Punishing or subsidizing? Regulation analysis of sustainable fashion procurement strategies

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ABSTRACT

In the recent years, the fashion and apparel industry has seen intense competition and increasing production quantity, along with growing concern about the sustainability issues and the environmental impacts. Many companies in fashion supply chains have tried various approaches to be more "green", and procurement is one of the most important functions which influences supply chain sustainability, because procurement does not only affect the supply chain output but also change the supply chain structure. In this paper, we consider a typical fashion supply chain comprising of an apparel manufacturer, a retailer and a logistic service provider (LSP), where we analyze two commonly used procurement strategies: control and agency. We examine the effects of two widely used government regulations: punishing and subsidizing, on the management of sustainable fashion procurement. We show that, there exist conflicts between supply chain profit goals and sustainability goals: The retailer will obtain more profits under control, but the price is that it determines a larger order size and the supply chain becomes less sustainable. To improve sustainability, a local government can either punish or subsidize the retailer. We show that, punishing can only reduce the order size, while subsidizing may induce the retailer to change its procurement strategy from control to agency, when the subsidy exceeds a threshold. We also find that the objectives of improving sustainability and maximizing social welfare may be conflicting, so it is an important task to find a balance between them for the government.

1. Introduction

The fashion and apparel industry is one of the world's oldest industries in the world and generates thousands of billions of dollars each year. According to a report by the European Commission, the textile and clothing industry is the world second biggest economic sector and occupies 7% of the total world exports (European Commission (EC), 2013). Along with the substantial output of this industry, however, there has been growing concern about the issue of sustainability and the environmental impacts of fashion industry. The apparel manufacturing is highly intertwined with many sustainability and environmental issues, for example, energy and water use, toxic dye, waste of raw materials, etc. According to another study by European Commission on the environmental impact of products (EC, 2006), clothing alone is responsible for 2 to 10 % of the EUs life-cycle environmental impacts.

Many apparel retailers, such as Levi's, Gap, H & M, and Wal-Mart, have been aware of the importance of sustainability and spent some efforts on reducing production quantity and buying back the waste so as to make themselves more "green". In a recent report by the United States Fashion Industry Association (United States Fashion Industry Association (USFIA), 2016), 89% of respondents say ethical sourcing and sustainability issues are more important in their company's sourcing decisions. However, revenue and/or profit

maximization is still a firm's primary objective prior to sustainability concerns. To better control the firms' behavior and improve the sustainability of fashion industry, the governance of fashion supply chains by local government is important and necessary (Y. Li et al., 2014). Generally speaking, government can either punish the companies for the huge amount of material/energy use, or subsidize them for their self-control with sustainability considerations. Therefore, in this paper, we aim at investigating how the local government's punishing and subsidizing regulations can affect the firms' production and procurement decisions, as well as the structure of the fashion supply chain.

According to previous studies and industrial observations, there are two important properties of fashion supply chain structure: (1) the buy-back contract is widely used; (2) the procurement function can be outsourced to a logistics provider (LSP). For the former, possible reason is that, the management of demand uncertainty in fashion industry is particularly difficult, due to diverse styles, sizes, short life cycles of apparel, etc. It is reported that "meeting consumer demand" is ranked in the Top 5 business challenges in fashion industry (USFIA, 2016). To tackle this problem, manufacturers tends to produce more than the actual demand because the loss of a stock-out is often higher than the unit cost of holding inventory. However, the manufacturers usually rely on fashion retailers to reach the end customers, and the over-produced apparels must be shown in the stores. If the retailers' abilities of managing demand uncertainty are weak, they may place a small order, and the manufacturers' sales goals will not be achieved. Therefore, to encourage retailer's procurement, apparel manufacturers often provide buy-back contracts (also referred to as return policy, see J. Li et al., 2014) along with their supplies to retailers. That is, manufacturer will buy back unsold apparels at retailers (retailers return them to manufacturer) and try to salvage them. While it may be a good way to deal with the demand uncertainty problem, it creates lots of waste during the production and thus more pollution appears. This is a double-edged sword for the economy and the society.

For the latter, we observe that LSPs such as Li & Fung and Eternal Asia Supply Chain Management Ltd,[1] are purchasing for many apparel retailers. For example, Calvin Klein and Tommy Hilfiger,[2] completely delegates their procurement to Li & Fung (Business Wire, 2017). In our paper, this procurement strategy is referred to as "agency". By contrast, Wal-Mart and Kate Spade & Co. both choose to purchase by their own and only ask Li & Fung to handle their logistics service (Layne, 2015). In our paper, this procurement strategy is referred to as "control". Under control, the retailer manages the procurement by its own and directly sources from the apparel manufacturer, while the LSP only handles the related services. Under agency, the retailer delegates the LSP to handle the procurement along with the logistics services. Previous literature has studied the profit differences of these two procurement strategies, without the consideration of supply chain sustainability. Typical examples include Guo et al. (2010), Chen et al. (2012), and Wang et al. (2014). In this paper, we develop a stylized model to analyze the impact of the apparel retailer's procurement strategies on the fashion supply chain's sustainability. We focus on the impact of two government regulations: punishing and subsidizing.

Our research questions are threefold: (1) Which procurement strategy is more profitable for the parties in a fashion supply chain? (2) Which procurement strategy is more "green" and sustainable for the society? (3) Is there any effective regulation that a local government can adopt to affect the retailer's procurement strategy and improve the sustainability?

We first show that, without the local government's input, the control strategy is always more profitable for the retailer. Under control, the total ordering and logistics cost of the retailer is lower, and hence it is willing to order more from the apparel manufacturer so as to reduce the risk of stock-out. In addition, we show that, the retailer and the LSP are both better off under control than that under agency. However, the control strategy is less sustainable due to the larger amount of waste along with the increased production quantity. Facing to the conflict of profitability and sustainability, most retailers will still place profitability as their foremost objective. According to a survey by USFIA about the retailer's sourcing decision, 78% of respondents choose "directly source from a selected supplier" while only 33% of respondents choose "turn internal product package to a third party" (USFIA, 2016).[3]

Being aware of this conflict, a local government has incentives to establish some regulations to affect the retailer's decision and improve the sustainability of a fashion supply chain. We consider that, the local government can either punish or subsidize the retailer for this goal. With a punishing regulation, the local government will impose a unit penalty to the retailer for the ordering quantity that exceeds the optimal one under agency. That is, the retailer will only be punished under control because of the increased ordering quantity. With a subsidizing regulation, the local government will award a unit subsidy to the retailer for the ordering quantity that is below the optimal one under control, so that the retailer is more willing to choose the agency regulation without the concern of too few ordering quantity. By analyzing and comparing the outcomes under these two regulations, we show that, punishing can never push the retailer to change its procurement strategy, but just reduce its order quantity. By contrast, subsidizing can encourage the retailer to choose the agency strategy, if the unit subsidy is large enough. Having said that, the accurate threshold of the unit subsidy is difficult to compute, and the effect of a subsidizing regulation is also constrained by the financial state of the local government. On the contrary, punishing is always effective and can increase the government's income. Therefore, a punishing regulation might be more attractive for the government, because it is costless and hence more robust.

In the extension, we generalize the bounds of punishing and subsidizing, and analyze their effects on the retailers decisions. The two general bounds can be any given value and therefore can better describe government regulations. That is, given any value above which the government will punish the retailer for over booking/ordering, we characterize the retailer's responses, and examine the effect on supply chain sustainability. Similarly, given any value lower than which the government will offer rewards for production reduction, we examine the effects of the regulations. Our study can be particularly important in today's China, because "destocking

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[1] Li & Fung and Esternal are also referred to supply chain service provider/manager in the other papers/news.

[2] Fashion brands like Calvin Klein and Tommy Hilfiger are actually fashion retailers, because they outsource the manufacturing function to the upstream contract manufactures. Therefore, we exchangeably use fashion brands and fashion retailers throughout this paper.

[3] There are five choices in the survey and they are non-exclusive. That is, some retailers may have multiple sourcing models with different manufacturers, and therefore the sum of percentages can exceed 100%.