



Contents lists available at ScienceDirect

Omega

journal homepage: [www.elsevier.com/locate/omega](http://www.elsevier.com/locate/omega)

## Preselling to a retailer with cash flow shortage on the manufacturer<sup>☆</sup>

Yongbo Xiao<sup>a</sup>, Jihong Zhang<sup>b,\*</sup>

<sup>a</sup>School of Economics and Management, Tsinghua University, Beijing 100084, China

<sup>b</sup>International Business School, Beijing Foreign Studies University, Beijing 100089, China

### ARTICLE INFO

#### Article history:

Received 18 December 2016

Accepted 9 September 2017

Available online xxx

#### Keywords:

Supply chain management

Advance selling

Cash flow shortage

Financial supply chain

Newsvendor models

### ABSTRACT

In this paper, we consider a supply chain that consists of one manufacturer and one retailer. Due to long production lead time and high cost associated with bank loans, the manufacturer considers offering products at a discounted price, before production starts, to the retailer to raise the necessary cash for production. We investigate the manufacturers optimal mix of financing strategy with preselling by studying a three-stage Stackelberg game between the supply chain members. As a game leader, considering the interest costs associated with bank loans, the manufacturer first determines the discount rate for the presale. The retailer determines the advance ordering quantity and then pays the manufacturer. Given the amount of on-hand cash, the manufacturer determines the amount of cash to be borrowed from a bank (if necessary) and the quantity of products to be produced. Finally, market demand is realized and satisfied by the inventories of the retailer and/or the excess inventory of the manufacturer. Optimal pricing and quantity decisions involved in the supply chain are studied. We propose a preselling-based incentive scheme that consists of a pre-ordering contract and a bidirectional compensation contract to motivate the manufacturer to increase production quantity and coordinate the supply chain. Numerical studies are conducted to show the benefit of the preselling strategy.

© 2017 Published by Elsevier Ltd.

### 1. Introduction

This study is motivated by the practice that we observed from Zhongneng Chemical, which is one of the top 50 producers of chemical fertilizer in China ([www.znch.com.cn](http://www.znch.com.cn)). As one of its major product lines, UREA is characterized by a short selling period and a long production lead time. In particular, most sales occur in May and June since mid-June to early July is the best season for autumn planting. The problem is that, UREA is produced continuously throughout the year, because any breakdown of the production can generate substantial loss for Zhongneng. Therefore, the production of UREA requires a large amount of money, given that most cash in-flows occur only during the selling season. Although a small portion of the required working capital can be satisfied by borrowing money from banks, Zhongneng must pay a high cost (i.e., interest cost) to raise capital from other sources. In recent years, cash scarcity across China has sharply driven up financing costs. For example, the yearly interest rate for private lending for mortgages in certain areas (e.g., Wenzhou City of China) exceeds 30%. This situation creates great pressure for manufacturers like

Zhongneng, because of the inflexibility in adjusting its wholesale price (which is already determined by the long-term contract with downstream distributors), a high interest rate increases the overall cost and therefore decreases the profitability for manufacturers. To cope with the challenge of cash flow shortage, Zhongneng considered raising capital by preselling to distributors.

Preselling to downstream firms to collect working capital before production and final-product delivery is common in many industries apart from the chemical industry. Two typical examples are the household electrical appliance and liquor production industries in which the need for working capital is considerable. For example, Zhuhai Gree Corporation ([www.gree.cn](http://www.gree.cn)), one of the leading household electrical appliance manufacturers worldwide, states that its trade clauses between clients are largely based on preselling. Its 2016 annual report reveals that Gree's ending balance of "unearned revenue" (i.e., advance payment) has reached 10 billion RMB, which is a 31.5% improvement over the beginning balance. Kweichow Moutai Co., Ltd ([www.moutaichina.com](http://www.moutaichina.com)), which is praised for producing China's "national alcoholic drink" and is one of the three most famous liquors worldwide, experienced even higher growth rate than Gree in preselling in 2016. The company's annual report shows that the ending balance of advance payment

<sup>☆</sup> This paper was handled by Associate Editor Michael Fry.

\* Corresponding author.

E-mail addresses: [xiaoyb@sem.tsinghua.edu.cn](mailto:xiaoyb@sem.tsinghua.edu.cn) (Y. Xiao), [zhangjihong@bfsu.edu.cn](mailto:zhangjihong@bfsu.edu.cn) (J. Zhang).

corresponds to a 112.3% improvement over the beginning balance in 2016.<sup>1</sup>

In a “preselling” program like that of Zhongneng, Gree, and Moutai, firms offer to sell their products, possibly at a discounted wholesale price, long before the selling season. If a distributor responds to the program and places an advance order, he/she needs to pay immediately, whereas the delivery of products is postponed until the selling season. Intuitively, preselling provides a “win-win” solution to firms involved in the supply chain. On the side of manufacturer, besides locking in certain amount of demand in advance, it creates another means of financing. This is extremely valuable when the financing cost from traditional sources, e.g., bank loans, is high. On the side of distributor, it guarantees a minimal quantity on the final-product delivery. This is especially beneficial when the manufacturer has a limited capacity. Nevertheless, to benefit the most from the preselling strategy, the manufacturer (say, Zhongneng) is faced with many challenging questions. The first question is: should Zhongneng offer a wholesale price discount during the presale? If a discount is needed to motivate the distributor to order more in advance, then Zhongneng will incur additional costs. Therefore, how should the firm balance the costs from loans and preselling and choose an appropriate financing mix to improve his/her overall profit? Specifically, to what extent should he/she discount the wholesale price in preselling, how much should he/she borrow from a bank, and how many should he/she produce considering the interactive behavior of the distributor? In addition, from the perspective of the entire supply chain, can a preselling-related incentive scheme be devised to motivate Zhongneng and its distributor to act in a coordinated way? In this paper, we develop a model to gain insights into the nature of these questions.

We consider a stylized supply chain that consists of one manufacturer and one retailer facing an uncertain demand. Due to cash flow shortage on the manufacturer’s side, he offers to sell his products at a discounted price, before production starts, to the retailer to collect cash necessary for production. We study a three-stage Stackelberg game between the supply chain members. As a game leader, considering the interest cost associated with bank loans, the manufacturer first determines his discount rate for the presale. As a response, the retailer determines the advance ordering quantity and pays the manufacturer. Given the amount of on-hand cash, the manufacturer determines the amount to be borrowed from a bank (if necessary) and the quantity of products to be produced. Finally, market demand is realized and satisfied by the inventories of the retailer and/or the excess inventory of the manufacturer. Following the wide stream of studies on supply chain coordination (e.g., [2,8]), we devise an incentive scheme for the supply chain considered to motivate the manufacturer and retailer to act in a coordinated way.

The major contributions of this study include the three following aspects of results.

(i) Preselling as a means to raise cash needed for production provides a win-win solution for the manufacturer and retailer. The optimal financing and producing strategies of the manufacturer may be one of the three following options, depending on the combination of parameters. That is, he simply produces up to the exact quantity pre-ordered by the retailer, he spends all the cash collected from presales without any bank loans, or he produces to a fixed level with certain amount of bank loans. The first option results in a “push” supply chain and the latter two results in a mixed supply chain (Section 4).

- (ii) Apart from the “double-margination” effect that widely exists in supply chains, high interest cost associated with bank loans can induce the manufacturer to produce less quantity (as compared to the centralized supply chain). Therefore, to realize the same efficiency as that of the centralized system, the retailer should motivate the manufacturer to produce more. This course of action is in sharp contrast to the buy-back or return contracts in which the up-stream firm motivates the down-stream firm to order more. Our proposed preselling-based incentive scheme consists of two parts: a pre-ordering contract under which the retailer provides a portion of the working capital that the manufacturer needs for production and a bidirectional compensation contract under which the supply chain members compensates each other for any unsold items. Under certain conditions, the pre-ordering contract together with the bidirectional compensation contract will coordinate the supply chain (Section 5).
- (iii) Preselling plays an increasingly important role in raising cash for the manufacturer as the interest rate associated with bank loans increases. However, this does not require the manufacturer to always motivate the retailer to order more in advance by providing an even lower discount rate when the interest rate is high. Our numerical results in Section 6 show that preselling plays a more important role for the manufacturer in raising capital for production when the interest rate is high, when the manufacturers profit ratio is relatively low, and/or when the market demand is less variable. Besides, the retailer could benefit from preselling rather significantly as well, but not necessarily when the interest rate is high.

The remainder of the article is organized as follows. In the next section, we provide a brief review of the relevant literature. We introduce the model and notation in Section 3 and study the optimal decisions for the supply chain members in Section 4. In Section 5, we propose a preselling-based incentive scheme to coordinate the supply chain. We conduct numerical experiments in Section 6 and conclude the paper in Section 7. Throughout the paper, by default we call the manufacturer as a “he” and the retailer as a “she,” respectively.

## 2. Literature review

Although the idea behind preselling (or advance selling) is not new, its functionality in raising capital from downstream firms has been less explored in the literature. We provide a brief review of the literature relevant to our research. In particular, three streams of literature are related to our study: advance selling, financial supply chain management, and supply chain coordination.

Advance selling is regarded as an efficient marketing tool in which consumers purchase products or services before consumption. Offering advance sales encourages customers to purchase while they are uncertain about their consumption states [17,29,36]. Advance selling helps retailers to expand the market and achieve inter-temporal price differentiation [33], reduce demand uncertainty by collecting advance demand information [30], and exploit consumer risk or loss aversion [23]. More discussion on advance selling to consumers can be found in [27], [37], and [35], among others.

If adopted between supply chain members (e.g., from manufacturers to retailers), advance selling (or preselling) can be used to reduce risk from demand and/or supply uncertainty. For example, by assuming that the price of the late order is random, Deng and Yano [13] studied the effect of a late ordering opportunity on a push system. Cvsa and Gilbert [11] demonstrated that below a threshold level of demand uncertainty, a supplier can benefit from providing adequate pricing incentives to entice downstream buyers

<sup>1</sup> Annual reports of the two companies can be downloaded from websites of Shenzhen Stock Exchange and Shanghai Stock Exchange, respectively.

Download English Version:

<https://daneshyari.com/en/article/7436466>

Download Persian Version:

<https://daneshyari.com/article/7436466>

[Daneshyari.com](https://daneshyari.com)