Decision Support Systems 56 (2013) 131–139

Contents lists available at ScienceDirect

Decision Support Systems

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

Will a supplier benefit from sharing good information with a retailer?☆

Tsan-Ming Choi [a,*], Jian Li [b], Ying Wei [c]

[a] Business Division, Institute of Textiles and Clothing, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong
[b] School of Economics and Management, Beijing University of Chemical Technology, Beijing 100029, China
[c] Management School, Jinan University, Guangzhou 510632, China

ARTICLE INFO

Article history:
Received 10 September 2012
Received in revised form 10 April 2013
Accepted 16 May 2013
Available online 2 June 2013

Keywords:
Supply chain management
Forecast updating
Returns policy

ABSTRACT

Information sharing has been known to be crucial in supply chain management. Prior empirical finding reveals that suppliers in practice tend to help their trading partners improve forecast accuracy. This paper examines this issue and explores the up–down (from an upstream supplier to a downstream retailer) strategic information sharing issues in a two-echelon supply chain. We first model a supply chain with forecast updating and returns policy. The forecast updating scheme adopts the Bayesian approach with unknown mean and unknown variance. We then proceed to analytically explore the effects of forecast updating on the supplier and the retailer. Our analysis has revealed that: 1. Demand information with low relevance can lead to a loss to the retailer. 2. In the absence of returns policy, the supplier has an incentive to provide "bad information" which may be harmful to the retailer. 3. The supplier will provide "good information" to the retailer only under the returns policy. 4. With up–down information sharing, win–win coordination can be achieved by using a proper returns policy. Many of these results can supplement and challenge the prior research findings that supplier has good incentive to help retailers in improving forecast.

1. Introduction

Information sharing between channel members in a supply chain has been shown to be highly important. For example, it can help alleviate the notorious bullwhip effect [17] and enhance many operational decisions such as inventory [28] and pricing. With the advance of modern technology, such as RFID and web-based EDI, supply chain channel agents can conveniently share information for improving their respective operations.

Previous studies have shown that information sharing [18] by retailers generally benefits the manufacturers directly [26]. However, whether information shared by manufacturers will always benefit the retailers is still unclear. Recently, Taylor and Xiao [29] have revealed an insightful and interesting finding that an upstream manufacturer is benefited from selling to a retailer who is a good forecaster.[1] Moreover, prior empirical finding based on a survey of 120 companies reveals that suppliers in practice put "improving trading partner's forecast accuracy" as top priority [14]. It is hence interesting to explore further the strategic information sharing issues in the supply chain.

At the same time, supply contracts have been shown to be useful in enhancing supply chain performance by dampening the double marginalization effect in the supply chain [6,7]. Among different types of supply contracts, a contract called "returns policy" is commonly adopted in the industry and widely explored in the literature.

☆ We sincerely thank the chief editor Professor James Marsden, the area editor, and the anonymous reviewers for their constructive and helpful comments which led to major improvement of this paper. This research is partially supported by RGC (HK) General Research Funding — PolyU 5420/10H, and the National Natural Science Foundation of China under Grant No. 71101063.

* Corresponding author. Tel.: +852 27666450.
E-mail addresses: jason.choi@polyu.edu.hk (T.-M. Choi), lijian@mail.buct.edu.cn (J. Li), yingwei@jnu.edu.cn (Y. Wei).

0167-9236/$ – see front matter © 2013 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.dss.2013.05.011

[1] Notice that in [29], Taylor and Xiao assume that the retailer has private observation (and hence information) of her own consumer demand forecast and all other supply chain model parameters are common knowledge to both the retailer and the manufacturer (p. 1586). Thus, they assume that the retailer knows everything in the supply chain. Obviously, these assumptions are non-trivial and rather restrictive. As such, Taylor and Xiao [29] and this paper are fundamentally different because they consider a manufacturer selling to a retailer who is a super supply chain agent (because the retailer knows everything). Information is acquired by the retailer herself and employs it for inventory decision. For the supply chain model in our paper, information is acquired by the upstream supplier and is privately owned by the supplier. The supplier can hence decide which specific piece of information to share with the downstream retailer. As a consequence, there is a strategic incentive issue on whether the supplier will share good or bad information to the retailer. This issue is inherently absent in Taylor and Xiao [29] because they assume the retailer knows everything in the supply chain.

Under the returns policy, the supplier promises the retailer to buy back any leftover of its own product by the end of the retail selling season with a partial refund. The returns policy is known to be effective in coordinating supply chains [24] and is one of the most widely seen supply contracts in practice [8,21]. As a result, this paper also examines the use of returns policy in the supply chain with information sharing.

To be specific, in this paper, we study a supply chain with one upstream (up) supplier and one downstream (down) retailer.[2] For the upcoming season, the retailer needs to place an order to the supplier in order to secure the needed quantity of a seasonal fashion product. Facing a short selling season and following the lead time requirement, the retailer can place only one order while she can order either early or late (up to a certain time point). If the retailer orders late, she has a chance to improve her forecast regarding the upcoming seasonal product's demand by some market information. In this paper, we consider the situation that the supplier will offer the demand data of a pre-seasonal product to the retailer (and hence we call it "up–down information sharing"). This kind of situation is rather common in various industries such as fashion apparel. For example, if we consider the supplier as the wholesale office of a sportswear brand such as Nike or Adidas, he has the demand data of all kinds of the respective branded products. In order to let the retailer know more about the market trend and popularity of the forthcoming seasonal product, the supplier will usually provide market information regarding the demand of some related pre-seasonal product(s). Following this simple industrial practice, various open research questions hence arise:

(i) Among the many pre-seasonal products, strategically, which one's data should be selected by the supplier and be shared with the retailer?
(ii) Does a pre-seasonal product which is related to the seasonal product in terms of their demand variances but not their means an appropriate choice?
(iii) Would the selection and sharing of a pre-seasonal product's demand information which is beneficial to the retailer also benefit the supplier? Alternatively, would the supplier have an incentive to share with the retailer some information which hurts the retailer but benefits himself [3]?
(iv) With information sharing, how can the supplier coordinate the supply chain (establish a win–win situation) by using the returns policy?

The objectives and contributions of this paper are to analytically address the above questions and provide managerial insights.

The rest of this paper is organized as follows. Section 2 reviews the three streams of related literature. Section 3 presents the forecast updating model. Section 4 derives the performances of the supply chain and its agents with and without forecast updating. Section 5 explores the effects of forecast updating and information sharing. Section 6 concludes this paper with a discussion on managerial insights. To simplify our exposition, all proofs and detailed derivations are provided in Appendix.

2. Literature review

Three streams of work are related to this paper, namely (i) the demand forecast [19] updating model, (ii) the optimal inventory policies with information updating, and (iii) the supply chain coordination mechanisms with information updating. We will review them as follows.

In terms of forecasting the unknown parameters of the demand distribution, Bayesian approach has been widely adopted since the 1950s [12,27]. The idea is to make use of information to obtain the posterior distribution (a-posteriori) from the estimated prior distribution (a-priori). Early works include [1,2,23]. Later on, motivated by the quick response (QR) industrial practice, Iyer and Bergen [16] studied the QR strategy for a manufacturer–retailer supply chain. Using the normal observation process (with known variance) and normal prior demand distribution, they divided the planning horizon into two distinct stages. Information observed in the first stage is used to revise the distribution parameters via a Bayesian approach. Following the Bayesian information updating with a conjugate pair, the variance of the demand distribution is assumed to be always decreased after observation. They built models of inventory decisions for both the manufacturer and the retailer. They discussed the benefits to each one of them before and after adopting QR. Choi et al. [10] compared two Bayesian models: One follows Iyer and Bergen [16] with the forecast revision on the unknown mean of demand only, the other follows Berger [3] with the forecast revisions on both the unknown mean and unknown variance. They showed that the model in [3] outperforms [16] by allowing more precise information updating. Similar to the above reviewed literature, this paper also employs Bayesian information updating model in examining the supply chain information sharing issues. However, this paper specifically focuses on the top–down scenario of information sharing which is different from the majority of the reviewed literature above.

Based on the updated demand information, an important problem is to identify the optimal inventory policy. For example, Gurnani and Tang [15] studied the two-stage ordering problems with forecast revisions and uncertain future ordering cost. They explored the case under which the retailer can place orders from the manufacturer at two distinct time instances. Key insights on the cases with worthless and perfect information are generated following an assumption with the bivariate normal distribution. Another interesting related area is on advance selling [28]. By advance selling, the retailer can better forecast the selling season demand because orders received in the advance selling period is usually correlated with the in-season demand. Despite being an appealing idea, advance selling is recently challenged by the analysis which takes consumer risk preference into account [25]. This paper also studies the inventory decision in the supply chain with information updating. However, the focal point of this paper is mainly on exploring the strategic issue on sharing "good" or bad" information and the respective influences on the inventory decisions and supply chain performance. These are some critical issues not yet addressed in the literature and they highlight the important differences between this paper and the above reviewed works.

In a supply chain with information updating, channel coordination becomes an important issue [20]. In particular, it may not be beneficial to the manufacturer if he allows the retailer to postpone her ordering decision even though such action allows the retailer to update her forecast and improve her expected profit [16]. Chen and Xu [5] considered a seasonal product supply chain with an inherent conflict between the retailer and the manufacturer owing to the issue on ordering time postponement (the retailer wants to delay the ordering decision and hence enjoys the benefits from information updating while the manufacturer suffers by having insufficient production time and even a small expected production quantity). Based on Iyer and Bergen's [16] model, Chen and Xu [5] provided analytical compensations plans with which both the manufacturer and the retailer will be benefited after information updating and hence achieve the Pareto improving situation. Other related works in this scope include a study on the backup agreement contract in fashion supply chains

[2] To enhance presentation, we take the retailer as a female and the supplier as a male in this paper.

[3] This issue is non-trivial because there are many cases in which forecast updating and information sharing will benefit one supply chain agent but not the other(s). For example, on one hand, Iyer and Bergen [16] found that the forecast updating scheme under a Quick Response program is beneficial only to the retailer but not the manufacturer in most cases and Pareto improvement can be achieved only with additional measures. On the other hand, Lee et al. [18] studied a two-stage supply chain and they revealed that information sharing is beneficial to the upstream supplier but not the retailer.