

# Supply Chain Finance, Performance and Risk: How Do SMEs Adjust Their Buyer-Supplier Relationship for Competitiveness?

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## Abstract

Supply chain finance (SCF) has attracted considerable attention being an innovative business model that allows firms, especially small- and medium-sized enterprises (SMEs), to convert illiquid assets into cash without incurring additional liabilities. However, its effects on SME performance and risk have been insufficiently studied. The competitiveness of SMEs depends on performance enhancement and risk mitigation. Thus, this study 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 positively impacts its performance but negatively impacts its risk. To further explore cross-sectional variability, we investigated the buyer-supplier relationship's moderating role. 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 and highlighting the moderating role of buyer-supplier relationship in SCF and SME competitiveness. Finally, we 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.

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## 1. INTRODUCTION

Maintaining liquidity to support sustainable operation for a competitive advantage has become a primary challenge in recent decades. The credit crunch became widespread worldwide; thus, a shortage of working capital has been a key operations dilemma for small- and medium-sized

enterprises (SMEs). Considering this, an alternative to traditional lending practices may be supply chain finance (SCF), 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 (Zhu et al., 2019). Several studies have shown that implementing SCF improves operational performance by helping SMEs gain short-term financing, thus increasing working capital and revenue, and mitigating supply chain risk (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 is mainly based on case studies or operational research models, which raised the need for data-driven empirical evidence.

Understanding the links between SCF, performance, and risk is vital for both SCF providers and adopters. Traditionally, extended payment terms always result in a higher risk for suppliers, who often have limited access to short-term financing and face high-debt costs (Hofmann & Kotzab, 2010). In contrast, SCF can reduce a supplier's credit risk by providing low-cost debt capital through financing, factoring, and advance payments. So far, research on SCF has been anecdotal 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 ambiguity may render SME stakeholders unaware of how the introduction of SCF would influence their business competitiveness.

Additionally, Hofmann & Kotzab (2010) argued that the supplier-customer relationship can be the main obstacle to developing a collaborative solution in terms of working capital management. Thus, another focus of our study is 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. Drawing on a supply chain relationship concept, this study uses customer concentration (also referred to as customer-base concentration or customer dependence) to explore the role of major customer relationship management in SCF adoption. Specifically, the customer concentration is considered 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., 2017). 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 customer concentration levels, the previous discussion about linking CRM and SCF is scant. By examining the moderating role of customer concentration in the implementation of SCF, we evidenced the debate on the potential for the buyer-supplier relationship to achieve financing benefits.

The primary objective of our research is to empirically demonstrate the importance of SCF in SMEs' competitiveness and 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 contributes 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. Supplier wanting to receive an SCF service must first provide certain documentation. Accordingly, financial service providers will decide whether to offer capital to ensure the supplier's capability to convert accounts receivable into cash, resulting in sufficient working capital flow, lower debt costs, and new opportunities for financing and factoring. This section reviews SCF literature and discusses 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.

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

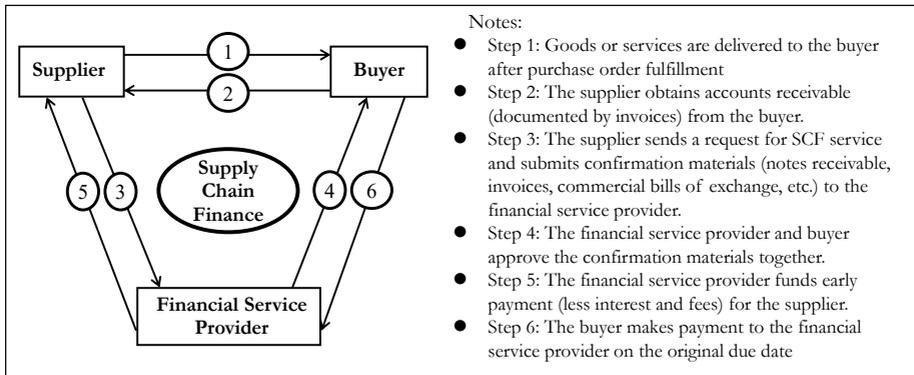


Fig. 1 - General SCF approach. Source: own research

## 2.2. Supply chain finance, performance, and risk

There is strong agreement on the importance of SCF as a financing service, which can improve the supply chain performance (Auboin et al., 2016; Bi et al., 2021; Lekakos & Serrano, 2016; 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) argued that both the supplier and lender (i.e., the financial service provider) might benefit from short-term financing, such as increased profit, by employing an operational research model. SCF also includes factoring as a growing source of funding while reducing the costs of lending for SMEs. Based on international factoring data, Auboin et al. (2016) proposed that SME's access to international trade is likely to be influenced by factors. The third aspect of SCF is advance payments. Overall, these aspects of SCF adoption are explicitly related to the value of a supplier's accounts receivable, leading to superior supplier performance.

In this study, Supplier performance is considered the 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 & Mishra, 2011). Additionally, SCF can be employed to improve suppliers' balance sheets and working capital (Wuttke et al., 2013b), which is supported by Thangam (2012), who claimed that advance payments via SCF reduce costs and increase profitability. Accordingly, the following hypothesis is proposed:

H1. A positive association exists between SCF and supplier performance.

However, some scholars have focused on the risks of SCF and have questioned 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 that low profitability is the most important negative factor affecting the implementation of SCF, followed by the low stability of cash flow, high dependence on customers, and firm age.

Credit risk is used here to refer to potential loss due to a borrower's nonpayment of a loan or other line of credit (Kim et al., 2017; Liu & Park, 2020). One of the central tenets of SCF is that increased capital flow will influence both performance and 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 supply chain risk management perspective, SCF ensures supplier's collection of accounts receivable, resulting in the flexibility and reliability of cash flow and thus reducing the risk of supply disruption (Gelsomino et al., 2016). In sum, our study examines a supplier's credit risk and argues that the implementation of SCF will reduce this risk:

H2. A negative association exists between SCF and credit risk.

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

Prior studies have emphasized the critical impact of the buyer-supplier relationship on SCF implementation because the implementation involves the direct participation of customers (Hofmann & Kotzab, 2010; More & Basu, 2013; Zhao et al., 2015). Thus, investigating customer relationships' role in the link between SCF and both supplier performance and credit risk is interesting. Based on six European cases, Wuttke et al. (2013a) 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). Although no empirical evidence to date has demonstrated the moderating role of customer concentration in the relationship between SCF and both supplier performance and risk, the theoretical basis of this assumption arises from previous customer concentration research (Saboo et al., 2017). In this present 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). Gelsomino et al. (2016) argued cooperation and coordination among supply chain



partners are essential to successfully implementing SCF. Meanwhile, we argue that operational efficiencies associated with the high customer concentration described earlier can help firms 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 (Chen et al., 2021; Patatoukas, 2011). Third, more relational capital promotes collaboration when implementing SCF; thus, suppliers with higher customer concentration have more potential advantages (Hofmann & Kotzab, 2010; More & Basu, 2013; Zhang et al., 2015). Therefore, we propose the following:

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

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

### 3. RESEARCH OBJECTIVE, METHODOLOGY AND DATA

#### 3.1 Sample and analysis

This research selected a unique sample from The New Third Board Market (an SME board), which is an over-the-counter market in China (Liu & Park, 2020). This research collected data from 4,792 SMEs in the Chinese manufacturing sector. Specifically, indicators of firm age, firm size, sales growth, leverage, location, SCF, and customer concentration were obtained from the Choice database, a commonly used data source for Chinese firms in academic studies (Liu & Park, 2020). Note that to mitigate reverse causality and address endogeneity concerns, we draw on a performance indicator (i.e., supplier performance) in the 2016 annual reports. Further, credit risk data (in the form of credit risk ratings) were obtained from the Chinaeval Credit database, 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. For the analytical methodology, hierarchical linear regression was employed to further analyze the collected data. Hierarchical linear regression is a commonly used technique for multilevel data analysis that overcomes the potential problems caused by the absence of homogeneity in the variances (Woltman et al., 2012). After excluding missing values, our sample included 4,679 firms for further analysis.

#### 3.2 Variable

**Supplier performance.** Supplier performance is measured using a set of traditional performance measures: return on assets (ROA), return on sales and return on equity. 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.** Following 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 SCF, 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. In the literature, SCF helps SMEs convert accounts receivable into cash. Moreover, 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). Therefore, accounts receivable turnover can be assumed to be a robust measure of SCF. The primary variable of our study is the SCF implementation level; therefore, 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:

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

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 (Chen et al., 2021; 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:

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

where  $\text{Share}_j$  is a supplier's sales share from its main customer  $j$  ( $j=1,2,\dots,n$ ), 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 the guidelines of Bernerth & Aguinis (2016). The supplier's performance and credit risk are likely to be influenced by these control variables (Irvine et al., 2015; Kim et al., 2017). We measure firm age as the number of years since the establishment of the firm (Irvine et al., 2015), firm size as the natural logarithm of total assets (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 (Li et al., 2018). Additionally, prior studies have found that firm performance can positively affect credit risk (Ho et al., 2015; Kim et al., 2017; Psillaki et al., 2010); thus, we added supplier performance as a control variable in the models for credit risk.

## 4. RESULTS AND DISCUSSION

Descriptive statistics and Pearson's correlation matrix for the variables are summarized in Table 1, which shows that most independent variables correlate significantly with either supplier performance or credit risk. Furthermore, we assess the significance of multicollinearity among independent variables using the variance inflation factor (VIF) for each regressor. 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 (Table 2) and another for credit risk (Table 3).

Tab. 1 – Descriptive statistics and 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*	-0.227*	0.063*	0.216*	-0.070*	1	
9. Credit risk	-0.096*	-0.269*	-0.125*	0.418*	-0.058*	-0.184*	0.133*	-0.678*	1
Mean	13.077	28.524	0.208	0.430	8.430	0.497	0.322	5.377	4.974
Standard deviation	5.239	55.138	0.959	0.237	1.417	0.289	0.268	8.555	1.668

Note: \* $p < 0.05$ .

Table 2 presents the results of the hierarchical linear regression for supplier performance as the dependent variable. First, considering the influence of control variables on supplier performance, the coefficients of  $R^2$  value and significant F-statistic of the base model (Model 1) show the model performed well with the data, indicating goodness of fit (Hair et al., 2009). Five control variables, that is, 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 ( $\beta = -11.975$ ) and firm age ( $\beta = -0.062$ ) harm supplier performance, whereas firm size ( $\beta = 1.605$ ), sales growth ( $\beta = 1.442$ ), and location ( $\beta = 0.477$ ) improve supplier performance. Surprisingly, the result for firm age is contrary to the findings of previous studies: SMEs have difficulty obtaining the same resources and installing base as large firms, so they need time to continuously improve their service quality and operational capabilities. Given this, with the increase in 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  $R^2 = 3.98\%$ ;  $p < 0.01$ ), demonstrating the improvement in the overall model fit (Hair et al., 2009). The coefficient of SCF is positive and strongly significant ( $\beta = 5.951$ ,  $p < 0.01$ ), indicating that the performance of SMEs increases as they adopt SCF, thereby generating support for Hypothesis 1. The results are supported by previous studies (Ali et al., 2019; Lekkas & Serrano, 2016; Shou et al., 2021). For

instance, Shou et al. (2021) found that SCF adoption helps manufacturing firms achieve better performance in terms of cost efficiency and profitability improvement.

Finally, the moderating effect of the buyer-supplier relationship is considered in Model 3. The inclusion of the interaction term (SCF  $\times$  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 significant and positive ( $\beta=3.859, p<0.01$ ), as posited by Hypothesis 3. Therefore, the greater the SME's customer concentration, the stronger the relationship will be between SCF and supplier performance. Although previous studies have provided numerous examples of the importance of collaboration and linkages between supply chain members for the successful SCF implementation and performance growth (Gelsomino et al., 2016; Hofmann & Kotzab, 2010), this finding supports their propositions by offering direct empirical evidence that clarifies the relationship between SCF, customer concentration, and supplier performance.

Tab. 2 – 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*** (0.023)	-0.060*** (0.023)	-0.061*** (0.023)
Firm size	1.605*** (0.123)	1.649*** (0.122)	1.649*** (0.122)
Sales growth	1.442*** (0.125)	1.178*** (0.124)	1.173*** (0.124)
Leverage	-11.975*** (0.632)	-12.063*** (0.619)	-12.086*** (0.619)
Location	0.477*** (0.084)	0.415*** (0.082)	0.409*** (0.082)
SCF		5.951*** (0.410)	4.742*** (0.618)
Customer concentration		-0.336 (0.450)	-2.253*** (0.860)
SCF * Customer concentration			3.859*** (1.477)
Intercept	2.513*** (0.867)	0.134 (0.909)	0.853 (0.950)
Observations	4,679	4,679	4,679
R <sup>2</sup>	11.48%	15.46%	15.59%
Change in R <sup>2</sup>		3.98%	0.12%



F-statistic	121.21***	122.05***	107.78***
Prob > F	0.000	0.000	0.000

Notes: Heteroskedasticity-robust standard errors in parentheses; \*\*\*  $p < 0.01$ ; \*\*  $p < 0.05$ ; \*  $p < 0.1$ .

We then analyze the results for credit risk as to the dependent variable. Table 3 shows that the base model (Model 4) is statistically significant with an F-statistic of 1601.14 and a significance level of 0.000, indicating goodness of fit (Hair et al., 2009). Meanwhile, the coefficient of determination  $R^2$  is 67.28%, indicating the high explanatory power of Model 4 (Hair et al., 2009). As discussed earlier, supplier performance is considered a control variable across Models 4–6 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 ( $\beta = 3.871, p < 0.01$ ) are detected to harm 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 ( $\beta = -0.009, p < 0.01$ ). These results imply that SMEs ought to monitor their debt situation and prevent excessive debt ratios from aggravating the credit crisis, which is supported by previous research, such as an empirical investigation of the US firms (Jo & Na, 2012).

Next, the variable SCF is added to Model 5, and the inclusion generates a positive and significant increase in the explained variance (change in  $R^2 = 0.54\%$ ;  $p < 0.01$ ), thus enhancing the model's overall fit (Hair et al., 2009). The results of Model 5 show that the coefficient for SCF is negative and significant ( $\beta = -0.387, p < 0.01$ ), thereby supporting Hypothesis 2. Consistent with Martin & Hofmann (2017), we found that an SME's SCF adoption is negatively associated with its credit risk. The results also echo Lam & Zhan's (2021) empirical study of firms publicly listed on the US stock markets. They analyzed this correlation based on a longitudinal dataset of US-listed service providers. Their findings reveal 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  $\times$  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  $R^2 = 0.03\%$ ;  $p < 0.1$ ). Moreover, customer concentration is negative and statistically and 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). Their investigation of American public firms claimed that firms with a concentrated customer base would face higher firm risk. This may be because, as they have indicated, the supplier firm's risk would significantly increase because of major customers' unpaid invoices. Meanwhile, in SCF practices, the payables to the supplier are offered by the financial service provider and not by the customer. Therefore, we can infer that such an indirect financial connection between the buyer and supplier will not be detrimental to SME competitiveness; instead, a concentrated customer base will benefit SMEs by strengthening the relationship between SCF and credit risk.

Tab. 3 – 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 concentration		0.167*** (0.053)	0.328*** (0.102)
SCF * Customer concentration			-0.325* (0.176)
Intercept	5.686*** (0.102)	5.752*** (0.108)	5.691*** (0.113)
Observations	4,679	4,679	4,679
R <sup>2</sup>	67.28%	67.82%	67.85%
Change in R <sup>2</sup>		0.54%	0.03%
F-statistic	1601.14***	1230.44***	1094.67***
Prob > F	0.000	0.000	0.000

Notes: Heteroskedasticity-robust standard errors in parentheses; \*\*\* p<0.01; \*\* p<0.05; \* p<0.1.

## 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 by employing hierarchical regression analyses of a large sample of 4,679 firms from a Chinese SME board. This study empirically identifies that the SCF implementation helps SMEs create competitive advantages from improved financial performance and reduced credit risk. Furthermore, we highlight 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 SCF implementation. 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, this study significantly contributes to SCF literature by developing a robust proxy variable for SCF. According to prior studies, a strong correlation exists between SCF and accounts receivable (Gomm, 2010; Kelly, 2013; Raghavan & Mishra, 2011; Song et al., 2018; Zhao et al., 2015). Expanding this idea, we developed a scaled decile rank transformation of accounts receivable turnover as a proxy variable to determine the degree to which a supplier implements SCF.

Second, our work also contributes to the emerging literature focusing on the relationship between SCF and performance (Auboin et al., 2016; Lekkakos & Serrano, 2016; Wuttke et al., 2013a; Wuttke et al., 2016). Based on a large SME sample, this study provides 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 the potential of SCF to improve the performance outcomes for suppliers (Lekkakos & Serrano, 2016; Shou et al., 2021; Song et al., 2018).

Third, this study provides empirical evidence of the negative association between SCF and credit risk, which extends the prior work of Lam & Zhan (2021) and Martin & Hofmann (2017), who proposed that SCF implementation 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 valuable approach to reducing credit risk by facilitating the effective and efficient collection of accounts receivable.

Fourth, we determine the moderating role of customer concentration in the relationship between SCF and 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 SCF implementation. This confirms the importance of CRM in SCF implementation, which is consistent with Hofmann & Kotzab (2010), 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 SMEs. 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 also has several managerial implications for both SME suppliers and financial service providers. The first implication is that SCF can help SMEs win competitive advantages

by improving firm performance and mitigating credit risk. Maintaining financial health is vital for long-term competitiveness (Batchimeg, 2017; Kliestik et al., 2020); therefore, SMEs are 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 buyer-supplier relationship management. As our results suggest, SMEs with a concentrated customer base are likely to benefit more from SCF. Therefore, although continually developing new customers is critical to SME competitiveness, we recommend that the managers of SMEs who have implemented SCF should not focus less on the relationships with their key customers. This agrees with previous studies, such as Zhong et al. (2020), who investigated the US public firms. They found that the firm with a higher concentration of customers tends to be more dedicated to the competitive environment. Therefore, it appears to be more efficient in the use of resources. Third, our study suggests that CRM should be considered when providing SCF services for financial service providers because it potentially benefits both borrowers and lenders. In particular, the cause of any SCF service failure must be identified by examining the relationship between buyers, suppliers, and financial service providers. Moreover, information asymmetry among these players should be reduced. Finally, our findings provide useful information for SCF practitioners and supply chain managers looking to implement SCF with their business partners.

### 5.3 Limitations and directions for future research

Our findings have several limitations, which suggest future research opportunities. First, our dataset can impose the limitation of our study. A cross-sectional design was used in the analysis; thus, a longitude 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; hence, the generalizability of the results to other countries should be determined. Although studies from different regions have reported similar difficulties faced by SMEs, we encourage future research to overcome the issue of generalizability. Second, we limited our investigation of SCF to the supplier's perspective; however, the perspective of buyers and financial service providers should be considered in future research. Third, our results hold only for SMEs, and we suggest investigating the importance of SCF for large enterprises or buyers. Fourth, although our study provided substantial empirical evidence concerning the relationship among SCF, the buyer-supplier relationship, performance, and risk, other methods, such as the game theory approach and mathematical simulation, would be helpful for building new knowledge in this field. Finally, additional research is needed for the mediators of the SCF–performance relationship to fully understand the effects of SCF in supply chain management.

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