f(-1+g))^2}$	$M = \frac{5(1-g)}{128}$ $R = \frac{3+5g}{128}$	$M = \frac{1-5g-20f(1-g)^2}{128(1+4f(-1+g))}$ $R = \frac{5g-1-4f(3+2g-5g^2)}{128(1+4f(-1+g))}$

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