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Supply chain finance: Optimal introduction and adoption decisions

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ABSTRACT

Supply chain finance (SCF) can improve supply chain performance by facilitating longer payment terms for buyers and better access to financing for suppliers. In spite of these clear benefits, there is empirical evidence for some hesitation and resistance to SCF adoption, manifesting in an often substantial time lag between a buyer's introduction of SCF and its adoption by all targeted suppliers. Observed adoption processes often resemble the s-shaped Bass-curve suggesting that successful early adoptions support adoption decisions by other suppliers. Based on these observations, we consider supplier SCF adoption decisions within a diffusion model, to obtain insights regarding a buyer's optimal SCF introduction decisions in terms of timing and payment terms. We find that initial payment terms and procurement volume strongly affect the optimal timing of SCF introduction and optimal payment term extensions. The degree to which the buyer can influence suppliers in their adoption decisions affects the optimal introduction timing, but not optimal payment terms. Interestingly, our results suggest that, in spite of the clear benefits, many buyers might be well-advised to postpone their SCF implementations.

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1. Introduction

Trade credit granted by suppliers is an important source of financing. In the UK, for instance, 80% of all business-to-business transactions are made on trade credit (Summers and Wilson, 2002). Even buying firms with strong credit ratings prefer trade credits to bank loans as this improves their net working capital (Petersen and Rajan, 1997). However, from a supply chain perspective this approach is suboptimal if suppliers have weaker credit ratings and thus pay higher interest rates than their customers. An interesting solution to this problem is a practice called supply chain finance (SCF), sometimes also referred to as reverse factoring (Tanrisever et al., 2012). With SCF a supplier delivers to a buyer and provides trade credit by allowing payment due dates. Once the buyer has checked the delivery she confirms the invoice release to her financial institution. Based on this confirmation, the supplier receives the due amount directly from this financial institution, minus some interest based on the buyer's credit rating. The buyer eventually pays the loan principle after expiration of the payment terms. Both parties can significantly profit from using SCF. Suppliers with weak credit ratings benefit from low interest rates. Compared with traditional factoring, SCF is less expensive and does not involve recourse. Buying firms, in turn, use SCF to

extend their payment terms even further and thus obtain more trade credit and improve their working capital (Tanrisever et al., 2012). This is possible without worsening their upstream supply chain's liquidity because SCF provides the supplier with the necessary funds.

However, even though firms could substantially benefit from SCF, its implementation is often delayed. As an illustrative example, consider the adoption process of a large German firm in the industrial automation industry, which introduced SCF in July 2010 and immediately started to invite its relevant suppliers to participate. Fig. 1 depicts the number of suppliers onboarded over time. It clearly resembles the so called Bass curve (Bass, 1969): initially, the number of suppliers using SCF grows slowly, then the growth accelerates before it eventually declines. Wuttke et al. (2013a) explored the adoption process of SCF through a series of six rigorous case studies in European production firms, and they empirically derived two reasons for the observed patterns. First, SCF requires internal clarifying. Procurement officers, who are supposed to use SCF in their daily routines but have not been involved in the SCF implementation process before, need to be persuaded of using SCF. Both the purpose of and processes related to SCF thus needs to be clarified. The more suppliers actually use SCF and the more successful cases there are, the faster clarifying takes place.

The second reason discovered by Wuttke et al. (2013a) is called upstream dissemination and requires a closer look at the suppliers' typical internal decision and incentive structure. Procurement managers of buying firms communicate with sales managers of

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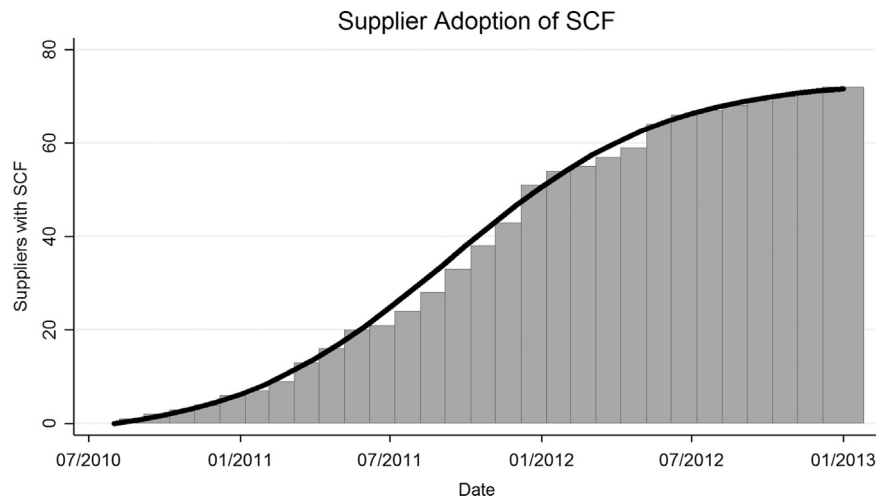


Fig. 1. Number of suppliers using SCF (data from a German firm in the industrial automation industry).

suppliers, whose incentives are based on two outcomes: increased prices and reduced payment terms. However, adopting SCF leads to neither of these goals. Yet, it requires efforts related to understanding the process and identifying knowledgeable colleagues. As a consequence, in the absence of explicit incentives for sales people that encourage exploring SCF, suppliers may not consider SCF adoption in spite of obvious benefits. At the beginning, SCF is new to most of the suppliers' CFOs and CEOs, too, and it might take exposure to a certain number of successful SCF business cases to convince them of the benefits of SCF, and to start the internal process of evaluating and then promoting SCF adoption. Given the financial benefit of SCF, any such decision for SCF adoption promotion in turn increases other suppliers' executives exposure and willingness to explore SCF, so that all suppliers will consider SCF and adopt it, if their evaluation demonstrates financial benefits. In essence, a similar word-of-mouth effect as described by Bass (1969) applies.

While the aforementioned firm introduced SCF in July 2010, it could have also waited until more of its suppliers had been exposed to successful SCF business cases through other buying firms' initiatives, which would have accelerated the diffusion process. Besides a faster introduction process, waiting brings the added benefit of lower introduction costs as the platform technology matures. Yet, waiting also implies foregone profit. This trade-off motivates our main research question: When should buying firms introduce SCF?

A second decision of buying firms within this context regards the extension of payment terms. While payment term extensions do not affect whether the supplier is in consideration of SCF – essentially a supplier will evaluate SCF adoption if the CFO has seen sufficient successful cases – they affect whether a supplier's evaluation will lead to a positive outcome and SCF adoption. Longer payment terms increase the buying firm's benefits, but they also reduce the attractiveness of SCF for suppliers, suggesting a trade-off between per-supplier benefit for the buyer and the number of suppliers eventually using SCF. This leads to our second research question: How much should a buying firm extend payment terms? The objective of our study is thus to make normative predictions on optimal SCF introduction decisions of buying firms.

We consider a sequential game with a buyer (female) and a set of suppliers (male). Along with introducing SCF, the buyer proposes payment term extensions. As long as the supplier is not in consideration of SCF, he will not adopt it. If he is in consideration because his CFO has seen enough successful cases, he will evaluate the offer and accept it if it is in his economic interest. We utilize a social contagion model (cf. Bass, 1969) to capture that suppliers'

consideration of SCF depends on their exposure to successful SCF cases. We then analyze the economic impact of SCF by studying the impact of payment term extensions. We characterize both, the optimal introduction time and the optimal extension of payment terms. Finally, we extend the buyer's decision problem to a game where we consider several buying firms sharing several suppliers.

Our paper contributes to the literature on the finance-operations interface as it comprises several novel perspectives. First we shed light on the importance of timing decisions by buying firms. We show that it is often not optimal to introduce SCF immediately but rather to wait. This provides a formal explanation for the often observed hesitation by buyers who argue that their suppliers would not be ready yet. In fact, we find that each buyer should adopt SCF once a specific fraction of her suppliers are persuaded of the SCF concept. Emphasizing the importance of timing complements former research that primarily assessed the SCF performance based on the assumption that all suppliers are fully persuaded right from the start. Second, our research provides structural results that help to characterize optimal strategies and different types of buying firms: those that should introduce SCF immediately, those that should wait, and those that should never introduce SCF. Third, our SCF introduction framework allows us to explore the role of the influence that buying firms can exert over suppliers. While their influence will not lead to greater payment term extensions, buyers can affect the adoption pace by suppliers. We show that positive influence is a necessary condition for buying firms to introduce SCF immediately and that more influence leads to earlier introduction in general. Finally, we characterize optimal payment term extensions, which are central to the allocation of benefits between buyers and suppliers.

2. Literature review

Two streams of research are related to our work: the operations-finance interface and the innovation diffusion. Next, we review each stream in turn. The intertwining of financial and operational decisions has recently received an increasing attention in the literature (Wuttke et al., 2013a, 2013b; Protapappa-Sieke and Seifert, 2010; Gupta and Dutta, 2011; Pfohl and Gomm, 2009; Hofmann, 2005; Jamal et al., 2000) where the main focus lies on how financial restrictions and decisions influence the operational performance of a supply chain. Wuttke et al. (2013b) and Wuttke et al. (2013a) are both based on multiple case studies providing empirical insights into the supply chain and finance interface. We incorporate several observations of Wuttke et al. (2013b) into our

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