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# Incorporating social media observations and bounded rationality into fashion quick response supply chains in the big data era <sup>☆</sup>

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## ABSTRACT

In this paper, we study the fashion quick response program with social media observations, demand forecast updating, and a boundedly rational retailer. We analytically find that the likelihood of having good social media comments on the product plays a critical role in affecting the value of quick response, and its impact is mediated by the fashion retailer's prior attitude towards the market demand. We then demonstrate how a Pareto improving situation can be achieved under quick response, and uncover that manipulating social media comments can benefit the manufacturer under the surplus sharing contract, but not under the two-part tariff contract.

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## 1. Introduction

Quick response programs are well-established in modern supply chain management. Among different features of real world observed quick response programs, the most critical and essential ones are: (i) The shortening of lead time, and (ii) the use of information to improve demand forecast and hence the respective inventory planning. Although the quick response program has been proposed in the fashion industry for decades, it is still an important and timely supply chain management system. In fact, today's fashion industry is filled with various influential concepts such as fast fashion, demand risk management (Cantor et al., 2014), sustainability, and corporate social responsibility. It is amazing to observe that quick response relates to all of them. To be specific, to support fast fashion business models, quick response is fundamental. Quick response can improve sustainability (Choi, 2013; Govindan and Cheng, in press) and corporate social responsibility of the supply chain system (Govindan, in press) because it better matches supply and demand which benefits both the environment (e.g., reducing unsold products and wastes) and the society (e.g., improving the consumer welfare).

Fashion retailers are now operating in the big data era (Chan et al., 2016; Wang and He 2016). The advance of mobile technologies (Xu et al., 2014), product tracking technologies (e.g., RFID) (Basole and Nowak, in press), cloud computing (Nohadani et al., 2016), social media tools (Aloysiu et al., in press; Colicev et al., 2016), enterprise systems (Duan and Xu, 2016), and business analytics applications (Cao et al., 2015; Hazen et al., in press; See-To and Ngai, in press) have revolutionized the way fashion retailers operate. For example, the fashion retailer Sears has extensively invested in big data related

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technologies so as to achieve an efficient omni-channel retailing operation. In particular, social media platforms such as Facebook, YouTube, Twitter, etc are very popular and well-developed. Comments from consumers on these social media platforms, which form a set of “big data” (Choi et al., in press), would definitely affect the fashion retailers regarding their beliefs towards the future demand.

For fashion retailers, under quick response, two sources of information can hence be acquired regarding demand of a future product, namely the “core” information from the sale of a related product, and the “supplementary” social media information. Both would affect the belief and the behaviors of the fashion retailer. In this paper, we explore the following situation: when the social media information is consistent with the fashion retailer’s prior belief towards the market demand or the observed sale projection (i.e., from the core information), the fashion retailer is more confident and will place an order with a higher certainty (and hence a lower degree of bounded rationality). On the contrary, if the social media information is inconsistent with the fashion retailer’s acquired information, the fashion retailer is less confident which leads to a higher degree of bounded rationality in its ordering. Thus, this paper combines the social media observation and the real market demand observation into the analytical model and explores from a behavioral operations management perspective the respective quick response fashion supply chain.

The contribution of this paper is stated as follows: First, we develop a novel model which relates the fashion retailer’s degree of bounded rationality to its level of confidence towards the future market demand in the presence of social media. Second, we analytically prove that the likelihood of having good social media comments on the product plays a critical role in affecting the value of quick response, and its impact is mediated by the fashion retailer’s prior attitude towards the market demand (optimistic, neutral or pessimistic). Third, from the quick response supply chain system’s perspective, we analytically demonstrate that a Pareto improving situation for implementing quick response is achievable by both the two-part tariff contract and the surplus sharing contract. Interestingly, comparing between these two contracts, we reveal that by manipulating the social media comments (e.g., by hiring people to add good or bad comments), we can improve the manufacturer’s expected profit under the surplus sharing contract, but it does not work for the case when the fashion retailer and the manufacturer adopt the two-part tariff contract. To the best of my knowledge, this paper is the first study which incorporates social media information, market demand information and bounded rationality behaviors into the analysis of quick response supply chain systems. All insights are novel and derived in closed-form.

The remaining parts of this paper are organized as follows. First, a literature review is reported in Section 2. Then, the formal analytical model is introduced in Section 3. Analyses and findings on both the traditional response and quick response modes of operations, as well as the expected value of quick response, are presented in Section 4. The contractual arrangements in the fashion quick response supply chain and the respective insights on manipulation of social media comments are explored in Section 5. This paper concludes with a discussion of managerial implications in Section 6. All proofs and some important derivations can be found in Appendix A.

## 2. Literature review

Three streams of research are relevant to this paper and we review them as follows.

### 2.1. Quick response programs

First, in the operations research and management science (OR/MS) literature, quick response supply chains have been investigated for almost two decades. Earlier studies such as Fisher and Raman (1996), Iyer and Bergen (1997) and Donohue (2000) are all motivated by industrial practices in the fashion industry. To be specific, Fisher and Raman (1996) investigate the value of early sales information in an accurate response program. Iyer and Bergen (1997) discuss the quick response program in a single manufacturer single retailer supply chain channel. They focus on exploring Pareto improvement in the quick response supply chain and propose measures such as volume commitment, service commitment and wholesale price commitment to help. After that, Gurnani and Tang (1999); Donohue (2000) and Choi et al. (2003) extend the single-ordering analysis to the case with two orderings. Information updating has been considered in all of them, and Donohue (2000) focuses on measures which can optimize the respective supply chain and Choi et al. (2003) study the level of profit risk reduction with the use of quick response. Motivated by the presence of demand and cost uncertainty, Liu and Nagurney (2013) study in a global sourcing context the quick-response production system facing both demand volatility and cost uncertainty. In recent years, many quick response related studies include consumers, such as the forward looking strategic consumer behaviors (Su and Zhang, 2008; Du and Chen, in press), in the analysis. For example, Cachon and Swinney (2011) discuss the fast fashion program, which is supported by quick response, with the considerations of strategic forward looking consumer behaviors. Yang et al. (2015) specifically examine how quick response performs in the presence of strategic consumers. Most recently, Lee et al. (2015) study the supply chain systems selling to loss-averse consumers. The authors propose that the quick response program is an effective way to achieve an efficient supply chain with loss-averse consumers. This paper is related to Iyer and Bergen (1997) in which the same Bayesian information updating model is employed for modeling the demand forecast updating with the use of information from the related product’s sale. We also consider contractual arrangements to achieve Pareto improvement in the quick response supply chain. However, different from all of them, this paper includes the social

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