Supply chain finance, performance, and risk: How SMEs adjust their buyer-supplier relationship for competitiveness?

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ABSTRACT

Supply chain finance (SCF) has attracted considerable attention as it is an innovative business model that allows firms, especially small and medium-sized enterprises (SMEs), to convert illiquid assets into cash without incurring additional liabilities, yet, its effects on SME performance and risk have been insufficiently studied. Since the competitiveness of SMEs depends on performance enhancement and risk mitigation, this paper constructs a scaled decile rank transformation of account receivable turnover to gauge the degree to which a supplier implements SCF, thereby examining the relationship between SCF, performance, and risk. We collect data on 4,679 SMEs from the Chinese manufacturing sector. Thereafter, hierarchical linear regression, a complex form of multiple linear regression analysis, is employed to test the hypotheses. The results indicate that an SME’s SCF adoption has a positive impact on its performance but a negative impact on its risk. To further explore cross-sectional variability, the buyer-supplier relationship’s moderating role is investigated, and the results show that an increase in customer concentration strengthens both the positive effects of SCF on performance and the negative effects of SCF on risk. Overall, our study contributes to the literature on the
interface of operations and finance in supply chains by exploring the multiple facets of SCF adoption as well as highlighting the moderating role of buyer-supplier relationship in SCF and SME competitiveness. Finally, we also provide managerial implications for SMEs and financial service providers by validating the value of SCF implementation and the buyer-supplier relationship management in forging competitive advantages.

**Keywords:** Supply chain finance, customer concentration, supplier performance, credit risk, SMEs

**JEL Classification:** D22, G30, L25

1. INTRODUCTION

Maintaining liquidity to support sustainable operation for competitive advantage has become a primary challenge in recent decades. Since the credit crunch became widespread worldwide, a shortage of working capital has been a key operations dilemma for small and medium-sized enterprises (SMEs). In light of this, an alternative to traditional lending practices may be supply chain finance (SCF), which is a collaborative and innovative business model that provides credit and services for suppliers, especially SMEs, to convert illiquid assets into cash without creating additional liabilities (Chen et al., 2018; Zhu et al., 2019). Several studies have shown that implementing SCF improves operational performance by helping SMEs to gain short-term financing, leading to increases in working capital, revenue growth, and supply chain risk mitigation (Gong et al., 2018; Song et al., 2018; Wuttke et al., 2016; Wuttke et al., 2019). Moreover, scholars pointed that SCF can lead the entire supply chain to benefit from the collaboration between the buyer, supplier, and financial service providers (Lam et al., 2019; Wuttke et al., 2016). However, early evidence has mostly based on case studies or the development of operational research models, which raised the need for data-driven empirical evidence.

Understanding the links between SCF, performance and risk is an important issue for both SCF providers and adopters. Traditionally, extended payment terms always result in a higher risk for suppliers, who may often have limited access to short-term financing and face high debt costs (Hofmann and Kotzab, 2010). In contrast, SCF can reduce a supplier’s credit risk by providing low-cost debt capital in the form of financing, factoring, and advance payments. So far, research on SCF has been anecdotal in nature or based on case studies; the paucity of empirical evidence has resulted in the role of SCF in financial performance and credit risk remaining uninvestigated. Such unclarity may render the stakeholders of SMEs unaware of how the introduction of SCF would influence their business competitiveness.

In addition, as Hofmann & Kotzab (2010) argued that the relationship between a supplier and its customers can be the main obstacle to developing a collaborative solution in terms of working capital management, exploring whether cross-sectional variability in a supplier’s financial performance and credit risk response to SCF can occur because of the buyer-supplier relationship is another focus of our study. Drawing on a concept from supply relationship studies, this study uses customer concentration (which also is referred to as customer-base concentration or customer dependence) to explore the role of major customer relationship management in the SCF adoption. Specifically, customer concentration is considered to be a critical dimension of customer relationship management (CRM) for suppliers, representing the degree to which a supplier sells products or services to its main customers who account for a significant share of the company’s sales (Liu & Park, 2020; Patatoukas, 2011; Saboo et al.,
Generally, successfully implementing SCF requires collaboration between suppliers, customers, and financial service providers. Some studies have provided direct evidence of the mechanisms underlying the influence of supply chain relationships on SCF. For example, the implementation of SCF may be hampered by a lack of collaborative vision (More & Basu, 2013), and the high dependence on customers can also negatively affect the service success of SCF (Zhao et al., 2015). Even though the relationship between SCF and supplier performance or credit risk may differ in strength at different levels of customer concentration, there has been little previous discussion about linking CRM and SCF. By examining the moderating role of customer concentration in the implementation of SCF, we provide evidence for the debate on the potential for buyer-supplier relationship to achieve financing benefits.

The primary objective of our research is to empirically demonstrate the importance of SCF in SME’s competitiveness and to investigate the role of customer concentration as a variable that moderates the links of SCF with a supplier’s financial performance and credit risk. Specifically, our study aims to contribute to the literature by addressing the following inquiries: 1) Does an SME’s SCF adoption affect its performance? 2) Does an SME’s SCF adoption affect its risk? 3) Are the relationships linking SCF to performance and risk moderated by customer concentration?

The rest of our research is organized as follows. Section 2 documents the related literature on SCF and develops the research hypotheses. Section 3 presents the research methodology, while Section 4 estimates the proposed effects and illustrates the results. Theoretical contributions, managerial contributions, limitations, and directions for future research are presented in Section 5.

2. THEORETICAL BACKGROUND

2.1. Supply chain finance

SCF constitutes a range of commercial financing solutions for the various financial problems faced by suppliers. If a supplier wants to receive an SCF service, it must first provide certain documentation. Based on this, financial service providers will decide whether to offer capital to ensure a supplier can convert accounts receivable into cash, resulting in sufficient working capital flow, lower debt costs, and new opportunities for financing and factoring. In this section, we review SCF literature and discuss the impact of SCF on a business. We first explain the evolution of the SCF concept and then introduce the general process of implementing SCF. Following this, we summarize how SCF adoption affects the performance and risk of players within a supply chain and how the buyer-supplier relationship affects SCF adoption.

Even though the common view of SCF is that it integrates corporate finance and supply chain network, its nature has almost completely changed since it first appeared in service form. Originally, SCF was recognized as financing activities within supply chains, such as financial flow (Pfohl & Gomm, 2009), assessing the financial performance of a supply chain (Bhagwat & Sharma, 2007), optimizing the financial structure of the players within a supply chain, and facilitating cash flow across company borders (Gomm, 2010). However, these definitions of SCF are no longer consistent with current process management practices.

Our study defines SCF as a collaborative and innovative business model which provides credit and services for suppliers, especially SMEs, to convert non-liquid assets into cash. In fact, maintaining sufficient cash flow is vital to the survival and development of SMEs because the
sustainability of a small business is dependent on its cash holdings. In this respect, the related literature emphasizes that SCF causes accounts receivable turnover, which is known to play a key role in improving cash flow within supply chains (Gomm, 2010; Kelly, 2013; Raghavan & Mishra, 2011; Zhao et al., 2015). As shown in Fig. 1, general SCF approaches rely on cooperation among partners within a supply chain, but SCF requires the involvement of a third-party financial institution who plays the role of service provider and then settles suppliers’ accounts receivable in advance of the buyers’ payment maturity date, lowering the financing costs compared to the suppliers’ own traditional sources of funds. However, despite the evolving interests in this area, literature on SCF is still underdeveloped and a multidisciplinary strategy to research is needed to help mitigate and better manage performance and risk within and across the supply chain.

2.2. Supply chain finance, performance, and risk

There is strong agreement on the importance of SCF as a financing service which can improve supply chain performance (Auboin et al., 2016; Bi et al., 2021; Lekkakos & Serrano, 2016; Liu et al., 2015; Wuttke et al., 2016). Generally, most scholars have reported a positive association between SCF and supply chain performance; they have focused on different aspects of SCF such as financing, factoring, and advance payments. In terms of financing, Raghavan & Mishra (2011) presented the argument that both the supplier and lender (i.e., the financial service provider) may gain benefits from short-term financing, such as increased profit, by employing an operational research model. SCF also includes factoring as a growing source of financing while reducing the costs of lending for SMEs. Based on international factoring data, Auboin et al. (2016) proposed that SME access to international trade is likely to be influenced by factoring. The third aspect of SCF is advance payments. For another example, Thangam (2012) developed an economic-order-quantity (EOQ) based model with perishable products that incorporated both advance payments and two-echelon trade credits and illustrated the benefits of advance payments in terms of reducing the total costs within a supply chain. Overall, these aspects of SCF adoption are explicitly related to the value of a supplier’s accounts receivable, leading to superior supplier performance.

In the present study, supplier Performance is considered as financial performance of a supplier firm (Karahanna & Preston, 2013; Xu & Liu, 2020). This study seeks to investigate whether the implementation of SCF affects supplier performance. Key arguments in the literature supporting the greater implementation of SCF are that it allows longer payment terms for buyers, increases access to loans at low interest rates for suppliers, and improves their working capital (Wuttke et al., 2016). Furthermore, research on the relationship between SCF and supplier performance emphasizes that short-term financing can enhance operational profit (Raghavan and Mishra, 2011) and improve financial performance (Johnson & Templar, 2011). Additionally, SCF can be employed to improve the balance sheets and working capital of suppliers (Wuttke et al., 2013b), which is supported by Thangam (2012), who claims that advance payments via SCF reduce costs and increase profitability. Accordingly, we expect that the implementation of SCF will effectively improve supplier performance:

**H1. There is a positive association between SCF and supplier performance.**

Some scholars, however, have focused on the risks of SCF, and have called into question the view that SCF is beneficial for all players because suppliers transfer their own financial risks to their buyers and lenders, allowing suppliers better access to capital liquidity at more cost-effective rates (Jaffee et al., 2010; Kelly, 2013; Lekkakos & Serrano, 2016; Wuttke et al., 2016).
Due to information asymmetries, the risks facing financial service providers and buyers when implementing SCF can be summarized as follows: 1) both suppliers and buyers with low solvency will not repay the loan (Jaffee et al., 2010; Kelly, 2013); 2) suppliers have the incentive to overstate their initial capital (Chen & Hu, 2011); 3) suppliers could divert the loan to projects with higher risk (Chen & Hu, 2011); and 4) both the buyer and lender will face losses with the bankruptcy of a supplier (Raghavan & Mishra, 2011). Interestingly, Zhao et al. (2015) developed a big data prediction model for the service failure of SCF and suggested low profitability is the most important negative factor affecting the implementation of SCF, followed by the low stability of cash flow, a high dependence on customers, and firm age.

_Credit risk_ is used here to refer to potential loss due to a borrower's non-payment of a loan or other line of credit (Chen et al., 2010; Kim et al., 2017; Liu & Park, 2020). Actually, one of the central tenets of SCF is that increased capital flow will influence not only performance but also risk. The main idea is that SCF allows a supplier to mitigate the credit risk of default with its high-credit customers and financial service providers due to the selling of receivables (Zhang et al., 2015). From the perspective of supply chain risk management, SCF ensures a supplier can collect accounts receivable, resulting in the flexibility and reliability of cash flow, reducing the risk of supply disruption (Gelsomino et al., 2016; Steeman, 2014). In sum, our study examines a supplier’s credit risk and expects that the implementation of SCF will reduce this risk:

**H2. There is a negative association between SCF and credit risk.**

### 2.3. Supply chain finance and buyer-supplier relationship

Prior studies have emphasized the critical impact of buyer-supplier relationship on the implementation of SCF because the implementation involves the direct participation of customers (Hofmann & Kotzab, 2010; More & Basu, 2013; Zhao et al., 2015). For example, More & Basu (2013) proposed that the lack of collaborative vision may cause the service failure of SCF in the context of India. However, research from China indicated that high relation strength (i.e., a high dependence on customers) hurts the service success of SCF (Zhao et al., 2015). In fact, developing and promoting collaborative working capital management solutions requires cooperation among buyers and suppliers (Hofmann & Kotzab, 2010). Thus, it is also of interest to investigate customer relationships’ role on the link between SCF and both supplier performance and credit risk. Based on six European cases, Wuttke et al. (2013a, p. 159) remarked that “Relational strength (trust, power, and communication intensity) has a positive impact on the dissemination of SCF in the sense that it increases the effectiveness of the dissemination process in the supply base.”

_Customer concentration_ refers to the degree to which a supplier sells products or services to its main customers who account for a significant share of the firm’s total sales (Irvine et al., 2015; Liu & Park, 2020; Patatoukas, 2011; Saboo et al., 2017). The relationship between SCF and both supplier performance and risk may differ in strength at different levels of customer concentration. Although there is no empirical evidence to date on the moderating role of customer concentration in this relationship, the theoretical basis of this assumption arises from previous customer concentration research. For instance, Saboo et al. (2017) suggests that the association between a firm’s organizational capabilities and its profitability is affected by customer concentration differences.
In this study, we predict higher customer concentration to strengthen the effects of SCF on supplier performance and credit risk in three ways. First, operational efficiencies may accrue for suppliers with a more highly concentrated customer-base because of greater information sharing, better planning, reduced marketing and administrative expenses, greater product distribution, and improved production coordination and upstream inventory management at the strategic, tactical and operational levels between the buyer and supplier (Ak & Patatoukas, 2016; Irvine et al., 2015; Patatoukas, 2011). As Gelsomino et al. (2016) argued, cooperation and coordination among supply chain partners are essential to successfully implementing SCF, we argue that that operational efficiencies associated with the high customer concentration described above can help better benefit from SCF and achieve better performance. Second, customer integration may benefit from a high customer concentration, leading to effective flows of inventory, information, and working capital (Patatoukas, 2011; Zhao et al., 2008). Third, given that more relational capital promotes collaboration when implementing SCF, suppliers with a higher customer concentration have more potential advantages (Hofmann & Kotzab, 2010; More & Basu, 2013; Zhang et al., 2015). Therefore, we examine whether the customer concentration affects 1) the responsiveness of supplier performance to the implementation of SCF and 2) the responsiveness of supplier credit risk to the implementation of SCF.

**H3. Firms with higher levels of customer concentration exhibit increased supplier performance responsiveness to the implementation of SCF.**

**H4. Firms with higher levels of customer concentration exhibit increased supplier credit risk responsiveness to the implementation of SCF.**

### 3. RESEARCH OBJECTIVE, METHODOLOGY AND DATA

#### 3.1. Sample and analysis

To investigate whether SCF affects supplier performance and credit risk and whether customer concentration moderates these relationships, this research selected a unique sample from The New Third Board Market (an SME board), which was established in 2006, and is an over-the-counter (OTC) market in China (Li, Meng & Wei, 2015; Liu & Park, 2020). The present research collected data from 4,792 SMEs in the Chinese manufacturing sector; after excluding missing values, our sample included 4,679 firms for further analysis. The general characteristics of the sample are summarized in Tab. 1.

Our large-scale sample was obtained from two public databases in 2016-2018. Specifically, indicators for firm age, firm size, sales growth, leverage, location, SCF, and customer concentration for 2016 were obtained from the *Choice* database (http://choice.eastmoney.com), which is a commonly used data source for Chinese firms in academic studies (Chen et al., 2021; Liu & Park, 2020). Note that in order to mitigate reverse causality and address endogeneity concerns, we draw on performance indicator (i.e., supplier performance) in the annual reports of 2017. Further, credit risk data (in the form of credit risk ratings) was taken from *Chinaeval Credit* database (http://www.zpxy.org/), which is an independent third-party credit rating agency, on July 3, 2017 (Liu & Park, 2020). As such, a time lag of one year was established between the independent and dependent variables, and detailed explanations of these variables can be found in the next section. It should be noted that the credit risk data after 2019 is currently not available, we therefore use cross-sectional data to test the hypothesis. As regards analytical
methodology, hierarchical linear regression, a commonly used technic for multilevel data analysis that overcomes the potential problems caused by the absence of homogeneity in the variances, was employed to further analyze the collected data (Woltman et al., 2012). The software used for data management and statistical analysis was STATA 15.

3.2. Variable

Supplier performance. Supplier performance is measured using a set of traditional performance measures: return on assets (ROA), return on sales (ROS), and return on equity (ROE). Following the most common practice in the literature, our study measures ROA as the ratio of net income to total assets and uses it as a proxy for supplier performance.

Credit risk. According to Liu & Park (2020), we use a credit risk rating with nine categories in which AAA-related suppliers are assigned a value of 1, and suppliers with ratings of C are assigned a value of 9.

Supply chain finance. To measure supply chain finance, we first use scaled decile rank transformation of the account receivable turnover, which is the ratio of sales to the average accounts receivable, to reflect the degree to which a supplier implements SCF. Chen et al. (2018) has argued that SCF helps SMEs to convert accounts receivable into cash. In the literature, scholars have confirmed that SCF has a high correlation with accounts receivable turnover (Gomm, 2010; Kelly, 2013; Raghavan & Mishra, 2011; Song et al., 2018; Zhao et al., 2015), thus accounts receivable turnover can be assumed to be a robust measure of SCF. Because the primary variable of our study is the level of implementation of SCF, we employ scaled decile rank transformations based on accounts receivable turnover (see Patatoukas, 2011, for a similar approach). The raw values of accounts receivable turnover are replaced by the corresponding decile ranks from 0 (lowest rank) to 1 (highest rank). Thus, SCF can be calculated with the following equation:

\[
\text{Supply chain finance} = \text{Rank}(\text{Accounts receivable turnover}) = \text{Rank}\left(\frac{\text{Sales}_t}{(\text{Accounts receivable}_{t-1} + \text{Accounts receivable}_t)/2}\right),
\]

(1)

where \(\text{Sales}_t\) is a supplier’s sales in year \(t\), and \(\text{Accounts receivable}_{t-1}\) and \(\text{Accounts receivable}_t\) represent the supplier’s accounts receivable in year \(t - 1\) and \(t\), respectively.

Customer concentration. In line with previous studies (Irvine et al., 2015; Kim, 2017; Liu et al. 2020; Saboo et al., 2017; Zhu et al., 2021), we measure customer concentration by employing the Herfindahl-Hirschman Index (HHI):

\[
\text{Customer concentration} = \sum_{i=j}^{n} (\text{Share}_j)^2 = \sum_{i=j}^{n} \left(\frac{\text{Sales}_i}{\text{Sales}}\right)^2,
\]

(2)

where \(\text{Share}_j\) is a supplier’s sales share from its main customer \(j\) \((j = 1, 2, \ldots, n)\), and \(\text{Sales}_j\) and \(\text{Sales}\) represent a supplier’s sales to customer \(j\) and its total sales, respectively.
Control variables. To control for external effects, we select firm age, firm size, sales growth, leverage, and location as control variables based on Bernerth and Aguinis (2016). Both a supplier’s performance and credit risk are likely to be influenced by these control variables (Irvine et al., 2015; Kim et al., 2017; Rojahn & Zechser, 2017). We measure firm age as the number of years since establishment (Irvine et al., 2015; Wagner et al., 2012), firm size as the natural logarithm of total assets (Flammer, 2013; Kim et al., 2017), sales growth as the annual growth rate of sales (Irvine et al., 2015), leverage as the ratio of long-term debt to total assets (Kim et al., 2017), and location as the index of marketization at the provincial level (Fan et al., 2016; Li et al., 2018). Because we focus on the manufacturing SMEs, thus, industry dummies were not included. Additionally, since prior studies have found that firm performance can have a positive effect on credit risk (Ho et al., 2015; Kim et al., 2017; Psillaki et al., 2010), supplier performance is added as a control variable in the model of credit risk.

4. RESULTS AND DISCUSSION

The Pearson’s correlation coefficients for the variables in this study are summarized in Tab. 2, illustrating that most of the independent variables have a significant correlation with either supplier performance or credit risk. Furthermore, we assess the significance of multicollinearity among independent variables using variance inflation factor (VIF) for each regressor, and the results indicate that the VIFs range from 1.03 to 4.68 (mean VIFs = 1.97), which are much less than the criterion value of 10, suggesting that multicollinearity is not a serious issue for further analysis (Hair et al., 2009). Two separate multi-stage hierarchical regressions are employed to estimate the main and moderating effects of the key explanatory variables on the dependent variables, one for supplier performance (Tab. 3), and another for credit risk (Tab. 4). Control variables are entered in the first step (Model 1 and Model 4). In the second step, SCF and customer concentration are entered to test H1 (Model 2) and H2 (Model 5). In the third step, the interaction of SCF and customer concentration is entered (Model 3 and Model 6) in the third step to test hypotheses H3 and H4.

< Insert Tab. 2 near here >

The hierarchical linear regression results for supplier performance as the dependent variable are presented in Tab. 3. First, considering the influence of control variables on supplier performance, the coefficients of determination R² value and significant F-statistic of the base model (Model 1) show the model performed well with the data and indicate great model fit (Hair et al., 2009). Five control variables – firm age, firm size, sales growth, leverage, and location – are significant at the 1% level (p < 0.01), explaining 11.48% of the variance in supplier performance. Among them, leverage (β = −11.975) and firm age (β = −0.062) are found to harm supplier performance, while firm size (β = 1.605), sales growth (β = 1.442), and location (β = 0.477) are reported to improve supplier performance. Surprisingly, the result for firm age is contrary to previous studies that have argued that since it is difficult for SMEs to have the same resources and installed base as large firms, so they need time to continuously improve their service quality and operational capabilities. Given this, with the increase of firm age, the enhanced operational efficiency would empower SMEs to achieve better performance (Valtakoski & Witell, 2018).

Next, we add SCF as an independent variable in Model 2. The inclusion of SCF generates a positive and significant increase in the explained variance (change in R² = 3.98%; p<0.01), demonstrating the improvement in the overall model fit (Hair et al., 2009). The impact of SCF is positive and strongly significant (β = 5.951, p < 0.01), indicating that the performance of SMEs increases as they adopt SCF, which therefore generating support for Hypothesis 1. The
results are supported by previous studies (Ali et al., 2019; Bui, 2020; Lekkakos & Serrano, 2016; Shou et al., 2021). For instance, Shou et al. (2021) found that the adoption of SCF help manufacturing firms achieve better performance in terms of cost efficiency and profitability improvement.

Finally, the moderating effect of buyer-supplier relationship is considered in Model 3. It can be seen that the inclusion of the interaction term (SCF × customer concentration) generates a positive increase in the explained variance (change in $R^2 = 0.12\%$; $p < 0.01$), and the coefficient for the interaction term is found to be significant and positive ($\beta = 3.859, p < 0.05$), as posited by Hypothesis 3. This validates that as an SME’s customer concentration increases, the relationship between SCF and supplier performance would become stronger. Despite previous studies have provided numerous examples of the importance of collaboration and linkages among supply chain members for the successful SCF implementation or performance growth, e.g., Gelsomino et al. (2016), Hofmann & Kotzab (2010) and More & Basu (2013), this finding supports their propositions by offering direct empirical evidence that clarifies the relationship between SCF, customer concentration, and supplier performance.

< Insert Tab. 3 near here >

We next analyze the results for credit risk as the dependent variable. As can be seen from Tab. 4, the base model (Model 4) is deemed statistically significant with a F-Statistic of 1601.14 and a significance level of 0.000, which means the model fit is good (Hair et al., 2009). Meanwhile, the coefficients of determination $R^2$ is 67.28%, which indicates Model 4 has high explanatory power (Hair et al., 2009). Note that, as discussed earlier, supplier performance is considered as a control variable across Models 4 to 6 because of its potential extraneous effects on credit risk that could affect the internal validity (Ho et al., 2015; Kim et al., 2017; Psillaki et al., 2010). First, Model 4 shows that all six control variables except leverage are detected to have a negative impact on SME credit risk. In particular, firm size has the strongest negative influence on credit risk ($\beta = -0.449, p < 0.01$), followed by supplier performance ($\beta = -0.102, p < 0.01$), sales growth ($\beta = -0.078, p < 0.01$), location ($\beta = -0.052, p < 0.01$), and firm age ($\beta = -0.449, p < 0.01$). These results imply that SMEs ought to monitor their debt situation and should prevent excessive debt ratios from aggravating the credit crisis, which is support by previous research such as an empirical investigation of U.S. firms (Jo & Na, 2012).

Next, the variable SCF is added into Model 5, and the inclusion generates a positive and significant increase in the explained variance (change in $R^2 = 0.54\%$; $p<0.01$) and enhances the overall model fit (Hair et al., 2009). The results regarding Model 5 show that the coefficient for SCF is negative and significant ($\beta = -0.387, p < 0.01$), generating support for Hypothesis 2. Consistent with Martin & Hofmann (2017), an SME’s SCF adoption is found to be negatively associated with its credit risk. The results also echo an empirical study of firms publicly listed on the US stock markets, the work of Lam & Zhan (2021), which analyzed this correlation based on a longitudinal dataset of U.S. listed service providers, and reported that the SCF initiative alleviates firms’ idiosyncratic financial risk and that this relationship can be strengthened for firms with greater information technology capabilities and operational slack.

Finally, the buyer-supplier relationship’s moderating role (SCF × customer concentration) between SCF and SME credit risk is determined, and the results are presented in Model 6. The interaction term generates a positive increase in the variance explained (change in $R^2 = 0.03\%$; $p < 0.1$). Customer concentration is found to be negative and statistically significantly moderates the relationship between SCF and SMEs’ credit risk ($\beta = -0.325, p < 0.1$), thus, Hypothesis
4 is supported. This finding corroborates previous literature (Liu & Park, 2020; Matthew et al., 2018). For example, Matthew et al. (2018) suggested that a focal firm’s credit risk can be mitigated by having a rather concentrated customer-base. However, to some extent, the results contradict Dhaliwal et al. (2016). Based on an investigation of American public firms, they claimed that firms with a concentrated customer-base would face higher firm risk. This may because, as they have indicated, the supplier firm’s risk would significantly increase as a result of major customers’ unpaid invoices, whereas in SCF practices, the payables to the supplier are offered by the financial service provider and not by the customer. Therefore, it is reasonable to infer that such an indirect financial connection between the buyer and supplier will not be detrimental for SME competitiveness; instead, a concentrated customer-base will benefit SMEs by strengthening the relationship between SCF and credit risk.

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5. CONCLUSION

Our study builds on the SCF literature and considers the relationship between SCF, customer concentration, supplier performance, and credit risk. We test our hypotheses through employing hierarchical regression analyses of a large sample of 4,679 firms from a Chinese SME board. This study empirically identifies that the implementation of SCF helps SMEs create competitive advantages from improved financial performance and reduced credit risk. Furthermore, we highlights the role of buyer-supplier relationship management in SCF success, our results show that firms with higher levels of customer concentration exhibit greater supplier performance and credit risk responsiveness to the implementation of SCF. Overall, our study offers several valuable insights and makes theoretical and managerial contributions.

5.1. Theoretical contributions

Theoretically, this study contributes to the literature in several ways. First, our study responds to Caniato et al.’s (2016) call for more empirical research on SCF adding to previous conceptual insights on SCF with a clear basis in evidence. According to prior studies, there is a strong correlation between SCF and accounts receivable (Gomm, 2010; Kelly, 2013; Raghavan & Mishra, 2011; Song et al., 2018; Zhao et al., 2015), expand on this idea we developed a scaled deciel rank transformation of accounts receivable turnover as a proxy variable to determine the degree to which a supplier implements SCF. By doing so, this study significantly contributes to the literature on SCF by developing a robust proxy variable for SCF.

Second, our work also contributes to the emerging literature focusing on the relationship between SCF and performance (Auboin et al., 2016; Chen & Hu, 2011; Lekkakos & Serrano, 2016; Wuttke et al., 2013a; Wuttke et al., 2016). Based on a large SME sample, this study provide new evidence of the positive association between SCF and supplier performance at the firm level. This is consistent with previous findings in SCF research, which have reported that SCF can lead to improved performance outcomes for suppliers (Lekkakos & Serrano, 2016; Shou et al., 2021; Song et al., 2018; Wuttke et al., 2013a).

Our third contribution is providing empirical evidence of the negative association between SCF and credit risk, which extends prior work by Dyckman (2011), Lam & Zhan (2021), Jaffee et al. (2010), and Martin & Hofmann (2017), who proposed that the implementation of SCF can mitigate both supply chain disruption and supplier risk. Moreover, the findings are consistent with Wang et al. (2020), who emphasized the importance of accounts receivables in supply
chain risk management. Based on this, SCF can be considered a useful approach to reducing credit risk by facilitating the effective and efficient collection of accounts receivable.

Our fourth contribution is determining the moderating role of customer concentration in the relationship between SCF and both supplier performance and credit risk, which extends the literature on the combination of SCF and CRM (Hofmann & Kotzab, 2010; More & Basu, 2013; Zhao et al., 2015). Our findings indicate that firms with higher levels of customer concentration exhibit higher supplier performance responsiveness to the implementation of SCF. This confirms the importance of CRM in SCF implementation, which is consistent with research by Hofmann & Kotzab (2010) and More & Basu (2013), who proposed that the collaboration between buyers and suppliers is a key driver of SCF success. The findings of this study suggest that firms with higher levels of customer concentration strengthen the negative effects of SCF on risk. Overall, customer concentration plays an important role in the relationships among SCF, performance, and risk in the context of SMEs.

5.2. Managerial contributions

Our study has several implications for both SME suppliers and financial service providers. The first implication for suppliers is that SCF can help SMEs to win competitive advantages by improving firm performance and mitigating credit risk. Since maintaining financial health is of vital importance for long-term competitiveness (Batchimeg, 2017; Kliestik et al., 2020), SMEs are therefore encouraged to implement SCF for a higher accounts receivable turnover, and lower credit risk.

The second implication is that the effectiveness of SCF in practice is contingent on buy-supplier relationship management. As our results suggest, SMEs with a concentrated customer-base are likely to benefit more from SCF. Therefore, while continually developing new customers is regarded as critical to SME competitiveness, we recommend the managers of SMEs that have implemented SCF should not focus less on relationships with their key customers. This is in line with previous studies such as Zhong et al. (2020). By conducting an investigation on the US publicly firms, they found that the firm with a higher concentration of customers tends to be more dedicated to the competitive environment, and therefore it appears to be more efficient in the use of resources.

Third, for financial service providers, our study suggests that CRM should be considered when providing SCF services because it potentially benefits both borrowers and lenders. In particular, it is essential to identify the cause of any SCF service failure by examining the relationship between buyers, suppliers, and financial service providers. It is important to reduce information asymmetry among these players. Finally, our findings provide useful information for SCF practitioners and supply chain managers who are looking to implement SCF with their business partners.

5.3. Limitations and directions for future research

There are several limitations in our findings, which suggest future research opportunities. The first limitation of our study can be imposed by our dataset. Because a cross-sectional design was used in the analysis, thus, a longitudinal investigation can be adopted by future research to determine the causality between SCF and performance over time. Moreover, our findings may be limited to the Chinese SMEs, the generalizability of the results to other countries should be determined. Although studies from different regions have report similar difficulties faced by
SMEs, e.g., the resonance of SMEs in Indian and Norwegian concerning supply chain management (Thakkar et al., 2011; Vaaland & Heide, 2007), we encourage future research to overcome the issue of generalizability. Secondly, we limited our investigation of SCF to the supplier’s perspective; the perspective of buyers and financial service providers should thus be taken into consideration in future research. Thirdly, our results hold only for SMEs and it is suggested that the importance of SCF for large enterprises or buyers be investigated. Fourthly, despite our study provided substantial empirical evidence concerning the relationship among SCF, buyer-supplier relationship, SME performance and risk, other methods such as game theory approach and mathematical simulation would be helpful for building new knowledge in this field. Finally, additional research is needed into mediators of the relationship between SCF and performance to fully understand the effects of SCF in the supply chain management.

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Tab. 1 - Characteristics of the sample. Source: own research

|                          | N   | Unit                | Mean | Std. Dev. | Min  | Max  |
|--------------------------|-----|---------------------|------|-----------|------|------|
| **Control Variables**    |     |                     |      |           |      |      |
| Firm age                 | 4,768 | Years              | 13.07 | 5.23     | 4.00 | 60.00 |
| Total asset              | 4,768 | Millions of US dollars | 28.52 | 55.14    | 0.65 | 1717.85 |
| Sales growth             | 4,768 | Ratio              | 0.20  | 0.95     | -1.01 | 37.20 |
| Leverage                 | 4,792 | Ratio              | 0.42  | 0.23     | 0.00 | 10.12 |
| Location                 | 4,792 | -                  | 8.43  | 1.42     | 0.62 | 9.78 |
| **Key Variables**        |     |                     |      |           |      |      |
| Supply chain finance     | 4,768 | -                  | 0.50  | 0.29     | 0.00 | 1.00 |
| Customer concentration   | 4,768 | -                  | 0.32  | 0.27     | 0.00 | 1.00 |
| Supplier performance     | 4,679 | Ratio              | 5.38  | 8.55     | -20.84 | 27.86 |
| Credit risk              | 4,768 | Rating             | 4.97  | 1.67     | 1.00 | 9.00 |

Tab. 2 - Pearson's correlation matrix. Source: own research

| Variables                  | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    |
|----------------------------|------|------|------|------|------|------|------|------|------|
| 1. Firm age                | 1    |      |      |      |      |      |      |      |      |
| 2. Firm size               | 0.192* | 1    |      |      |      |      |      |      |      |
| 3. Sales growth            | -0.098* | 0.024 | 1    |      |      |      |      |      |      |
| 4. Leverage                | -0.017 | 0.119* | 0.023 | 1    |      |      |      |      |      |
| 5. Location                | 0.059* | -0.109* | -0.012 | -0.030* | 1    |      |      |      |      |
| 6. SCF                     | -0.036* | -0.031* | 0.151* | -0.006 | 0.048* | 1    |      |      |      |
| 7. Customer concentration  | -0.175* | -0.176* | 0.018 | 0.029* | -0.030* | -0.141* | 1    |      |      |
| 8. Supplier performance    | -0.001 | 0.128* | 0.159* | -0.221* | 0.063* | 0.216* | -0.070* | 1    |      |
| 9. Credit risk             | -0.096* | -0.200* | -0.125* | 0.418* | -0.058* | -0.184* | 0.133* | -0.678* | 1    |

*p<0.05

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Tab. 3 - Hierarchical regression results for supplier performance. Source: own research

| Independent variables | Dependent variable: Supplier performance |
|-----------------------|------------------------------------------|
|                       | Model 1        | Model 2        | Model 3        |
| Firm age              | -0.062***     | -0.060***     | -0.061***     |
|                       | (0.023)        | (0.023)        | (0.023)        |
| Firm size             | 1.605***       | 1.649***       | 1.649***       |
|                       | (0.123)        | (0.122)        | (0.122)        |
| Sales growth          | 1.442***       | 1.178***       | 1.173***       |
|                       | (0.125)        | (0.124)        | (0.124)        |
| Leverage              | -11.975***     | -12.063***     | -12.086***     |
|                       | (0.632)        | (0.619)        | (0.619)        |
| Location              | 0.477***       | 0.415***       | 0.409***       |
|                       | (0.084)        | (0.082)        | (0.082)        |
| SCF                   | 5.951***       | 4.742***       |                |
|                       | (0.410)        | (0.618)        |                |
| Customer concentration| -0.336         | -2.253***      |                |
|                       | (0.450)        | (0.860)        |                |
| SCF * Customer concentration | 3.859***     |                |                |
|                       | (1.477)        |                |                |
| Intercept             | 2.513***       | 0.134          | 0.853          |
|                       | (0.867)        | (0.909)        | (0.950)        |

| Observations          | 4,679          | 4,679          | 4,679          |
| \(R^2\)               | 11.48%         | 15.46%         | 15.59%         |
| Change in \(R^2\)     | 3.98%          | 0.12%          |                |
| F-statistic           | 121.21***      | 122.05***      | 107.78***      |
| Prob > F              | 0.000          | 0.000          | 0.000          |

Heteroskedasticity-robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

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Tab. 4 - Hierarchical regression results for credit risk. Source: own research

| Independent variables       | Dependent variable: Credit risk | Model 4     | Model 5     | Model 6     |
|-----------------------------|---------------------------------|-------------|-------------|-------------|
|                             |                                 |             |             |             |
| Supplier performance        | -0.102*** (0.002)               | -0.099*** (0.002) | -0.099*** (0.002) |
| Firm age                    | -0.009*** (0.003)               | -0.008*** (0.003) | -0.008*** (0.003) |
| Firm size                   | -0.449*** (0.015)               | -0.451*** (0.015) | -0.451*** (0.015) |
| Sales growth                | -0.078*** (0.015)               | -0.066*** (0.015) | -0.065*** (0.015) |
| Leverage                    | 3.871*** (0.077)                | 3.905*** (0.077) | 3.909*** (0.077) |
| Location                    | -0.052*** (0.010)               | -0.048*** (0.010) | -0.048*** (0.010) |
| SCF                         | -0.387*** (0.051)               | -0.285*** (0.074) |
| Customer-base concentration | 0.167*** (0.053)                | 0.328*** (0.102) |
| SCF * Customer-base         |                                 | -0.325* (0.176) |
|                             | concentration                   |             |             |             |
| Intercept                   | 5.686*** (0.102)                | 5.752*** (0.108) | 5.691*** (0.113) |
| Observations                | 4679                            | 4679        | 4679        |
| \( R^2 \)                   | 67.28%                          | 67.82%      | 67.85%      |
| Change in \( R^2 \)         | 0.54%                           | 0.02%       |
| F-statistic                 | 1601.14***                     | 1230.44***  | 1094.67***  |
| Prob > F                    | 0.000                           | 0.000       | 0.000       |

Heteroskedasticity-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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Step 1: Goods or services are delivered to the buyer after purchase order fulfillment.
Step 2: The supplier obtains accounts receivable (documented by invoices) from the buyer.
Step 3: The supplier sends a request for SCF service and submits confirmation materials (notes receivable, invoices, commercial bills of exchange, etc.) to the financial service provider.
Step 4: The financial service provider and buyer approve the confirmation materials together.
Step 5: The financial service provider funds early payment (less interest and fees) for the supplier.
Step 6: The buyer makes payment to the financial service provider on the original due date.

Fig. 1 - General SCF approach. Source: own research

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