Transportation Research Part E 113 (2018) 22–37

Contents lists available at ScienceDirect

Transportation Research Part E

journal homepage: www.elsevier.com/locate/tre

Does buy-back induce more fashion sub-sourcing? Contract property and performance analysis

Baozhuang Niu[a], Lei Chen[a], Xiaopo Zhuo[b,*], Xiaohang Yue[c]

[a] *School of Business Administration, South China University of Technology, Guangzhou 510640, PR China*
[b] *Sun Yat-sen Business School, Sun Yat-sen University, Guangzhou 510275, PR China*
[c] *Lubar School of Business, University of Wisconsin-Milwaukee, Milwaukee, USA*

ARTICLE INFO

Keywords:
Three-layer supply chain
Procurement outsourcing
Direct-sourcing
Sub-sourcing
Demand uncertainty

ABSTRACT

In fashion industry, we observe that fashion brands like Zara and Gymboree rely on Li & Fung for their clothes manufacturing, but procure materials by themselves (referred to as *direct-sourcing* in this paper). In contrast, Calvin Klein and Timberland authorize Li & Fung to sub-source materials and manufacture clothes (referred to as *sub-sourcing* in this paper). Motivated by these observations, we consider a three-layer supply chain comprising of a material supplier, a procurement agent and a fashion brand, and analyze their preferences over two typical procurement structures: direct-sourcing and sub-sourcing. Under sub-sourcing, buy-back contracts, through which fashion brands return unsold products and thus shift overstock risk to procurement agents, are widely adopted in fashion industry. We identify demand enlargement effect and wholesale power effect of the buy-back contract under sub-sourcing. These two effects change the fashion brands' profit balance between direct-sourcing and sub-sourcing, and may induce the fashion brand to prefer sub-sourcing. We further examine the impact of demand uncertainty on the fashion brand's profits, and observe that sub-sourcing is dominant under low demand uncertainty. When demand uncertainty is high, sub-sourcing with buy-back may outperform direct-sourcing given a moderate buy-back price.

1. Introduction

In the recent years, fashion industry has been among the top three most important industries in the world. The latest industrial reports show that fashion industry accounts for 2% of the world's gross GDP, representing over $3,300,000,000,000 in 2016[1]. Having said that, the development of fashion industry is highly hindered by the difficulties of fashion supply chain management, because fashion brands manage products characterized by short product life cycles, volatile and unpredictable demand, and inflexible supply processes (Sen, 2008).

Typical fashion supply chains are shaped by Li & Fung, a HK-based service company that provides multiple services such as material sourcing, production, quality assurance, cost calculations and logistics. Li & Fung serves more than 250 locations in over 40 different markets across the world, and works with 15,000 suppliers to serve hundreds of fashion brands[2]. Most CEOs of fashion brands state that Li &Fung is the No.1 procurement agent which can be relied on. For example, W. McComb, CEO of Liz Claiborne Inc., comments that "With Li & Fung as a partner, our brands will have access to a vast, worldwide network of manufacturing partners

* Corresponding author.
E-mail addresses: bmniubz@scut.edu.cn (B. Niu), 201610105349@mail.scut.edu.cn (L. Chen), zhuoxp@mail2.sysu.edu.cn (X. Zhuo), xyue@uwm.edu (X. Yue).

[1] "Global fashion industry statistics - International apparel". See https://fashionunited.com/global-fashion-industry-statistics.
[2] "Li & Fung Limited | Global Supply Chain Managers ". See https://www.lifung.com.

https://doi.org/10.1016/j.tre.2018.02.010
Received 2 November 2017; Received in revised form 22 February 2018; Accepted 23 February 2018
Available online 08 March 2018
1366-5545/

and best-in-class systems, management and talent–all of which give us more flexibility and a better competitive position"[2]. Essentially, supply chain partnership between fashion brands (Zara, Calvin Klein etc.) and procurement agents (Li & Fung etc.) can be divided into two types[2]: (1) Direct-sourcing, under which fashion brands as Zara and Gymboree rely on Li & Fung for their clothes manufacturing, but procure materials by themselves. (2) Sub-sourcing, under which Calvin Klein and Timberland rely on Li & Fung for both procurement and manufacturing, for the benefits of "one-stop-services"[2].

Intuitively, sub-sourcing may cost more, as fashion brands relinquish the control over procurement and suffer from significant double marginalization effects: procurement agents distort the system decisions related to quantities and prices. However, sub-sourcing can be beneficial, because materials inventory risk is shifted to the procurement agents, reducing the fashion brands' costs due to demand uncertainty. In the OM field, many scholars have recently designed contracts and characterized conditions under which sub-sourcing outperforms direct-sourcing. For example, Guo et al. (2010) show that, with updated demand knowledge, the two-period profit sum generated under sub-sourcing can exceed that achieved under direct-sourcing. In contrast, Wang et al. (2014) show that, the more significant double marginalization effect under sub-sourcing dominates the cost savings derived from material inventory risk shifts. Therefore, the comparison of direct-sourcing and sub-sourcing does not have clear answers and hence, induces various debates in practice, especially in fashion industry where demand uncertainty is high (Shen et al., 2013).

We note that, fashion brands may hold large amounts of unsold products (25–40%) at the end of a selling season (Shen and Li, 2015). Therefore, close collaboration throughout the fashion supply chain becomes indispensable, and buy-back contract is extensively adopted (Shen and Li, 2015). Under buy-back contract, fashion brands can return unsold products to procurement agents at the end of a selling season, at a pre-determined buy-back price. This shifts part of the *overstock* risk from fashion brands to the procurement agents, which encourages the fashion brands to order more and improves the performance of the entire supply chain. It is worth noting that, buy-back contract between a fashion brand and a procurement agent only exists under sub-sourcing, because once fabric is cut and made into clothes, it cannot be returned to the suppliers.

In this paper, we mainly follow the settings of Wang et al. (2014), and examine the contract property of sub-sourcing with buy-back, which is motivated by practice in fashion industry but absent in Wang et al. (2014). We answer the following research questions: Will sub-sourcing with buy-back break Wang et al. (2014)'s results that direct-sourcing is dominant? If the answer is yes, under what conditions and why?

We consider a three-layer fashion supply chain comprising of a fashion brand, a procurement agent, and a material supplier. The supplier wholesales materials (e.g. fabric) to the fashion brand (or the procurement agent) under direct-sourcing (or sub-sourcing). In contrast, the procurement agent signs a buy-back contract with the fashion brand under sub-sourcing. We study three typical scenarios defined as follows (Fig. 1).

(1) **scenario D,** where the fashion brand uses direct-sourcing involving a wholesale price contract between the fashion brand and procurement agent.
(2) **scenario S,** where the fashion brand uses sub-sourcing involving a wholesale price contract between the fashion brand and procurement agent. There is no buy-back.
(3) **scenario SB,** where the fashion brand uses sub-sourcing with buy-back where the fashion brand can return unsold products to the procurement agent.

We compare these three scenarios to investigate the preferences of the fashion brand towards procurement outsourcing structures, and characterize the properties of sub-sourcing with buy-back. Our findings are summarized as follows.

First, we focus on scenario SB (sub-sourcing with buy-back) and identify two effects induced by the buy-back price: (1) demand enlargement effect, (2) wholesale power effect. Demand enlargement effect refers that the fashion brand's ordering quantity increases in the buy-back price. Wholesale power effect refers that the procurement agent's wholesale pricing power can be enhanced or

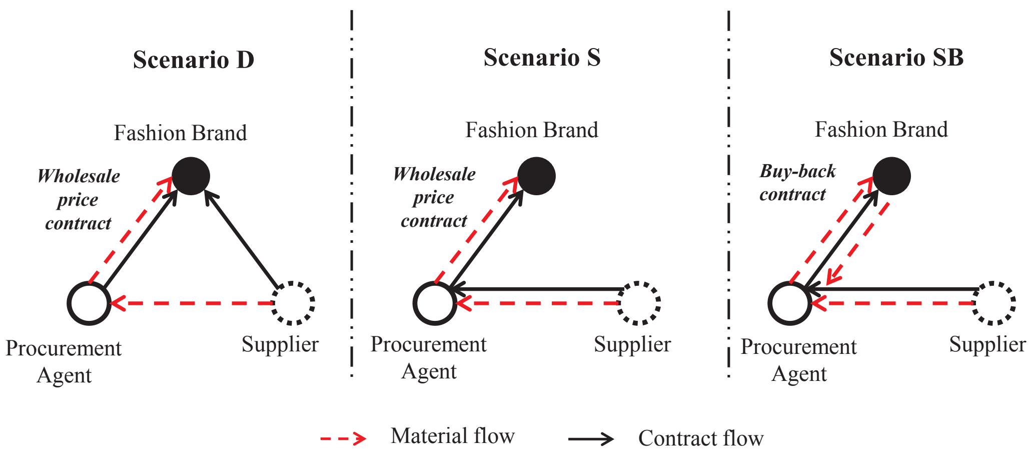

Fig. 1. Three typical scenarios.