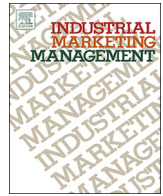




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Should leading brand manufacturers supply private label brands to retailers: Calibrating the trade-offs

Sandra J. Milberg^a, Andres Cuneo^{a,b,*}, Catherine Langlois^c

^a School of Business, Universidad Adolfo Ibañez, Diagonal Las Torres 2700, Santiago, Chile

^b Universitat Ramon Llull, ESADE, Av. Torre Blanca 59, Barcelona, Spain

^c McDonough School of Business, Georgetown University, 3700 O Street, N.W., Washington DC 20057, United States

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ABSTRACT

The consolidation of retailers across markets has considerably altered the competitive dynamics between leading brand manufacturers and retailers. The era in which brand manufacturers dictate the game to compliant retailers is long gone. Nowadays, with more equal negotiation power retailers are no longer just channel partners but rather business partners with whom to build business-to-business relationships. This has become apparent especially since retailers have developed their own private label brands (PLB) and actively seek brand manufacturers to supply them. For brand manufacturers supplying PLB may bring potential benefits but may also harm profits. Thus, this research investigates conditions under which a leading brand manufacturer would be better or worse off in terms of profitability producing PLB for retailers. Using a game theoretic model, we calibrate the trade-offs between the shelf space devoted by the retailer to the manufacturer brand and the amount of profit required from supplying the PLB necessary to counteract cannibalization and to generate profits for the manufacturer, under different levels of uncertainty regarding the availability of alternative suppliers. Calibrating these trade-offs provides brand manufacturers clear guidelines for negotiations with retailers regarding shelf space allocation and wholesale prices to be profitable supplying PLB.

1. Introduction

The growth and consolidation of retailers across a large number of countries has reshaped the retail scenario and significantly altered the competitive dynamics between retailers and brand manufacturers. For many years, retailers were spectators in a market dominated by powerful brand manufacturers. Retail fragmentation and media concentration contributed to brand manufacturer's growth (Kumar & Steenkamp, 2007). Today the situation has changed considerably. The process of consolidation of the retailing system has reinforced retailers' competitive position (AIM, 2016) leading to an increase in their bargaining power with brand manufacturers, enabling retailers to control a number of key business decisions related to logistics, marketing and sales (Pauwels & Srinivasan, 2004; terBraak, Deleersnyder, Geyskens, & Dekimpe, 2013). For example, retailers strongly influence decisions about product assortments, shelf space allocation, shelf positioning, and the number and typologies of brands to be offered. This consolidation represents an important shift in the relationship between brand manufacturers and retailers (Sutton-Brady, Taylor, & Kamvounias, 2017). Retailers are no longer channel partners but rather business partners

with whom to build business-to-business relationships.

A key consequence from the consolidation of retailers is the development of their own brands. Relying on their bargaining power and scale, retailers have successfully developed private label brands (PLB) as a core strategy (Kim, Jung, & Park, 2015), becoming direct competitors to manufacturer brands (Pauwels & Srinivasan, 2004). The level and extent of PLB penetration across countries, industries and product categories presents a significant challenge to brand manufacturers. Specifically, they are present in more than 90% of consumer-packaged goods categories (Euromonitor, 2010; terBraak, Deleersnyder, et al., 2013). Market shares in the United States and across Europe have reached on average 16.7% (Nielsen, 2018) and 17.1%, (IRI, 2016), respectively, but enjoy higher shares in countries such as Spain (52%), Switzerland (50%), UK (46%), Germany (45%) and France (32%) (PLMA, 2017).

It is important to note that the penetration of retailer PLB in many other markets is significantly lower, for example in Latin America: Argentina (5.1%), Brazil (0.9%), Chile (6.3%), Mexico (2.4%), in Eastern Europe: Russia (4.7%), Serbia (5.1%), Ukraine (1.3%) and, in Asia Pacific: China (0.2%), Malaysia (2.0%), Vietnam (0.6%), Taiwan

* Corresponding author at: Universitat Ramon Llull, ESADE, Av. Torre Blanca 59, Barcelona, Spain.

E-mail addresses: sandra.milberg@uai.cl (S.J. Milberg), andres.cuneo@esade.edu (A. Cuneo), langlois@georgetown.edu (C. Langlois).

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(2.1) (Europanel, 2016). In part, this may be explained by country-level factors in these markets that create barriers to the growth of PLB (Cuneo, Milberg, Benavente, & Palacios-Fenech, 2015). For example, in numerous markets there is generally a lack of reliable and good quality suppliers to produce PLB (Deloitte, 2015).

The issue of the availability of reliable suppliers who can provide high quality PLB has become more germane and significant as retailers are increasingly offering premium, high quality products, creating more complex PLB portfolios that go beyond basic and standard products (Ailawadi & Harlam, 2004; McKinsey, 2017; terBraak, Dekimpe, & Geyskens, 2013; Yang & Xinxin, 2010). In fact, the wave of PLB growth is being led by premiumization and upstream innovations (BCG, 2018). Although premium PLB are extremely attractive to retailers, commanding higher margins (Ailawadi & Harlam, 2004; terBraak, Dekimpe, & Geyskens, 2013) and creating greater store loyalty (Ailawadi, Pauwels, & Steenkamp, 2008), the challenge finding reliable suppliers with the quality standards and innovative capabilities they require can be daunting. Specifically, while Second-tier brand manufacturers (non-leaders), due to weaker competitive positions and pressures from the growth of PLB may generally be willing to supply PLB to either benefit from volume or fill spare capacities (Rabobank, 2012), they as well as dedicated manufacturers who manufacturer only brands for retailers and not their own, often lack the quality level and/or innovation required by retailers to supply premium PLB.

Hence, retailers approach leading brand manufacturers (Top-tier manufacturers) as they can provide premium quality and the innovation that retailers demand. Therefore, for retailers often the only game in town to supply premium PLB is to approach Top-tier manufacturers (terBraak, Deleersnyder, et al., 2013). This creates a somewhat unique dilemma for Top-tier manufacturers especially when there is uncertainty about the likelihood of another supplier being able and willing to supply PLB according to retailers' specifications and when considering the upside and downside for Top-tier manufacturers to supply PLB.

On the upside, McKinsey (2017) identified brand manufacturers' production of retailer's PLB as an important operating model that will open opportunities for future growth and a source of revenue. Supplying PLB allows brand manufacturers to leverage scale, obtain profits and to create retailer goodwill that helps them procure prime shelf space (terBraak, Deleersnyder, et al., 2013). Shelf space allocation and better positioning influence the attractiveness of product offerings playing a pivotal role in generating sales and profits (Chandon, Hutchinson, Bradlow, & Young, 2009). On the downside, supplying PLB entails substantial risks. First, brand manufacturers supplying retailers a competing brand (PLB), is likely to result in some cannibalization of their own brands. Second, if however, there is another brand manufacturer willing to supply PLB, brand manufacturers choosing not to supply PLB will probably still experience some cannibalization and will forego any profits they might have obtained from supplying PLB. Third, not supplying can result in a loss of bargaining power, reduction in shelf space allocation and a worse positioning for the manufacturer brand on the shelves if there is another supplier available, resulting in a loss of revenues.

Thus, the question for Top-tier brand manufacturers as to whether they should supply PLB is a critical managerial concern due to the potential trade-offs impacting their *revenues* and *profits*. To address this dilemma the objective of this research is to understand circumstances under which a *Top-tier brand manufacturer* will be better or worse off in terms of *profitability* agreeing to supply PLB. Determining the economic viability of supplying PLB is a critical first step in considering supplying PLB. Thus, we develop an economic model that suggests that the uncertainty of alternative supplier's availability and the trade-offs among shelf space allocation and position, degree of cannibalization and profits obtained from the PLB impact whether Top-tier brand manufacturers will be profitable supplying PLB. More specifically, under different levels of uncertainty regarding the availability of alternative

suppliers, the model calibrates the shelf space devoted to the Top-tier brand and the amount of profit required from supplying the PLB necessary to counteract cannibalization to generate sufficient profits for the Top-tier brand manufacturer.

While, some prior studies recognize that shelf space allocation and positioning, cannibalization and profitability associated with supplying PLB are factors deserving consideration by brand manufacturers in assessing whether or not to supply PLB (Dunne & Narasimhan, 1999; Gomez-Arias & Bello-Acebron, 2008; Quelch & Harding, 1996) they neither explicitly examine or incorporate these factors into their studies nor calibrate the trade-offs among them. Calibrating these trade-offs provides brand manufacturers with clear guidelines for negotiations with retailers regarding shelf space allocation and position as well as wholesale prices for determining when it would be profitable to supply PLB. Further, to the best of our knowledge no prior research explicitly incorporates alternative supplier uncertainty as a factor. Thus, including these factors in our model contributes to both the current literature and to managerial practice.

2. Literature review

The rapid development and expansion of retailer PLB in developed countries has not been overlooked by academics. In the last few decades researchers have conducted numerous studies to understand the growth of this phenomenon (Amrouche & Yan, 2017; Koschate-Fischer, Cramer, & Hoyer, 2014; Lamey, Deleersnyder, Steenkamp, & Dekimpe, 2012). Researchers have provided conceptual and empirical insights about key factors that determine PLB success across countries (Cuneo et al., 2015; Seabri & Zaccour, 2017) and across a variety of product categories (Ailawadi et al., 2008; Cuneo, Lopez, & Yague, 2012; Erdem, Zhao, & Valenzuela, 2004). For example, researchers find that retail factors such as retail concentration, category size and margin, are positively associated with the development of PLB market share (Ailawadi & Harlam, 2004; Cotterill & Putsis, 2000; Sethuraman & Gielen, 2014).

Another area that researchers have focused their investigations is on identifying the benefits accrued by retailers from developing and selling PLB. There are obvious incentives for retailers to launch PLB such as 1) they have up to 20–30% larger gross margins than manufacturer brands (Ailawadi & Harlam, 2004; Hoch, 1996; Hoch & Banerji, 1993), 2) they generate brand awareness and consumer loyalty by differentiating the retailer from competitors (Corstjens & Lal, 2000; Koschate-Fischer et al., 2014) and 3) they augment retailers' negotiating positions with suppliers (Draganska, Klapper, & Villas-Boas, 2010; Scott & Zettelmeyer, 2004).

While there are obvious benefits for retailers to offer PLB, the benefits for manufacturers who both sell their own brands and supply PLB to retailers is less clear. Thus, one area that deserves more attention than it has received from academic researchers is the supplying side of PLB (Sethuraman & Raju, 2012). This issue can be viewed from two perspectives, that of retailers and that of manufacturers. From the retailers' side, once they decide to launch their own PLB a strategy to choose suppliers must be developed. In some markets retailers may have the option to choose among different types of suppliers: Top-tier brand manufacturers, Second-tier brand manufacturers or dedicated manufacturers (who only supply PLB). In some markets all of these supplier options are readily available while in many others they are not.

There are several studies that investigate retailers' choice of PLB suppliers. For example, Kumar, Radhakrishnan, and Rao (2010) develop a supply chain model that indicates that a retailer will choose a brand manufacturer to supply PLB rather than a dedicated manufacturer when 1) the size of the quality sensitive consumer segment is larger than that of the price sensitive consumer segment, 2) the quality sensitive segment's valuation is larger than that of the price sensitive segment, and 3) the margin required by the retailer on the PLB is not very high. Their model also suggests that a retailer will choose a

dedicated manufacturer to produce PLB when the price sensitive consumer segment is bigger than the quality sensitive consumer segment.

Additionally, [Berges-Sennou and Bouamra-Mechemache \(2012\)](#) argue that there are trade-offs when choosing PLB suppliers. For example, a Top-tier brand manufacturer who produces both PLB and their own brand may use idle capacity to gain in efficiencies. This can allow them to offer a higher quality PLB at a lower cost than other fringe suppliers. On the other hand, when a Top-tier manufacturer supply both a PLB and its own brand, becoming a dual brander, the retailer's negotiation power is likely to diminish. Building on these findings [Berges-Sennou \(2006\)](#), indicates that retailers will choose a Top-tier brand manufacturer to supply their PLB when the manufacturer has low bargaining power. However, the retailer's decision can reverse when consumer's brand loyalty for the Top-tier manufacturer brand is high.

Other researchers find that retailers are more likely to choose a high quality brand manufacturer to supply its premium PLB and a lower quality manufacturer to supply intermediate and low quality PLB ([Gomez-Arias and Bello-Acebron, 2008](#)). Further, because retailers are offering more and more three-tiered PLB portfolios: basic, standard and premium products, they seek manufacturers who can produce differentiated offerings ([Geyskens, Gielens, & Gijbrecchts, 2010](#)). Often retailers seek high quality, Top-tier brand manufacturers to produce premium products and choose to position the PLB as close as possible to the market leader ([Sayman, Hoch, & Raju, 2002](#)). Finally, [terBraak, Dekimpe, and Geyskens \(2013\)](#) examine how different types of PLB suppliers, e.g., brand manufacturers or dedicated manufacturers, affect retailer margins. While they find that premium PLB result in higher retailer margins when supplied by Top-tier brand manufacturers this advantage tends to diminish due to higher costs associated with promoting premium brands.

The other side of the coin, which is the focus of this research, is the decision by brand manufacturers to supply or not to supply PLB. In the literature there does not seem to be a clear agreement as to whether or under what conditions it is a good or bad strategy for a brand manufacturer to supply PLB to retailers. Given the importance of this issue to brand manufacturers and retailers alike it is somewhat surprising that there is not more extensive research on brand manufacturers' decision making to supply PLB ([Sethuraman & Raju, 2012](#)). Some researchers argue for and others against brand manufacturers supplying PLB. For example, [Quelch and Harding \(1996\)](#) argue against well-known brands supplying PLB because the cannibalization cost is generally larger than the contribution of the PLB to the firm's profits.

Others have a more favorable view of brand manufacturers supplying PLB for retailers. More specifically, [Dunne and Narasimhan \(1999\)](#) argue that brand manufacturers can increase their profitability by using excess capacity to supply PLB. Additionally, they contend that if there is an alternative manufacturer who is willing supply brands for retailers it is a sufficient condition for a brand manufacturer to supply the PLB rather than lose profits associated with providing the PLB. If a brand manufacturer supplies the retailer, at least he may be able to negotiate shelf space, wholesale prices and gain market share from the PLB to counteract the cannibalization effect of the PLB on their profits. On the other hand, [Chen, Narasimhan, John, and Dhar \(2010\)](#) using a structural model, show how brand manufacturers may benefit from supplying PLB even when they do not face competition from other suppliers. It is important to note that the context of their analysis is a single undifferentiated product market (milk) which more than likely impacts the findings and may not apply to markets characterized by differentiated products.

In addition, [Wu and Wang \(2005\)](#) using an analytic model, suggest that when a brand manufacturer provides PLB it can diminish the promotional competition with other brand manufacturers by decreasing incentives. Further, ([terBraak, Deleersnyder, et al., 2013](#)) demonstrate that brand manufacturers supplying PLB can create retailer goodwill, increasing their bargaining power which in turn helps brand manufacturers procure shelf space presence for their products, increasing

potential profitability.

There does seem to be some consensus that the benefits and costs accrued from supplying PLB may differ depending on the characteristics of the manufacturer such as whether the manufacturer is a Top-tier brand manufacturer or a dedicated producer as well as the manufacturer's quality positioning ([Gomez & Rubio, 2006](#); [Gomez-Arias & Bello-Acebron, 2008](#); [terBraak, Dekimpe, & Geyskens, 2013](#)). For example, [Gomez-Arias and Bello-Acebron \(2008\)](#) identify some situations under which a brand manufacturer will be more or less profitable supplying PLB depending on its and the retailer's PLB quality positioning. Their model indicates that a high quality brand manufacturer should supply the PLB only if it is positioned by the retailer as a premium PLB. If on the other hand the PLB brand is positioned below the high quality brand manufacturer then they should allow a lower quality producer to supply the PLB in order to increase their profits. This suggests that it is not necessarily the best course of action, i.e., profitable, for a high quality brand manufacturer to supply the PLB in an effort to avoid third parties from supplying a PLB, especially one positioned at lower quality.

In summary, the overall conclusion based on prior research, to answer the question as to whether brand manufacturers will be profitable supplying PLB seems to be, it depends on various conditions. Specifically, research suggests that it depends on factors such as manufacturers' excess capacity, availability of alternative suppliers, brand manufacturer and PLB quality positionings, shelf space position and allocation, profit obtained from supplying PLB and, potential cannibalization by PLB. Thus, based on factors identified in prior research we develop an economic, game theoretic model that considers these factors to assess the conditions under which it would be profitable for brand manufacturers, in particular a Top-tier brand manufacturer, to supply PLB. To be more specific, a stated assumption of the model is that the brand manufacturer has excess capacity to produce PLB otherwise the likelihood of producing would be greatly diminished. Additionally, the model explicitly considers the uncertainty related to whether or not there are alternative suppliers available to deliver a PLB with the quality positioning specified by the retailer, which in this case is premium high quality PLB. Hence, as discussed earlier, given the high quality positioning of Top-tier brand manufacturers they are the ones that have the ability to deliver the high quality tier required by the retailer and as a consequence retailers seek Top-tiers to supply high quality PLB. Therefore, the model considers only Top-tier brand manufacturers decision-making to supply high quality PLB. Further, the model incorporates shelf space position and the shelf space allocated to the Top-tier brand. Moreover, the model considers the profitability necessary for Top-tier manufacturers to obtain from supplying PLB as well potential cannibalization of the Top-tier brand by PLB. Finally, the model calibrates, under different levels of uncertainty regarding the availability of alternative suppliers, the tradeoffs among the shelf space allocated to the Top-tier brand and the profit required by the Top-tier manufacturer from supplying the PLB to counter cannibalization in order to generate sufficient profits for the Top-tier brand manufacturer if they were to supply PLB.

3. Model description and setup

Consider a market where a Top-tier manufacturer is approached by a retailer to supply a PLB. We assume that the Top-tier manufacturer has excess capacity and is able to produce at a cost that allows for profitability. The Top-tier manufacturer sells its products to the retailer under a Top-tier brand that generates a profit p_0 per unit. The Top-tier manufacturer also enjoys a privileged l_0 linear footage of shelf space to exhibit its branded products. We assume that there is a minimum product outflow per linear foot of shelf space per day of q , however, depending on the positioning of the products on the shelf, captured by a parameter $s \in [0, s_{max}]$, the outflow per linear foot can vary. For example, if $s \in [0, 0.2]$, the product outflow can increase by a maximum of

20% depending on the positioning on the shelves. So, the product that is high-up and less visible might sell at an average rate of q while a product prominently displayed, i.e. exhibited in high-traffic aisles or placed at the eye-level, sells at $q(1 + 0.2)$. Positioning on the shelf, price and linear footage of shelf space are up for negotiation if the retailer requests the Top-tier manufacturer to supply the PLB. Status quo positioning is assumed set at s_0 . Given the current parameter values, the profit that the Top-tier manufacturer makes on the Top-tier brand is:

$$p_0 q (1 + s_0) l_0$$

If the Top-tier manufacturer accepts to supply the PLB, the shelf space will be distributed between the Top-tier brand and the PLB. The Top-tier brand retains l_1 linear feet and the PLB occupies l_2 linear feet. The Top-tier manufacturer is assumed to retain shelf space s_0 for its Top-tier brand if it accepts to supply the PLB but the price it will charge to the retailer for the PLB will be lower than the one charged for the Top-tier brand. While the Top-tier brand generates p_0 profit per unit sold to the Top-tier manufacturer, the output to be sold under the PLB commands a lower profit per unit $p_1 < p_0$. This assumption is consistent with prior research that reports that manufacturer brands are more profitable than PLB on a dollar base (e.g. Corstjens & Lal, 2000).

If the retailer decides to launch a PLB, we assume that the retailer secures a prime space s_1 for its brand and allocates it on l_2 linear feet of shelf space. We also assume that the Top-tier brand will retain l_1 linear feet of shelf space if it agrees to supply the PLB. However, if it does not agree to supply the PLB, then it could end up with l_4 linear feet of shelf space depending on how competitive the PLB happens to be and how much shelf space the retailer is willing to give to its own PLB. If an alternative supplier sources a PLB of inferior quality then the Top-tier brand may retain a larger shelf space ($l_4 > l_1$) although it will also be the case that $l_4 < l_0$.

If the Top-tier manufacturer agrees to produce the PLB it receives:

$$p_0 q (1 + s_0) l_1 + p_1 q (1 + s_1) l_2$$

where $l_1 < l_0$. The introduction of a PLB sourced by an alternative supplier will reduce the Top-tier brand's shelf space and therefore sales. By accepting to supply the PLB, the Top-tier brand cannibalizes itself to some extent. But if it turns down the offer to supply the PLB, and the retailer gets the PLB sourced from an alternative supplier, cannibalization will happen to the Top-tier brand anyway.

Being this a game theoretic problem, it is the case that the Top-tier manufacturer would not accept to supply a PLB unless it anticipates that the retailer can find an alternative supplier (Second-tier manufacturer or other) which would then reduce the Top-tier brand's shelf space and cannibalize sales. So, it should be the case that:

$$p_0 q (1 + s_0) l_0 > p_0 q (1 + s_0) l_1 + p_1 q (1 + s_1) l_2 \quad (1)$$

Inequality (1) holds trivially if the Top-tier brand and the PLB together occupy less shelf space than the Top-tier brand alone, and the retailer does not assign better positioning on the shelves than it gives to the Top-tier brand. In practice, retailers do give Top-tier brands the best positioning on the shelves. Top-tier brands attract customers and generate additional traffic to the stores. Hence, retailers place their PLB next to Top-tier brands to leverage visibility and incentivize product comparisons and brand switch. It is therefore likely that $s_1 = s_0$. Inequality (1) is no longer trivial if we assume that the most likely scenario is that altogether shelf space $l_1 + l_2 > l_0$. It follows therefore that inequality (1) will hold as long as the increased shelf space occupied by the Top-tier brand manufacturer's products (together the top-tier brand and the retailer brand) does not compensate for the decrease in price that the Top-tier manufacturer gets for the products sold under the PLB.

If the Top-tier manufacturer refuses to supply the PLB and the retailer negotiates with another supplier, then the Top-tier brand will also be cannibalized ending up with:

$$p_0 q (1 + s_0) l_4 < p_0 q (1 + s_0) l_1 + p_1 q (1 + s_1) l_2 \quad (2)$$

which is an inferior outcome for the Top-tier manufacturer if the increase in profits resulting from a possible increase in sales of the branded product does not compensate for the profits obtained from supplying the PLB:

$$p_0 q (1 + s_0) (l_4 - l_1) < p_1 q (1 + s_1) l_2$$

If cannibalization is the same regardless of the provenance of the PLB so that $l_4 = l_1$ inequality (2) holds trivially.

A key issue for the Top-tier manufacturer is the uncertainty about alternative suppliers. If the Top-tier manufacturer knows that the retailer has no other supplier to source the PLB, then the best decision is to turn the request down and avoid cannibalizing its own sales as expressed in inequality (1). But if there is an alternative supplier, the Top-tier manufacturer does best by accepting to produce the PLB as then, cannibalization comes from additional sales that can still generate profits. In other words, there is a game theoretic problem for the Top-tier manufacturer if it would be better off refusing to cooperate with the retailer if the retailer does not have an alternative supplier but worse off if it does. Satisfying this premise means that the possible offers that the retailer can make to the Top-tier manufacturer must be calibrated. The retailer cannot simply offer the Top-tier manufacturer to keep the status quo for its brand while supplying the PLB on top. This would clearly be advantageous for the Top-tier manufacturer regardless of whether or not the retailer has alternative sources. As a result, the decision would be a no brainer for the Top-tier manufacturer. Similarly, for the retailer it would be better off having the Top-tier manufacturer accepting than refusing to supply, otherwise it would have never requested the Top-tier manufacturer to supply the PLB.

The retailer's payoffs are determined by the mark-up that it is able to make on the product and the rate at which the product sells, which is determined by positioning and space on the shelf. Thus, if the mark-up (in dollar terms) made on the Top-tier brand is m_0 if the retailer is not interested in developing a PLB, it receives payoff of $m_0 q (1 + s_0) l_0$ when the status quo prevails.

If the retailer can persuade the Top-tier manufacturer to source the PLB, then the retailer's payoff reads:

$$m_0 q (1 + s_0) l_1 + m_1 q (1 + s_1) l_2$$

If instead the retailer chooses an alternative supplier to produce its PLB, and we assume the same shelf positioning for the PLB, then its payoff becomes:

$$m_0 q (1 + s_0) l_4 + m_2 q (1 + s_1) l_3$$

For the retailer to incentivize the Top-tier manufacturer to supply the PLB it must be the case that:

$$m_0 q (1 + s_0) l_1 + m_1 q (1 + s_1) l_2 > m_0 q (1 + s_0) l_4 + m_2 q (1 + s_1) l_3 \quad (3)$$

although producing the PLB beats the status quo so that:

$$m_0 q (1 + s_0) l_4 + m_2 q (1 + s_1) l_3 > m_0 q (1 + s_0) l_0 \quad (4)$$

Relationship (3) involves several subtle trade-offs. First by sourcing its PLB from a Second-tier manufacturer the retailer stands to gain more profit from sales of the branded product. So, relationship (3) can only hold if enough additional profit is made on the PLB by sourcing it from a Top-tier manufacturer rather than from a Second-tier manufacturer. This can hold if the dollar margin made on the PLB produced by the Top-tier manufacturer is higher than the margin made on the PLB produced by the Second-tier manufacturer ($m_1 > m_2$). It also holds if PLB sales are lower when the product is sourced by a Second-tier manufacturer ($l_3 < l_2$). Both situations can stem from an assumption that the product made by the Top-tier manufacturer is of better quality. If so, sales would be higher, and a higher retail price could be justified. Then the retailer's dollar margin could also be higher ($m_1 > m_2$) even if the cost for the retailer is higher than the cost it would assume when

sourcing the PLB from a Second-tier manufacturer.

When relationship (4) holds the retailer is better off launching a PLB than not launching it. But if there are no alternative suppliers other than the Top-tier manufacturer, then the chance for the retailer to launch its own PLB is exclusively dependent on the Top-tier manufacturer's willingness to supply it.

4. The overall game: sequence of decisions and assumptions

The game involves two turns (see Fig. 1): the first belongs to the retailer who approaches the Top-tier manufacturer knowing beforehand whether there is an alternative supplier to source the PLB in case the Top-tier manufacturer turns the request down. If the retailer does not request the Top-tier manufacturer to supply its PLB, the game ends. If it requests the Top-tier manufacturer to supply the PLB, then it is the manufacturer decision to either accept or reject supplying the PLB. The Top-tier manufacturer's decision is highly influenced by the degree of uncertainty of not knowing a priori whether the retailer has an alternative supplier from where to source the PLB.

Parameter β represents the Top-tier manufacturer's initial belief that the retailer has an alternative manufacturer lined up if it decides to launch its PLB. The retailer has the first move. It can either request the Top-tier manufacturer to supply or not. If it does not it is assumed that the status quo prevails because the retailer does not want to launch its PLB. If the retailer requests the Top-tier to supply the PLB, it is the Top-tier manufacturer's turn to play and must decide, under uncertainty, whether to accept to supply the PLB or not. This decision will be based on an expected payoff calculation that depends on the belief that the retailer has an alternative manufacturer to supply the PLB. In practice, as the retailer's decision is to request or not, any equilibrium in which the Top-tier manufacturer has a significant decision to make will involve beliefs $b = \beta^{(1)}$.

The retailer will request only if it believes that there is a chance that the Top-tier manufacturer accepts. The Top-tier manufacturer will accept if:

$$\beta [p_0 q(1 + s_0)l_4] + (1 - \beta)[p_0 q(1 + s_0)l_0] < p_0 q(1 + s_0)l_1 + p_1 q(1 + s_1)l_2 \quad (5)$$

Relationship (5) shows that the Top-tier manufacturer will accept to supply the PLB if the expected payoff from refusing is less than the payoff from accepting:

$\beta [p_0 q(1 + s_0)l_4] + (1 - \beta)[p_0 q(1 + s_0)l_0]$. The expected payoff from refusing depends on the likelihood that the retailer has an alternative manufacturer to source the PLB and also on the trade-offs between sales cannibalization of its brand and additional profit.

Depending on the level of uncertainty the Top-tier manufacturer will trade-off the increased shelf space obtained by producing the PLB with the potential drop in profit derived from the lower margins it would obtain from PLB sales. The relationship is easily obtained assuming that the retailer will place its PLB next to the Top-tier brand so to have the same visibility as the Top-tier brand. Then we assume $s_1 = s_0$. For example, suppose that the Top-tier manufacturer believes that there is a 25% likelihood that the retailer has an alternative producer. If so, the Top-tier manufacturer will be indifferent between accepting and refusing to supply the PLB if:

$$0.25[p_0 q(1 + s_0)l_4] + 0.75[p_0 q(1 + s_0)l_0] = p_0 q(1 + s_0)l_1 + p_1 q(1 + s_0)l_2 \quad (6)$$

Suppose that the PLB cannibalizes Top-tier brand's sale by 25% so that $l_1 = 0.75l_0$. This would be the worst-case scenario for the Top-tier manufacturer where $l_4 = l_1$ and the PLB shelf space is $l_2 = 0.5l_0$, Eq. (6) reads:

$$[0.25 \times 0.75 + 0.75][p_0 q(1 + s_0)l_0] = 0.75 \times p_0 q(1 + s_0)l_0 + 0.5 \times p_1 q(1 + s_0)l_0 \quad (7)$$

Eq. (7) defines a trade-off between increased total shelf space and the minimum profit that the Top-tier manufacturer must make on the PLB in order to be indifferent between accepting and refusing to supply. Specifically, shelf space increases to $1.25l_0$ if the leading brand manufacturer produces for the retailer from an expected $0.9375l_0$ if it does not. Indeed if it does not produce for the retailer, there is a 25% chance that its shelf space will be $l_1 = 0.75l_0$ and a 75% chance that it will be simply l_0 , for an expected shelf space of $0.25 \times 0.75l_0 + 0.75l_0 = 0.9375l_0$. This represents an increase in shelf space of 33.3%. Given this, equality (7) holds if $\frac{p_1}{p_0} = \frac{0.9375 - 0.75}{0.5} = 0.375$, i.e. that the profit for the Top-tier manufacturer on the PLB must be at least 37.5% of the profit obtained from the Top-tier brand if it is to accept to supply for the retailer given an increase in overall shelf space of 33.3%. Holding cannibalization constant, we can generate a relationship between increased shelf space and profitability on the supply of the PLB. More generally, if shelf space attributed to the retailer brand is $k \times l_0$, then the % increase in total shelf space is $\frac{0.75 + k}{0.9375} - 1$ and the profit that the Top-tier manufacturer gets from the retailer brand, as a percent of the profit made on the Top-tier brand, must be $\frac{0.9375 - 0.75}{k}$ percent for the Top-tier manufacturer to be indifferent between supplying the PLB and foregoing the opportunity.

5. Results: calibrations of trade-offs

Top-tier manufacturers' decision to supply PLB mainly depends on the trade-offs between shelf space allocation, profits and sales cannibalization, both highly influenced by the uncertainty about the retailer having an alternative supplier of PLB. Below, we present calibrations of the trade-offs among these factors that Top-tier manufacturers need to consider before deciding, from an economic perspective, the conditions under which supplying PLB may be profitable.

Table 1 below provides data for different levels of uncertainty about the availability of alternative suppliers of PLB. In all cases, cannibalization of Top-tier brand sales is assumed constant so that $l_1 = 0.75l_0$. We also assume the worst case scenario for the manufacturer when the retailer sources from an alternative producer so that $l_4 = l_1$. The Top-tier manufacturer is assumed to have spare capacity, however we have set a capacity constraint at $1.75l_0$. This means that the Top-tier manufacturer can produce at most 75% more than what is currently producing. This capacity constraint is arbitrary and could be set lower (See Table 1).

Note that the percentage of increase in shelf space that the Top-tier manufacturer must consider is an increase relative to the expected shelf space it might obtain if it turns down the retailer's request. Thus, if the Top-tier manufacturer believes that the likelihood that the retailer has an alternative supplier is 25%, the expected shelf space cannibalization is $0.25 \times 0.75l_0 + 0.75l_0 = 0.9275l_0$. This compares to the total shelf space that the Top-tier manufacturer would have if it supplies the PLB. The expected shelf space if the Top-tier manufacturer refuses to supply the PLB goes down as the uncertainty about the retailer's alternatives goes up. Thus, if the Top-tier manufacturer believes that the likelihood that the retailer has an alternative supplier is 50%, the expected shelf space cannibalization is $0.50 \times 0.75l_0 + 0.50l_0 = 0.875l_0$. It follows that the potential shelf space attributed to the PLB corresponds to an increase in shelf space relative to expectations, as uncertainty increases.

¹ Given the game's payoff assumptions, the subgame perfect equilibria are pooling. In other terms the retailer either asks the manufacturer to produce or not regardless of whether it has alternative producers to turn to. As we are interested in the manufacturer's decision under uncertainty, we focus on the pooling equilibrium in which the retailer asks the manufacturer to produce its PLB and explores the trade-offs that must hold true for this equilibrium to prevail.

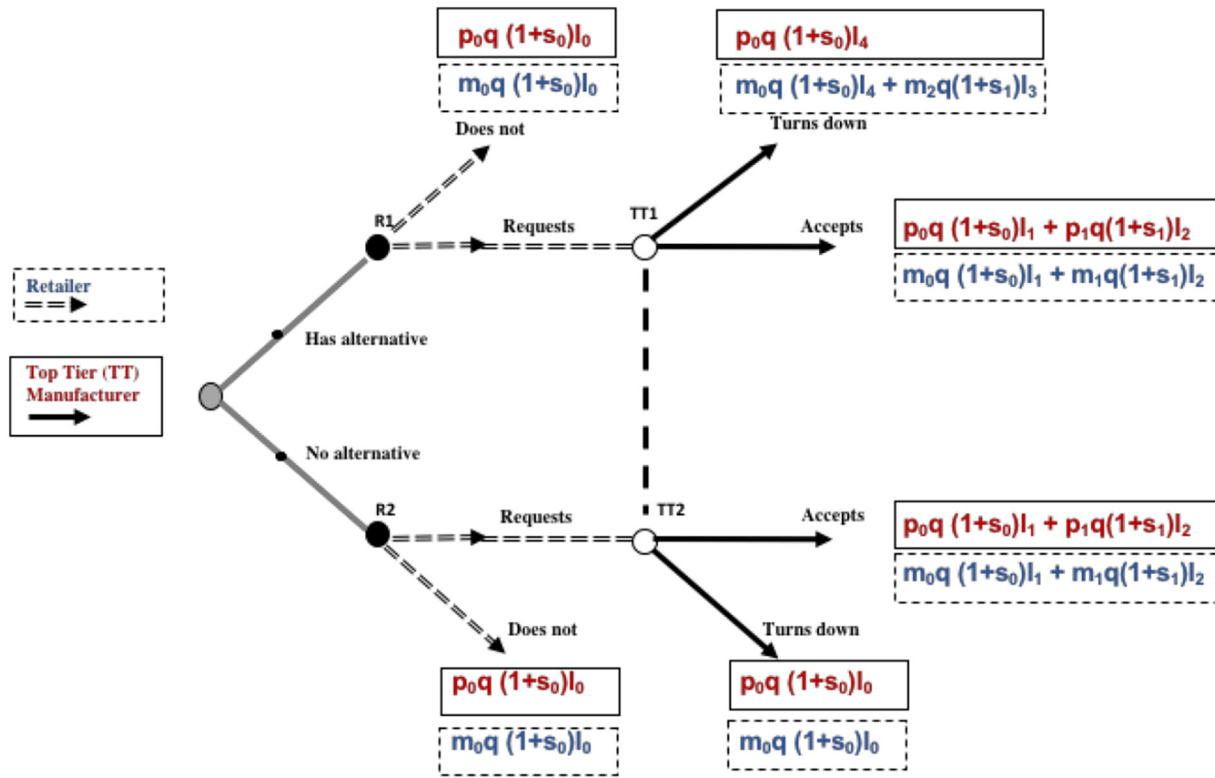


Fig. 1. The overall game.

Table 1
Required top-tier manufacturer profit on the retailer brand.

Chance that the retailer has access to alternative sourcing						
25%		50%		75%		
% increase in shelf space	Retailer brand shelf space	Required $\frac{p_0}{p_1}$ in %	Retailer brand shelf space	Required $\frac{p_0}{p_1}$ in %	Retailer brand shelf space	Required $\frac{p_0}{p_1}$ in %
10	$k = 0.28l_0$	66.7	$k = 0.21l_0$	58.8	$k = 0.14l_0$	43.5
15	$k = 0.33l_0$	57.1	$k = 0.26l_0$	48.8	$k = 0.18l_0$	33.9
20	$k = 0.37l_0$	50.0	$k = 0.30l_0$	41.7	$k = 0.22l_0$	27.8
25	$k = 0.42l_0$	44.4	$k = 0.34l_0$	36.4	$k = 0.27l_0$	23.5
30	$k = 0.47l_0$	40.0	$k = 0.39l_0$	32.3	$k = 0.31l_0$	20.4
35	$k = 0.52l_0$	36.4	$k = 0.43l_0$	29.0	$k = 0.35l_0$	18.0
40	$k = 0.56l_0$	33.3	$k = 0.47l_0$	26.3	$k = 0.39l_0$	16.1
45	$k = 0.61l_0$	30.8	$k = 0.52l_0$	24.1	$k = 0.43l_0$	14.6
50	$k = 0.66l_0$	28.6	$k = 0.56l_0$	22.2	$k = 0.47l_0$	13.3
55	$k = 0.70l_0$	26.7	$k = 0.61l_0$	20.6	$k = 0.51l_0$	12.3
60	$k = 0.75l_0$	25.0	$k = 0.65l_0$	19.2	$k = 0.55l_0$	11.4
65	$k = 0.80l_0$	23.5	$k = 0.69l_0$	18.0	$k = 0.59l_0$	10.6
70	$k = 0.84l_0$	22.2	$k = 0.74l_0$	16.9	$k = 0.63l_0$	9.9
75	$k = 0.89l_0$	21.1	$k = 0.78l_0$	16.0	$k = 0.67l_0$	9.3
80	$k = 0.93l_0$	20.0	$k = 0.83l_0$	15.2	$k = 0.71l_0$	8.8
85	$k = 0.98l_0$	19.0	$k = 0.87l_0$	14.4	$k = 0.75l_0$	8.3

Table 1 provides a relationship between expected shelf space (leading to sales) and the profit that the Top-tier manufacturer must get from the PLB to be indifferent between accepting to supply the PLB and refusing to do so. As the Top-tier manufacturer's uncertainty increases, the willingness to consider lower profits on the PLB for a given increase in shelf space increases. For example, if the manufacturer of the PLB suggests a 60% increase in shelf space relative to expectations if the Top-tier manufacturer refuses to supply, the minimum profit on the PLB must represent 25% of the profit made on the Top-tier brand if uncertainty is at 25%. But if the manufacturer believes that there is a likelihood of 50% that the retailer has alternatives, then it will only require a profit on the PLB of 19.2% of the profit made on the Top-tier

branded product. The uncertainty of the retailer having alternatives leads the manufacturer to accepting to supply the PLB on less stringent terms. Fig. 2 represents with indifference curves the trade-off between increase in shelf space and profit on the PLB given three levels of suppliers' uncertainty (examined in Table 1): 25%, 50% and 75%.

For each calibration, uncertainty, cannibalization and profit made on the Top-tier brand are held constant. Shelf space attributed to the PLB increases as one moves down each of these curves. If the Top-tier manufacturer believes that there is a 25% likelihood that the retailer has an alternative to supply the PLB, indifference is represented by the dotted curve. For any profit/shelf space combination above the dotted curve, the Top-tier manufacturer will find it in its best interest to supply

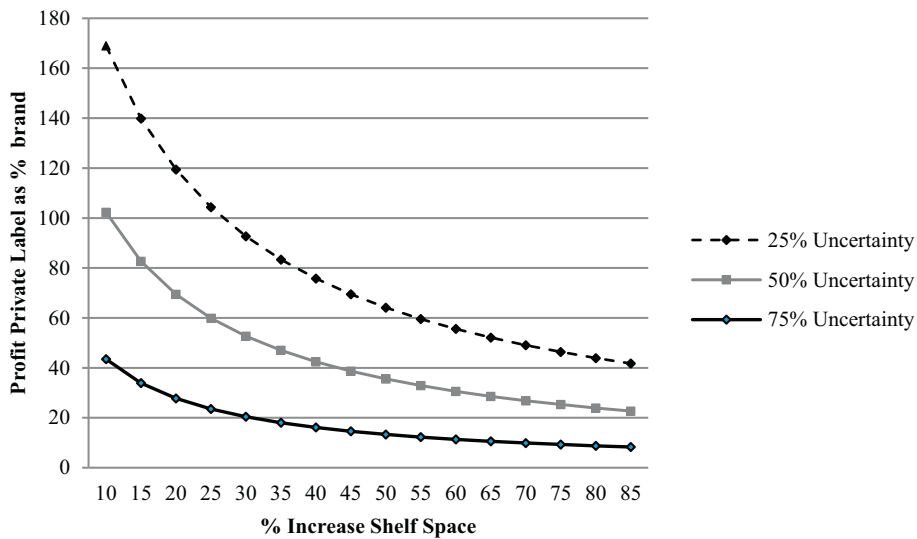


Fig. 2. Profit-shelf space tradeoff.

the retailer. In other words, if the retailer proposes to increase total shelf space by 60%, promising that the PLB will use three quarters of the space currently filled by the Top-tier brand, the Top-tier manufacturer will accept to supply if the profit it makes on the PLB exceeds 25% of the profit it currently makes (and will continue to make) on its Top-tier brand.

If the retailer sources the PLB from an alternative supplier eventually there could also be the case that the Top-tier manufacturer experience lower cannibalization than expected. To illustrate this impact we consider the case where the manufacturer believes that there is a 50% chance that the retailer has an alternative and we set $l_1 = 0.75l_0$, and $l_2 = 0.5l_0$. Now we explore the impact of less cannibalization from an alternatively PLB supplier, and set $l_4 = l_1 \times (1 + \epsilon)$. Eq. (6) now reads:

$$[0.5 \times 0.75 \times (1 + \epsilon) + 0.5][p_0q(1 + s_0)l_0] = 0.75 \times p_0q(1 + s_0)l_0 + 0.5 \times p_1q(1 + s_0)l_0 \quad (8)$$

Now the expected increase in shelf space for the Top-tier manufacturer if accepts to produce is $\frac{1.25}{0.5 \times 0.75 \times (1 + \epsilon) + 0.5}$ and the Top-tier manufacturer must obtain a profit on the PLB relative to its own brand of $\frac{0.5 \times 0.75 \times (1 + \epsilon) - 0.25}{0.5} - 1 = \frac{p_1}{p_0} - 1$ percent at least. Table 2 provides values depending on parameter ϵ which is allowed to vary between 0.05 and 0.15. This corresponds to a decrease in cannibalization from the alternative PLB supplier that ranges from 5% to 15%.

Table 2 points to the increase in profit on the PLB that the Top-tier manufacturer will require as its expectations about cannibalization if the PLB sourced elsewhere varies. For example, if the Top-tier manufacturer expects its brand to occupy 15% more shelf space when the retailer sources its PLB elsewhere, it will require the profits obtained from producing the PLB to exceed 36.25% of those obtained on its own branded product. By contrast it would be enough to get 25% of the

Table 2
Manufacturer requirements as cannibalization varies: when the retailer brand is sourced elsewhere.

Parameter ϵ	Increase in shelf space if produces %	Needed profit from private label $\frac{p_1}{p_0} - 1\%$
$\epsilon = 0$	42.8	25
$\epsilon = 0.05$	39.9	28.75
$\epsilon = 0.1$	37.0	32.5
$\epsilon = 0.15$	34.2	36.25

profit on its brand if the Top-tier manufacturer anticipates that an alternatively sourced PLB will cannibalize its brand as much as the PLB, hence would agree to produce.

Returning to the case where we assume $l_4 = l_1$ we now explore the impact of changing the assumption about the cannibalization rate of the Top-tier brand by the PLB regardless of sourcing. We now hold the Top-tier manufacturer's beliefs constant and vary the potential cannibalization of the Top-tier brand as a result of the launch of the PLB. Table 3 provides the shelf space/profit trade-off for various levels of cannibalization assuming that the Top-tier manufacturer believes that there is a 25% chance that the retailer has an alternative.

Table 3 illustrates the impact of cannibalization. If the Top-tier manufacturer's uncertainty about the retailer's alternatives remains constant at 25%, it will require higher profits on the PLB as cannibalization of its own brand increases. This is of course to be expected. So, if the retailer proposes a 50% increase in shelf space including its brand, the Top-tier manufacturer will require profit on the retailer brand in excess of 24% of the profits on its own brand if cannibalization is 20%. But if expected cannibalization increases to 30%, the Top-tier manufacturer will require profits on the PLB on top of 32.7% of profits on its own brand in order to agree to supply. Fig. 3 illustrates the trade-offs for two levels of cannibalization:

Along each calibration of Fig. 3, cannibalization is held constant and uncertainty is assumed to be 25%. Clearly with more cannibalization the Top-tier manufacturer will want to capture higher profits on the PLB and greater shelf space if it is to agree to supply the PLB.

6. Discussion and implications

The proliferation and transformation of PLB, going beyond more basic product offerings to multi-tier portfolios that increasingly include high quality and even symbolic products, has spurred managerial and academic interest in understanding issues related to both the demand and supply side of the equation. The vast majority of research has focused on the demand side, identifying factors that lead to the success of PLB and the retailer benefits accrued from offering PLB. Much less attention has been paid to the production side of supplying PLB, especially the case of Top-tier manufacturers providing premium PLB which have become and will continue to be the future of PLB growth (BCG, 2018). Thus, this research investigates conditions under which it would be profitable for a Top-tier brand manufacturer to supply a high quality PLB to a retailer.

It is important to reiterate that the dilemma of supplying premium quality PLB for retailers is somewhat unique to Top-tier brand

Table 3
Shelf space/profit trade-offs for various levels of cannibalization.

Cannibalization of leading national brand sales						
20%			25%		30%	
% increase in shelf space	Retailer brand shelf space	Required $\frac{p_0}{p_1}$ in %	Retailer brand shelf space	Required $\frac{p_0}{p_1}$ in %	Retailer brand shelf space	Required $\frac{p_0}{p_1}$ in %
10	$k = 0.25l_0$	61.2	$k = 0.28l_0$	66.7	$k = 0.32l_0$	70.9
15	$k = 0.29l_0$	51.2	$k = 0.33l_0$	57.1	$k = 0.36l_0$	61.9
20	$k = 0.34l_0$	44.1	$k = 0.37l_0$	50.0	$k = 0.41l_0$	54.9
25	$k = 0.39l_0$	38.7	$k = 0.42l_0$	44.4	$k = 0.46l_0$	49.3
30	$k = 0.44l_0$	34.5	$k = 0.47l_0$	40.0	$k = 0.50l_0$	44.8
35	$k = 0.48l_0$	31.1	$k = 0.52l_0$	36.4	$k = 0.55l_0$	41.0
40	$k = 0.53l_0$	28.3	$k = 0.56l_0$	33.3	$k = 0.60l_0$	37.8
45	$k = 0.58l_0$	26.0	$k = 0.61l_0$	30.8	$k = 0.64l_0$	35.1
50	$k = 0.63l_0$	24.0	$k = 0.66l_0$	28.6	$k = 0.69l_0$	32.7
55	$k = 0.67l_0$	22.3	$k = 0.70l_0$	26.7	$k = 0.73l_0$	30.7
60	$k = 0.72l_0$	20.8	$k = 0.75l_0$	25.0	$k = 0.78l_0$	28.8
65	$k = 0.77l_0$	19.5	$k = 0.80l_0$	23.5	$k = 0.83l_0$	27.2
70	$k = 0.82l_0$	18.4	$k = 0.84l_0$	22.2	$k = 0.87l_0$	25.8
75	$k = 0.86l_0$	17.4	$k = 0.89l_0$	21.1	$k = 0.92l_0$	24.5
80	$k = 0.91l_0$	16.5	$k = 0.93l_0$	20.0	$k = 0.97l_0$	23.3
85	$k = 0.96l_0$	15.7	$k = 0.98l_0$	19.0	$k = 1.01l_0$	22.2

manufacturers. More specifically, first there are many markets in which there are a limited number of Second-tier and dedicated suppliers. Second, in markets in which Second-tier brand manufacturers as well as dedicated manufacturers are present, for the most part, they do not have the capabilities to supply premium quality PLB, to innovate or have the necessary volume capacity. Third, even in the unusual situation where this is not the case (they have the requirements to supply higher quality PLB), it is important to recognize that Second-tier brand manufacturers are being squeezed by brands at both the higher and the lower ends of the market, putting their future survival in jeopardy (Cuneo, Milberg, Alarcon-Del-Amo, & Lopez-Belbeze, 2018; Rabobank, 2012). Thus, there is no quandary for Second-tier brand manufacturers in this situation as it will be in their best interest or even a necessity to supply premium PLB if they are able to do so as a means to remain a viable business entity. Fourth, and finally, in the extraordinarily rare circumstance in which dedicated manufacturers may have the required capabilities there is absolutely no dilemma for them to supply premium or any quality-tier PLB as supplying PLB to retailers is their complete business model. Therefore, given the general lack of capabilities of Second-tier and dedicated manufacturers to produce high quality premium PLB and the absence of a dilemma if they had such capabilities

this is why we consider only Top-tier brand manufacturers in our game theoretic model.

The findings of our research with regard to whether a Top-tier manufacturer should supply or not supply a PLB are consistent in general with prior studies, whose results suggest that it depends on a set of conditions under which manufacturer brands are better or worse off supplying PLB rather than a definitive yes versus no. More specifically, our research adds to previous investigations by showing that there are situations under which Top-tier brand manufacturers would be profitable supplying PLB and situations under which they would not depending on the uncertainty regarding the availability of alternative suppliers to supply PLB and the trade-offs among shelf space allocation, cannibalization and profits obtained from the PLB. While some prior studies on the topic of PLB production by brand manufacturers have discussed cannibalization, profits garnered by manufacturers from PLB and shelf space allocation they, almost exclusively, unlike our research, have not explicitly examined or incorporated these factors into their studies. One exception is the research of terBraak, Deleersnyder, et al., (2013) who include the allocation of shelf space in their study. They find that Top-tier manufacturers supplying PLB leads to retailer goodwill and a higher likelihood of procuring shelf space for their brands. It is

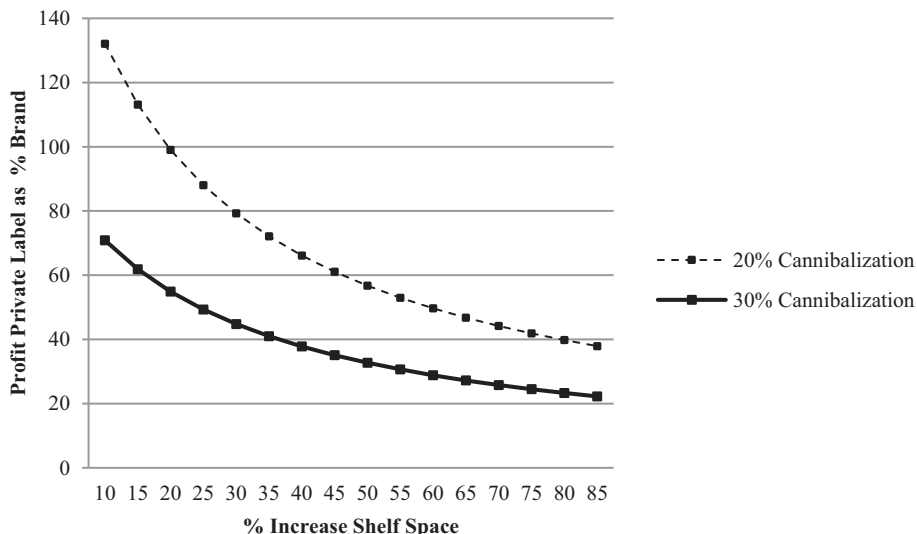


Fig. 3. Shelf space – profit tradeoffs given different uncertainty levels.

important to note that from a strategic perspective while PLB supply may reinforce the relationship with some retailers, i.e., create goodwill, PLB supply may not necessarily be profitable and may also potentially generate negative strategic outcomes such as relatively less focus on the branded operation, potential loss of brand differentiation with the PLB offering, and conflicts with other retailers.

Our research approach differs from [terBraak, Deleersnyder, et al. \(2013\)](#) with regard to the treatment of shelf space allocation. Specifically, their study treats shelf space allocation as a positive outcome of retailer goodwill for Top-tier manufacturers supplying PLB. Our study, on the other hand, considers shelf space allocation as an input, an important factor to consider and negotiate during the decision-making process to determine whether supplying PLB will be a profitable endeavor. The level of shelf space allocation necessary to attain a profitable outcome is a crucial element in assessing whether or not it would be worthwhile to supply PLB and therefore it plays a vital role in negotiations with retailers.

In addition, our research makes a contribution with regard to its consideration of the availability of alternative suppliers. As most research on PLB has been conducted in the United States and countries in Western Europe where for the most part there are ample suppliers of PLB, uncertainty regarding the availability of alternative suppliers of PLB has not been a factor of concern as there is little variability. However, in other parts of the world the situation is quite different in that there are fewer suppliers, especially those who can provide premium PLB to retailers. Even in markets in which there are more suppliers of PLB available our model provides brand manufacturers with a deeper and clearer understanding of the trade-offs between shelf space allocation, cannibalization and profits from the PLB necessary to negotiate a profitable outcome of supplying PLB.

Our research equips Top-tier brand managers with an economic model that suggests ranges at which Top-tier brand manufacturers should negotiate with retailers on each factor to either improve or maintain profits. Indeed, a main risk element in a dual-brand strategy is its negotiation power vis-à-vis retailers. Calibrating these trade-offs provides manufacturer brands with clear guidelines for negotiating with retailers regarding shelf space allocation and profit level obtained from supplying PLB, depending on the potential availability of alternative PLB suppliers which is a critical factor, especially in emerging markets where there is a lack of both available and reliable suppliers willing to produce premium PLB. Thus, this research is an important step in providing a business analysis regarding conditions that are necessary to achieve a profitable outcome for Top-tier manufacturers considering supplying PLB to retailers.

Further, we believe that our study also contributes to opening new avenues of research in the areas of industrial and business-to-business marketing both from topical and methodological perspectives. From a topical perspective a great deal of research on industrial and business-to-business relationships and interactions between companies has been conducted in several contexts such as as computing and electronics ([Lee & Johnsen, 2012](#); [Valtakoski, 2015](#)), industrial equipments ([Baptista, 2013](#); [Obal & Lancioni, 2013](#)) and professional services ([Abrahamsen & Hakansson, 2015](#); [Baumann, Le Meunier-Fitzhugh, & Wilson, 2017](#)). Less attention has been paid to business-to-business relationships and interactions specific to the retail context. In this regard, our research makes a contribution by investigating buyer – seller relationships, in particular those between retailers and brand manufacturers. Moreover, as our research focuses specifically on the supply relationship between retailers and brand manufacturers with regard to PLB sourcing there are unique issues that are not common in many business-to-business markets in other contexts. For example, it is unusual in other contexts that suppliers (brand manufacturers) are asked to supply to buyers (retailers) competing products (PLB) that have the potential to cannibalize the suppliers' products. Thus, this adds an interesting dimension to the study of buyer-seller relationships and interactions that can expand the current field of inquiry in business-to business relationships and provide

new research opportunities.

In addition, the consolidation of retailers, the growth of PLB, and the retailers' need of PLB sourcing, has reshaped the competitive dynamics between retailers and brand manufacturers. These trends constitute an important relational shift in which retailers are no longer just channels of distribution but rather business partners with whom to build business-to-business relationships. Thus, the dramatic growth of the PLB phenomenon and the lack of research on the supply side presents research opportunities for researchers interested in understanding the nature of the business-to-business relationships and interactions in an area of growing importance and one that to date can be characterized as under-researched.

From the methodological perspective, it is important to recognize that game theory can be used to gain a better conceptual understanding of decision-making in competitive situations. Game theory provides a structure to mathematically and logically analyze and describe strategic behavior. The objective is to identify optimal actions, given uncertainty and interdependence. The players of a game choose strategies by examining available information, the actions open to them, the expected payoffs and their expectations of the other players' decisions. The resulting equilibrium is the combination of best strategies for each player. Game theory is especially useful in studying business environments where there are a small number of identifiable actors, conflict, interdependence and uncertainty, which are typically the market conditions in business-to-business and industrial environments. Game theory has been applied to a wide range of marketing decisions: negotiations/bargaining, competitive behavior, innovation, pricing/bidding, market strategy, etc. ([Chatterjee & Lilien, 1986](#); [Herbig, 1991](#)) and we believe that it could be especially relevant to model in industrial and business-to-business, buyer-seller interactions, particularly in negotiations and bargaining. Negotiations involve a multitude of factors, hence it becomes extremely difficult to examine and understand all the options available increasing the risk of wrong decisions. Game theory can guide the decision making process by providing models and frameworks to predict potential outcomes and establishing rules for negotiation. For example, our research illustrates a game where a buyer (retailer) and a seller (brand manufacturer) negotiate PLB sourcing. For the seller this is a complex decision, first because the decision is made under uncertainty and second because the outcomes depend on understanding and calibrating the tradeoffs among a set of factors that can lead to either profits or losses. Understanding these tradeoffs informs sellers and buyers in the negotiation process the means to arrive at a satisfactory outcome for the parties involved Game theory provides a useful framework to understand the factors to consider in the negotiation and more importantly estimates the potential outcomes of different scenarios.

Additionally, game theory can be also used in other strategic situations where competitive behavior can be modeled and which fall within the domain of business-to-business and industrial marketing research: product decisions (e.g., entry or exit markets), supply chain design (e.g., capacity management, build vs out source decisions), auctions (e.g., sealed project bids), bargaining activities (e.g., pricing buy-back and revenue-sharing negotiations) and principal-agent decisions (e.g., compensation negotiations, supplier incentives).

7. Limitations and future research

Our research, like most other studies on PLB supply ([Chen et al., 2010](#); [Gomez-Arias & Bello-Acebron, 2008](#); [Wu & Wang, 2005](#)), does not present empirical support for its contentions. The reason why there is a dearth of empirical research on this topic is not surprising given that brand manufacturers often prefer to conceal that they are supplying PLB ([Dejong, 2007](#)) because awareness of this activity could negatively affect consumer perceptions which may lead to brand erosion that adversely can impact purchase behavior toward their own branded products ([Gomez-Arias & Bello-Acebron, 2008](#)). Some

companies go so far as to create separate physical production facilities to obscure their production of PLB to prevent consumers from becoming aware, thus reducing the likelihood of brand erosion (Kumar & Steenkamp, 2007). In fact in most cases consumers are unaware of who is producing PLB for retailers. Moreover, brand manufacturers also may not want to reveal that they are producing a PLB for a particular retailer as it potentially could impact their relationships with other retailers (terBraak, Deleersnyder, et al., 2013). As a consequence, it is difficult to conduct empirical research in this area given the lack of access to data due to the hidden and proprietary nature of it. Future research would clearly benefit from the ability to empirically verify the propositions set forth by analytical models. Perhaps forming close relationships with brand manufacturers and guaranteeing them anonymity with regard to their identities would be sufficient to allay their reluctance to provide data.

In addition, for brand manufacturers to arrive at a decision to supply or not supply PLB, a fundamental and necessary first step is to analyze and assess whether this would be a potentially profitable endeavor or not. This research identifies a set of important factors and the trade-offs among them that need to be considered to inform this decision. However, it is likely that other factors such as potential brand erosion as a consequence, in part, of reductions in the quality gap and differentiation between the PLB and manufacturer brands may exist. This lowers consumer willingness to pay a premium for manufacturer brands leading to sales cannibalization. Further, brand manufacturers to inform their decision making as to whether or not to supply a PLB to a retailer might also consider the impact on factors such as their bargaining power with retailers and retailers' goodwill toward them. Identifying and investigating these types of factors in future research endeavors to advance knowledge on this topic would be an important step following an analysis of the potential profitability that could be garnered from supplying PLB. If conditions to obtain a profitable outcome for supplying a PLB cannot be achieved, then supplying is unlikely to occur.

Finally, while the economic model in our research advances the understanding of critical factors and the trade-offs among them necessary for brand manufacturers to be profitable supplying PLB there are other interesting and important areas worth pursuing. For example, another topic to be considered in future studies is whether brand manufacturers who supply their own brand and decide to supply PLB, thus adopting a dual brander strategy, is a viable and sustainable strategy. Some companies believe that becoming a dual brander is a feasible strategy as it permits them to combine brand development and production capacity maximization. However, whether this strategy is profitable and more importantly sustainable in the long run remains an open question. A key challenge for dual branders is to simultaneously engage in two significantly different business models under the same roof. Branded businesses are driven by product differentiation, brand image and value share. To the contrary, PLB supply is about contract wins, cost efficiencies, production flexibility, volume share and customer relationships. According to Rabobank (2012) when compared to dedicated PLB suppliers, dual branders on average do not achieve enough returns for the investments in their brands. Thus, in the long run dual branders may risk brand erosion and cash-flow fluctuations. Dual branding strategies can pay-off, but they require several business model considerations ranging from structure, to market segments, to R&D, otherwise they may result in brand damage and potential losses. In addition, PLB supply adds short-run manufacturing complexity. Additionally, sales team demands increase as most retailers have separate buying teams for PLB, and retailers often demand innovation to flow into PLB which most likely reduce margins (Bain&Company, 2011). As a result, combining both models within the same company remains a major challenge for profitability in the long-term. Hence, before undertaking a dual brander strategy, brand managers need to fully understand the options for either collaborating with retailers by supplying PLB or alternatively defending against the PLB threat. Thus, research

investigating this issue would make an important contribution specifically to the area of private label brand supply and more generally to the area of business-to-business relationships in a retail context.

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