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Store brand introduction in a two-echelon logistics system with a risk-averse retailer

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ABSTRACT

We study a risk-averse retailer's optimal decision of introducing her store brand product by using the mean–variance formulation. The effects of the substitution factor, the capital constraint, and the development cost are examined. Taking the product quantities as the decision variables, the risk deducted surplus of the store brand product and the substitution factor play a vital role in the retailer's optimal policies. Both the capital constraint and the development cost reduce the mean–variance efficient solution set of the retailer and hence distort the risk management of the retailer. Some meaningful insights are generated.

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1. Introduction

Store brand of the retailer can date back to several decades ago (Deveny, 1993).[1] Nowadays, it has been a common practice that retailers, such as Tesco, Kroger, Woolworths, Walmart, etc., introduce their store brand business and use it as a weapon to compete with upstream manufacturers. The introduction of retailers' store brands has been a notable trend in the evolving area of retailing. Retailers' store brands account for about 16% market shares in the U.S. while about 30% in Europe in the food industry (Zimmerman et al., 2007), and account for at least 30% of all products sold in 15 countries, the greatest number ever (see Nielsen data compiled for PLMAs 2014 International Private Label Yearbook).

Advantages of store brand have been broadly proved by the practitioners and academics. An appropriate store brand business cannot only directly improve the retailer's profitability, but also lead to a better bargaining power with the upstream members (Mills, 1995; Morton and Zettelmeyer, 2004). Moreover, the store brand can also build customers' store loyalty, which is particularly important to retailers (Corstjens and Lal, 2000). However, different from the traditional status, the store brand retailers play a more determinant role in the failure or achievement of their own brand, and have to take all the risk of the development of store brand product. For example, manufacturers' national brand commodities are considered more popular than the retailer's store brand product because of their stability and reliability (Pinedo et al., 2008), even though the quality of retailers' store brand product might be higher than that of the national brand (Richardson et al., 1994;

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[1] In this study, the term "store brand" is the same as the term "private label". Literatures related to the retail market usually use "store brand" or "private label" to describe retailers' own brand. Please refer to Raju et al. (1995) and Dhar and Hoch (1997) for the typical definitions of "store brand" and "private label".

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Chintagunta et al., 2002). Moreover, the retailer needs to consider the risk arising from the uncertainty of introducing a new store brand, and to take her risk-averse attitude into consideration (Eeckhoudt et al., 1995; Chen et al., 2007). In addition, capital constraint is a common phenomenon in the retailers' operations (Buzacott and Zhang, 2004), and the potential market entry retailers should decide how to use the constrained capital efficiently.

Motivated by these messages, we examine our research issues: First, what is the optimal stocking quantities of the store brand retailer under the risk-averse situation; Second, how the substitution factor affects the risk-averse retailer's optimal decision and the desirability to introduce the store brand product; Third, what is the optimal product portfolio when the retailer is faced with the capital constraint and development cost. In the literature, mostly a profit maximizing (risk-neural) retailer and channel conflicts are considered in the analysis. In this study, we focus on the risk analysis of the retailer who plan to develop her store brand.

This study aims to provide insights for the retailer who is risk sensitive and is going to introduce her store brand product. By formulating the problem as a mean–variance optimization problem (Choi and Chiu, 2012b; Chiu and Choi, 2013), the optimal decisions of the risk-averse retailer for different situations are derived. Then management insights are obtained from the optimal decisions. We find that the retailer's incentive to develop the store brand business depends on the *risk deducted surplus* (of selling the store brand product) and the product's substitution factor. A small risk deducted surplus or a large substitution factor inhibits the retailer to change her strategy to the store brand business. Interestingly, as long as the substitution factor is not sufficiently large and the risk deducted surplus is not extremely small or large, the retailer tends to retail both products concurrently, while it is always optimal for the retailer to give up the risk-free decision and to introduce the store brand product, if the risk deducted surplus is small regardless of the substitution factor. Moreover, we reveal that the retailer is still willing to develop her store brand product even though the unit production cost of the store brand product is higher than the wholesale price of the manufacturer's product but the retail price of the store brand product is lower than that of the manufacturer's product. Furthermore, we reveal situations where the risk is unimportant in the retailer's decision making. These situations include, the profit of selling the store brand product is too low, the profit of selling the manufacturer's product is very high, and the substitution factor is big (i.e., the differentiation between the two products is small).

Both the capital constraint and the development cost may distort the risk management of the retailer. A retailer originally preferring not to develop her store brand product will become preferring to develop her store brand product, and switches from a risk-free decision to a risky decision, just because she has insufficient capital. The development cost causes the polarization of risk level of retailer's decision, under which only the risk-free solution or extremely high risk solutions are mean–variance efficient to the retailer.

This study is organized as follows. We first review the related literature in Section 2, and then provide a stylized model and discuss the assumptions in Section 3. Analytical results of the basic model are presented in Section 4. Later, we extend our model to include the capital constraint and the development cost, and investigate their impacts in Section 5. Section 6 concludes the major findings of this study. All the proofs are presented in the Appendix A.

2. Literature review

This study is closely related to two research areas, the area of retailer store brand business and the area of supply chain risk management. There is profound literature on the retailer store brand business, and the related literature can be divided into two streams. The first stream of research is that on incentives of retailers' market entry decisions. Mills (1995) shows that a well developed store brand program cannot only contribute directly to retailers' profitability, but also have positive indirect impacts such as better bargaining power with the upstream members. To further explain what makes the store brand entry so conducive for retailers, Raju et al. (1995) present an analytical framework and find that the introduction of store brand could lead to an improvement of the retailer's profit if the cross-price sensitivity among national brands is low and among the store brand is high. Narasimhan and Wilcox (1998) study the strategic role the store brand plays. They argue that, the private-label development enhances the retailer's channel power and makes it available to elicit a lower wholesale price by competing with the national brand manufacturer. From the perspective of customer loyalty, Corstjens and Lal (2000) extend the previous studies and find that a retailer can increase her profits by marketing such store brands regardless of whether there exists a cost advantage over the national brand and the retailer is able to obtain lower procurement price from the national brand or not. Chintagunta et al. (2002) provide evidence of both demand and supply effects of store-brand entry. Erdem et al. (2004) empirically study consumer choice behavior with respect to store brands in three different countries. Generally, they find that when consumers are uncertain about the product quality, they may develop expectations about product quality and justify the product by brands, although the quality may be higher for the store brand than for the national brand. However, they do not consider the risk of the retailer of introducing the store brand. Different from the foregoing works, this study focuses on the role of risk which plays in the retailer's market entry decision when both the stocking quantities of national brand and store brand products are endogenously decided. We focus on the risk analysis and adopt the mean–variance formulation to explore risk-averse retailers' market entry incentives of store brand business.

A second stream of related literature is that on the product position of the store brand. Richardson et al. (1994) examine the relative importance of extrinsic versus intrinsic cues in determining perceptions of store brand quality in an experiment,

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