Transportation Research Part E 118 (2018) 163–183

Contents lists available at ScienceDirect

Transportation Research Part E

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

Selection of financing strategies with a risk-averse supplier in a capital-constrained supply chain

Bo Li[a], Si-min An[a,*], Dong-ping Song[b]

[a] College of Management and Economics, Tianjin University, Tianjin 300072, China
[b] School of Management, University of Liverpool, Liverpool, UK

ARTICLE INFO

Keywords:
Supply chain management
Financing strategy
Trade credit
Risk aversion
Game theory

ABSTRACT

This paper investigates a supply chain where the retailer is capital-constrained and the supplier is risk-averse. The supplier's risk-averse behavior is gauged by Conditional Value-at-Risk method under two financing strategies: partial credit guarantee(PCG) and trade credit financing(TCF). We obtain the equilibrium solutions and characterize the preference of two financing strategies by the switching curves in two-dimensional space of credit guarantee coefficient and risk aversion degree. We find that there exists a region where TCF outperforms PCG for both players. Finally, we extend the model to the case in which both players are risk-averse and obtain similar results.

1. Introduction

For the last thirty years, small and medium-sized enterprises (SMEs) in China have played a significant role in economic development. According to the Business Registration Statistics, by the end of 2016 there were more than 40 million SMEs in China, accounting for 60% of GDP (sme.gov.cn). However, following the global economic crisis, SMEs are experiencing the problems of financing difficulty or financing expensive. In particular, because of their low credit rate and high default risk they have difficulty borrowing money from the bank to perform or expand their normal operations, referred to as the SME financing gap (Jaffee and Russell, 1976; Hussain et al., 2006). In recent years, supply chain financing (SCF) has attracted increasing attention as a means of solving financial difficulties faced by SMEs and has been widely used in practice. Innovative methods of SCF not only help SMEs access loans, but also protect the entire supply chain from bankruptcy risk (Fisher and Raman, 1996; Kouvelis and Zhao, 2012; Cai et al., 2014). There are two typical methods of SCF: bank credit financing (BCF) and trade credit financing (TCF). The former takes the external perspective of the supply chain, whereas the latter takes the internal perspective (Kouvelis and Zhao, 2012).

With regard to bank credit financing (BCF), SMEs often have great difficulty accessing bank loans directly because of immature market mechanisms, high information imperfection, and default risk (Hussain et al., 2006; Kouvelis and Zhao, 2012). Thus, capital-constrained SMEs may have to resort to informal financial institutions for loans, and are forced to pay higher lending costs (Chen et al., 2016). In order to take full advantage of a bank loan, a partial credit guarantee contract (PCG) can be designed to allow SMEs to obtain bank loans (Yan et al., 2016). A PCG is one type of BCF in which the core enterprises in supply chains have the larger scale, higher credit and more information regarding the borrower's credit worthiness than banks. With the help of the core enterprises' credit guarantee, even if the SMEs default, the guaranteeing enterprises will fill any partial gap in the loan for the SMEs, and this mechanism enables the SMEs to obtain bank credit successfully. Furthermore, PCG can be regarded as a form of insurance, which

* Corresponding author.
E-mail addresses: libo0410@tju.edu.cn (B. Li), anryo@sina.com (S.-m. An).

https://doi.org/10.1016/j.tre.2018.06.007
Received 24 January 2018; Received in revised form 13 May 2018; Accepted 20 June 2018
1366-5545/ © 2018 Elsevier Ltd. All rights reserved.

protects the bank from the possibility of SMEs' non-payment, and banks are willing to offer SMEs some extensive credit facilities if SMEs' credits are insured. In fact, there have been plenty of applications to credit guarantee schemes around the world. For example, about 2.8 billion Euros of almost 90,000 guarantees in Europe were provided by credit guarantee schemes in 2012 (eib.org). In addition, according to a report conducted by the Vienna Initiative Working Group, more than 75 percent of banks in Central, Eastern, and South-Eastern Europe have loans under PCG (eib.org). Similarly, Chinese commercial banks, such as the Industrial and Commercial Bank of China (icbc.com.cn) and the Ningbo branch of Everbright bank (cebbank.com) have offered many core firms' credit guarantee contracts in capital-constrained supply chains. If the core firm is the upstream supplier, then the downstream retailer can obtain a bank loan with the credit guarantee contract from the upstream supplier, under which the downstream SMEs can obtain loans without pledging their assets. With the credit support of the upstream suppliers, the downstream SMEs can fill the fiscal gap and reduce the cost of financing. At the same time, the upstream firms can speed up the return of funds and organize their production as soon as possible.

On the other hand, trade credit financing (TCF) is a short-term method of debt financing between the upstream supplier and downstream retailer in capital-constrained supply chains (Cai et al., 2014). That is, in addition to the conventional role of production, the upstream supplier also acts as an investor. The lender will recovery a delayed payment with interest to the borrower at the end of the selling period. For example, in the majority of US companies, TCF is the largest source of working capital, particularly for SMEs. More specifically, in America, TCF occupied 17.8% of total corporate assets in 1991, while in European countries, such as France, Germany, and Italy, more than 15% of corporate assets are represented by TCF (Rajan and Zingales, 1995). Based on a survey of 674 enterprises in Shenzhen and Shanghai stock exchanges from 2001 to 2007, 9.1% of total corporate assets in China are represented by TCF (Cai et al., 2014).

When the supplier offers credit/financing support to SMEs via either PCG or TCF, an issue of moral hazard may exist, since the retailer may go bankrupt or transfer cash to other projects. Therefore, the supplier has to bear a significant risk. Moreover, the PCG or TCF strategy can be seen as a risk transfer mechanism (Beck et al., 2010), which increases the risk of the supplier by providing credit guarantee or bearing the bankruptcy risk directly. Specifically, evidence has shown that the tail risk of the core firms is larger than that of SMEs (Adasme et al., 2006). Hence, we focus on the case where the supplier is risk-averse while the retailer is risk-neutral. However, it is noted that the retailer may also exhibit risk-averse behavior because of demand uncertainty and bankruptcy risk. To accommodate such a situation, we extend the model to the case where both supplier and retailer are risk-averse, as discussed in Section 7.

To the best of our knowledge, there is no research on the operational decisions in capital-constrained supply chains under PCG or TCF strategy considering risk-averse behavior of supply chain members. This paper attempts to fill the gap by introducing the supplier's risk-averse behavior into capital-constrained supply chain models and studying the interactive impacts of the credit guarantee parameter and the risk-averse attitude on the decisions and profits of supply chain members. We aim to investigate the following research questions: (1) How does the risk-averse behavior of the supplier affect the supply chain members' decisions and performance under PCG and TCF strategies? (2) How does the combination of key parameters, such as credit guarantee coefficient and the risk-averse indicator influence two players' decisions and performance under PCG and TCF strategies? (3) Which financing strategy will the supplier and the retailer prefer? How do the key parameters impact the two players' selection of financing strategies? Is there a win-win situation for two players in terms of financing strategy selection?

More specifically, this paper considers a supply chain consisting of a core supplier (he) and a small or medium-sized retailer (she) who is capital constrained. The supplier makes the wholesale pricing decision and the retailer makes the order quantity decision prior to the sale season. The retailer faces uncertain demand. We use conditional value at risk (CVaR) to gauge the supplier's risk-averse attitude and combine it into a risk-averse newsvendor problem. The optimal equilibrium solutions under PCG and TCF are obtained respectively and the sensitivities of some parameters are analyzed. Under the assumption of uniform distribution of demand, we find that the supply chain is viable (i.e. both supplier and retailer are profitable) only if the supplier's risk aversion degree is within in a specific interval, and the intervals differ for the PCG and TCF strategies. We also obtain analytical results regarding the preference of the two financing strategies characterized by a few switching curves in the two-dimensional space with respect to the credit guarantee coefficient and the risk aversion degree. Specific results include: (i) when the supplier's risk-averse indicator exceeds a certain threshold value (which indicates that the supplier tends to be optimistic), no matter how much the credit guarantee coefficient, the supplier will give a lower wholesale price under PCG than that under TCF, while the retailer keeps her ordering quantity unchanged under these two strategies; (ii) when the risk-averse indicator is less than the threshold value (i.e. the supplier tends to be more risk-averse), the decisions of two members will highly depend on the credit guarantee coefficient; (iii) when examining the combined impacts of the supplier's risk-averse attitude and the credit guarantee coefficient, two players normally have different preferences for the financing strategy between PCG and TCF. However, a region in which TCF is the better financing strategy choice for both supplier and retailer exists.

The paper is organized as follows. The Section 2 reviews the relevant literature. Section 3 defines the notations and presents the mathematical model under CVaR criterion. Section 4 derives the equilibrium solutions under PCG and TCF strategy, including the optimal order quantity and wholesale prices. Section 5 compares the performance of the supply chain under the two financing strategies. We conduct a series of numerical analyses in Section 6. Section 7 extends the model to the case where both the supplier and the retailer are risk-averse. Section 8 draws the conclusions.

2. Literature review

Our work is related to three streams of literature. The first stream is concerned with supply chain finance including the

Download English Version:

https://daneshyari.com/en/article/7427409

Download Persian Version:

https://daneshyari.com/article/7427409

Daneshyari.com