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Hua Song Kangkang Yu Anirban Ganguly Rabia Turson

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Hua Song
School of Business, Renmin University of China, Beijing, China
Kangkang Yu
School of Agricultural Economics and Rural Development, Renmin University of China, Beijing, China
Anirban Ganguly
Jindal Global Business School, Jindal Global University, Haryana, India, and
Rabia Turson
School of Business Administration, Xinjiang University of Finance and Economics, Urumqi, China

Abstract

Purpose – The purpose of this paper is to examine the effect of small and medium enterprises (SMEs)' supply chain network on influencing credit quality, or more specifically, whether bridging tie (structural network) or strong tie (relational network) of SMEs in the supply chain can improve the availability of equity and debt capital through information sharing.

Design/methodology/approach – A survey was conducted in manufacturing industry in China and 208 valid questionnaires were used to test all the hypotheses. The data were then analyzed by employing partial least squares path modeling.

Findings – The results suggest that both strong tie and bridging tie of SMEs can lead to a positive effect on information sharing in supply chain, which can further enhance the credit quality for SMEs. However, without information sharing, the strong tie has not significant influence on SMEs' credit quality, while bridging tie can directly impact on credit quality.

Originality/value – Despite their crucial role in sustaining national economies, SMEs are beset by the critical constraint of risk-free financing. Based on a survey, this research finds that the credit quality of SMEs is affected by two important factors: one concerns information sharing in supply chain and the other relates to the attributes of SMEs' supply chain network. This study implies that a SME may have a financing advantage for better embedding in the supply chain network, but different effects will be experienced according to constraints associated with information asymmetry in the supply chain.

Keywords Information sharing, Supply chain network, Bridging ties, SMEs credit quality, Strong ties

Paper type Research paper

1. Introduction

Small and medium enterprises (SMEs) usually face huge challenges to get liquid and working capital to support their operations. In the past, SMEs would seek working capital financing from commercial banks based on their own terms and credits. However, limited operating history, incomplete financial statement or being positioned

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at the start-up stage with characteristics associated with small sizes, insignificant performance, high risk, and many other factors, have constrained most of them are still constrained to effectively receive working capital by traditional ways (Song and Wang, 2013). Specifically, SMEs who introduce product innovation have more probability of financial constraints than other type of companies (Brancati, 2015). Only by means of higher requirements for mortgage or vouch, can banks compensate the potential loss (Duan *et al.*, 2009). In the case of debt financing, lenders typically request collateral in order to mitigate the risks associated with "moral hazard" and the lack of collateral is probably the most widely cited obstacle encountered by SMEs in accessing finance. This therefore leads to the fact that SMEs can only get funded under the condition of high credit scoring based on information transparency.

In the field of information system and management, recent studies take use of information processing theory to argue that information sharing strongly improves information quality and information processing capabilities of companies (Liu *et al.*, 2015; Wong *et al.*, 2015). Thus, information sharing is often considered as an important contributor to integrated information flow for two-way communications between downstream and upstream organizations and facilitate the streamlining of inter- and intra- organizational processes (Durugbo, 2014; Handfield *et al.*, 2015). As many supply chain-related issues arise due to lack of sharing information within the members in a supply chain (Lotfi *et al.*, 2013), information sharing requires firms to exchange not only transactional data, such as materials and product orders, but also strategic supply chain information (Prajogo and Olhager, 2012). Huang *et al.* (2003) suggest two types of role of information in the analysis of the supply chain: "one indicates whether a piece of information is considered as shared to the other entities; while another indicates whether a piece of information is considered as a factor that can affect the supply chain performance and benefits of information sharing" (p. 1492). Lotfi *et al.* (2013), on the other hand, attempt to make an overview of information sharing, types of shared information and benefits and barriers of shared information in a supply chain. Although the significant role and impact of information sharing in supply chains has been extensively studied, many researchers focus on the bullwhip effect and supply chain costs caused by information asymmetry (Hsieh *et al.*, 2006; Silvestro and Lustrato, 2014; Zhang and Chen, 2013); while few concern financial transactions, parallel to the flow of physical goods (Silvestro and Lustrato, 2014), which is also affected by information asymmetry.

In recent years, an emergent stream of practice and research on supply chain finance (Yan and Sun, 2015; Hofmann and Kotzab, 2010; Pfohl and Gomm, 2009; Gomm 2010) has evolved to improve SMEs liquidity and working capital. Supply chain finance is considered as a way of "optimizing the financial structure and the cash-flow within the supply chain" (Gomm, 2010, p. 135), or "providing visibility and controlling over all cash-related processes within a supply chain" (Grosse-Ruyken *et al.*, 2011, p. 15). The main reason cited is that each dyadic relationship in the supply chain is affected by the "embedded context" in which it operates (Anderson *et al.*, 1994), and "connectedness", which is defined as the extent to which any exchange relationship is contingent (either positively or negatively) on the exchange in any other relationship (Cook and Emerson, 1978). This network perspective has been widely used in recent supply chain studies such as the sharing of demand (Kahn *et al.*, 2006), logistics or joint innovation (Mello and Flint, 2009; Autry and Griffis, 2008), and supplier development (Nagati and Rebolledo, 2013), among others. However, strategies for adopting this approach with the intention of exploring the mechanisms underlying the financial flow still remain a question. Recently, Wuttke *et al.* (2013) adopted multiple case studies to

close the gap between the knowledge on product, information flow-oriented innovations and financial flow innovations along the supply chain. From a perspective of organizational innovation adoption, they have addressed a broad range of structural and relational issues in the supply chain network during the adoption of supply chain finance. However, further large-scale studies are still required to test the corresponding propositions in network domains.

As is reviewed above, the basis of supply chain finance is the supply chain network with integrated information flows, the extent to which a focal firm shares information with its partners (Durugbo, 2014). In addition, the key point of better evaluating SMEs' creditworthiness is information symmetry and transparency, which could be achieved by information sharing (Liu *et al.*, 2015; Wong *et al.*, 2015). Therefore, to investigate SMEs' financing problem, it is necessary to integrate supply chain finance with information sharing in the supply chain network, which is yet ignored in the literature on information system and management. In this study, we are trying to contribute to research and practice on this interface based on both information processing theory and network theory.

2. Literature review and hypothesis development

2.1 The role of information sharing in supply chain

Every organization requires quality information to cope with the uncertainties in business environment and improve their decision making process (Stern and Reve, 1980). Within supply chains, these uncertainties increase decision complexity and subsequently affect the need for information (Premkumar *et al.*, 2005). Therefore, it has been observed that integrating supply chain practice with effective information sharing has become a critical factor in the success of supply chain performance (Zhou and Benton, 2007). Information sharing in supply chain can be stated as an "inter-organizational sharing of data, information and/or knowledge in supply chains" (Kembro and Naslund, 2014, p. 181) and can greatly aid in supply chain capabilities and performance. An effective information processing practice involves a proper information flow across various nodes of the supply chain (Premkumar and William, 1994) and is seen to be dependent on information content and quality (Zhou and Benton, 2007). While information content refers to the information shared between supply chain components, information quality refers to the degree to which the information exchanged suffices the organizations requirements (Zhou and Benton, 2007). The quality and the content of the information vary across different components of the supply chain and effective information processing and sharing enhances most supply chain initiatives. The more knowledge acquisition activities are emphasized, the greater the growth of knowledge and information flows, which leads to a significant improvement in the performance of the supply chain (Hult *et al.*, 2004). However, it has been observed that in spite of a plethora of available literature on the role of information processing and sharing on the performance of supply chain, there was a clear void in its contribution toward supply chain financing and credit quality. This therefore motivated the authors' to investigate this void and the current research expected to shed some light on this important, but sparsely discussed issue.

2.2 The direct effects on SMEs' credit quality

In a perfect market setting, with perfect and costless information available to both parties, and no uncertainties regarding present and future trading conditions, the principal-agent relationship does not suffer from the market failure of information

asymmetry. However, information in the real world is neither perfect nor costless, especially since the small business finance market is characterized by risk and uncertainty regarding future conditions, in the process leading to an asymmetric distribution of information between the bank and the firm as well as investors frequently unable to determine the quality of potential borrowers (Tucker and Lean, 2003). From the lender's perspective, financers usually regard SME as riskier enterprises because SMEs face even a higher uncertain competitive environment than larger companies and also are comparatively less equipped in terms of both human and capital resources to withstand economic adversities, therefore giving rise to the problem of adverse selection (Stiglitz and Weiss, 1981). Furthermore, there is the problem of inadequate accounting systems, which undermines the accessibility and reliability of information concerning profitability and repayment capacity (Tucker and Lean, 2003). Before lending, investors must collect, process and interpret firm-specific information to distinguish between better firms with high-expected profits and low risk and contrast them against mediocre to poor firms with low expected profits and high risks. Thus, by carefully screening the pool of borrowers, the lender/investor may be able to differentiate adequately between "high quality" and "low quality" companies and projects. In that case, price variables (i.e. interest rates) may work as a screening device along with providing the lenders the ability to assess whether SMEs are utilizing the funds in an appropriate way (the "moral hazard" problem). However, screening can involve transaction costs that are large relative to an investor's return, making it less profitable to finance SMEs.

Above all, it is necessary to solve the problem of information asymmetry to enhance credit quality of SMEs. One of the most effective solutions is information sharing, which is a commitment to mitigate asymmetric information among chain members through providing access to private information, which in turn can facilitates data collection, documentation, and the storing, retrieving, and transferring of private information thereby leading to high level of visibility in the process (Simatupang and Sridharan, 2001; Yu *et al.*, 2001; Lee and Whang, 2000). Therefore, information sharing of SMEs can improve the information quality and information processing capabilities of all partners (Liu, *et al.*, 2015; Wong *et al.*, 2015), in the process aiding the lenders in supply chain to access a large quantity of worthwhile information, by which SMEs can go through the screening process and receive working capital from lenders.

Accordingly, we hypothesize:

H1. Information sharing in supply chain has a positive effect on SMEs' credit quality.

When the cost of survival or growth strategies in these firms exceed the financial resources owned and controlled by owner/managers, they become dependent on the availability of external sources of finance (Hussain *et al.*, 2006) The proximity of firms in a supply chain and the repeated exchanges between them is an alternative way to obtain capital. Network connectedness is the structure of a firm's relationship with other firms, specifically, the extent to which a firm is interconnected to each other (Granovetter, 1992). The type of network in which an organization is embedded defines the opportunities potentially available, while its position in that structure and the types of inter-firm ties it maintains define its access to those opportunities (Uzzi, 1996). There are two types of network connectedness, "cliques" and "bridge." On one hand, high network connectedness means that a firm belongs to a dense network, where the firms tend to know each other well through recurring interactions and interconnected ties that engender familiarity and trust (Echols and Tsai, 2005, Gulati, 1998; Gulati *et al.*, 2000). On the other hand, a bridge is a type of linkage that connects two different

entities in a business field and these links are heterogeneous and of low proximity (Granovetter, 1973). It is through these bridging ties that information travels among different parties. In other words, the bridge enhances between-industry communication. It is the strength and openness of ties within supply chain that partly determines the credit quality which SMEs can realize.

The relational embeddedness or cohesion perspective on networks, including levels of strong and weak ties, stresses the role of direct cohesive ties as a mechanism (Gulati, 1998). The primary advantage that strong ties provide to organizations is that it serves as part of the social control mechanism that governs partnership behaviors. Larson (1992) shows that strong ties incrementally promote and, in turn, enhance trust, mutual gain, reciprocity and a long-term perspective. Strong ties produce and are governed by relational trust and norms of mutual gain and reciprocity, which grow through a history of interactions (Powell, 1990; Larson, 1992). Since strong ties in supply chain network make a firm's particular exchange relationship contingent on other exchange relationships, this favor the collaboration and cooperation between upstream and downstream enterprises (Patti, 2006). Therefore, managers may achieve superior financial performance by taking the deliberate step toward establishing a collaborative framework for managing supply chain financial variables (Randall and Farris, 2009). Under the framework of close relationships involved with interconnected businesses, the relationship and even credit is more reliable than in normal social relationships, which will support the efficient operation of finance (Carter *et al.*, 2007)

The positional perspective on networks, including dense structure and sparse structure (structural holes), goes beyond the immediate ties of firms (Gulati, 1998). Burt and Celotto (1992) argues that the network positions associated with the highest economic return lie between, and not within, dense regions of relationships. He names these sparse regions as structural holes. Bridging ties define a kind of linkages across the structural holes, which connect more participates with diversified background, experiences, knowledge and skills (Reagans *et al.*, 2004). Furthermore, firms bridging structural holes are awarded control benefits because they act as intermediaries between disconnected partners, who rely on the firm to facilitate exchange flows across the network (Burt and Celotto, 1992; Gulati, 1998). Thus, if SMEs are embedded in a supply chain network full of bridges, the position where they are located will provide access to divergent regions of the network rather than to a single densely connected set of actors, which in turn, brings in the advantages of all kinds of resources (Khurana, 2002; Finne and Holmstrom, 2013). As Lamoureux and Evans (2011) suggests, supply chain financing is a way of funding optimization in an ecosphere dominated by a focal firm, and the diversity of the members would enhance its sustainability and the position of the SMEs would weaken the dependence on a certain partners, which in turn, will reduce the financing risk and increases the flexibility.

Thus, we hypothesize:

H2. Supply chain network has a positive and significant effect on SMEs' credit quality.

H2a. Strong ties in supply chain network have a positive effect on SME's credit quality.

H2b. Bridging ties in supply chain network have a positive effect on SME's credit quality.

2.3 The mediating effects on SMEs' credit quality

Both cliques and bridge highlight the informational advantages networks can confer on certain actors (Gulati, 1998). Much of the early research on the strength of a tie

draws on Granovetter's (1973) conceptualization of ties with a focus on information flows and strong ties are characterized by trust and rich information exchange. Since a high level of strong ties in supply chain network facilitates all kinds of flows among parties, such as business, logistics and information flows, any participants can easily access, understand and assess partners' strategies, operations and capabilities, and thus related information could be shared and delivered at low cost along the pipeline. However, stronger ties to multiple actors, who are connected to one another, provide redundant information (Granovetter, 1973; Burt and Celotto, 1992). Bridging ties are conduits across which an actor can access novel information along with providing participants access to unique information instead of redundant information from "local bridges" (Krackhardt, 1992). Therefore, a firm bridging many structural holes has few redundant ties and economizes on the number of ties required to access unique information (Burt, 2001). Above all, rich and finely grained information is gained through strong ties; while non-redundant and new and diversified information is obtained through bridging ties. Therefore, both enhance the symmetry of information in supply chain network:

H3. Supply chain network has a positive and significant effect on information sharing.

H3a. Strong ties in supply chain network have a positive effect on information sharing.

H3b. Bridging ties in supply chain network have a positive effect on information sharing.

Through collaborations with other firms in the industry, a firm involves itself in an inter-firm network that contains useful information and resource flows (Echols and Tsai, 2005). The present study has argued that strong ties facilitate information flows, but generates highly redundant information, while bridging ties creates novel and new information. As supply chain is not just a chain of businesses with one-to-one business-to-business relationships, but a network of multiple businesses and relationships (Lambert *et al.*, 1998), and the information required to assess SMEs credit could be delivered through different ties in supply chain network. As Durugbo (2014) suggested, separating business and technological information flows enhances flow fulfilment and facilitates moments of information, and integrative information can finally mitigate risk and cost in supply chain. Therefore, it can be concluded that the connectedness of SMEs in a supply chain network gives full access to a large quantity of information, which reduces information asymmetry, and thus enhances the quality of SME financing. Figure 1 illustrates the key relationships as the authors' move on to draw the final set of hypotheses:

H4. Information sharing mediates the effect of supply chain network on SMEs' credit quality.

H4a. Information sharing mediates the effect of strong ties in supply chain network on SMEs' credit quality.

H4b. Information sharing mediates the effect of bridging ties in supply chain network on SMEs' credit quality.

3. Research methodology and results

3.1 Sampling

The first phase of the research project included three rounds of survey using a questionnaire during 2013 to 2014, which was distributed in the poultry farming

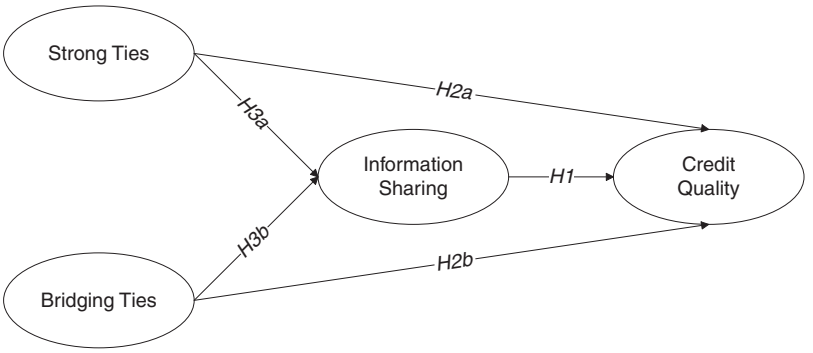


Figure 1.
Theoretical model

industry, telecommunication industry, fast-moving goods industry and auto industry in Shandong, Shenzhen and Beijing. This was followed, in early 2015, by a fourth round of survey of apparel industry in Hanzhou and Ninbo, Zejiang province, where there are all clusters of SMEs in corresponding industries. The purpose was to test the theoretical model using a large and convenient sample survey. We first found five notable firms who are involved in supply chain financing for SMEs in related business areas, and with the help of these focal firms (lenders), the survey was sent to their customers' (SMEs) managers independently for their responses as a research project to manage the social desirability issues.

The data used in this research were collected by means of a questionnaire. 550 questionnaires were distributed and 208 of these were returned, which yielded a valid response rate of 37.8 percent. Before launching the full scale interview process, the authors' decided to conduct a pilot study on a focussed group of respondents. The feedback from the study enabled the authors to improve the survey questionnaire. As shown in Table I, the distribution of the business attributes, the operation duration, the number of employees, the annual sales and the total assets in accordance with the definition of SMEs in the "Chinese Provisional Regulation of SMEs Standard" jointly issued by the ministry of industry and information technology, the national bureau of statistics and national development and reform commission, ministry of finance in 2011. According to the standard, a medium and/or small enterprise must have the following three characteristics: have less than 2000 staff; generate less than RMB 300 million in sales; and have less than RMB 400 million in assets. For testing non-response bias, ANOVA was adopted to compare the mean difference between the early and late respondents based on the four variables including business attributes, operation duration, number of employees, annual sales and total assets. The results showed that there were no significant mean differences ($p > 0.1$).

3.2 Measures

The measures for each construct are based on an extensive literature review. The dependent variable, credit quality, is a subjective measure of how well a firm can get working capital or liquidity from financial institute or other related parties. It is also used as a general measure of a firm's overall financial health over a given period of time, which commonly refers to access (open or closed), duration (long or short term), cost (affordable or unaffordable) and adequacy (adequate or inadequate) (Tagoe *et al.*, 2005; Gomm, 2010). The mediator, information sharing, is the extent to which a number of distinct types of information flow between a company and its suppliers, customers

	n	%
Business attributes		
Production	96	46.15
Production and distribution	41	19.71
Distribution	23	11.06
Retail	6	2.88
Logistics service	38	18.27
Missing	4	1.92
Operation duration		
Less than 1 year	1	0.48
1-2 years	12	5.77
2-5 years	39	18.75
5-10 years	56	26.92
Above 10 years	96	46.15
Missing	4	1.92
Number of employees		
0-100	67	32.21
100-300	75	36.06
300-500	26	12.5
500-600	8	3.85
600-1,000	10	4.81
1,000-2,000	22	10.58
Above 2,000		
Missing		
Annual sales (RMB)		
Below 5 million	8	3.85
5-10 million	19	9.13
10-20 million	21	10.1
20-30 million	19	9.13
30-50 million	34	16.35
50-150 million	50	24.04
150-300 million	56	26.92
Above 300 million		
Missing	1	0.48
Total assets (RMB)		
Below 10 million	47	22.6
10-20 million	30	14.42
20-30 million	20	9.62
30-40 million	21	10.1
40-100 million	37	17.79
100-200 million	13	6.25
200-400 million	37	17.79
Above 400 million		
Missing	3	1.44
Total	208	100.0

Table I.
Sample distribution

and other partners (Baihaqi and Sohal, 2013; Lee and Whang, 2000; Simatupang and Sridharan, 2001; Yu *et al.*, 2001). The measures of independent variables including strong tie and bridging tie are from relationship and network literature. For strong tie, we adopted the measures of trust developed by Golicic and Mentzer (2006); while for

bridging ties, we adopted the measures focussing on heterogeneity developed by Tiwana (2008). Control variables include business attributes, operation duration, number of employees, annual sales and total assets. The details of the items could be found in Table II.

Except for control variables, all the entire variables adopted multiple-item, five-point Likert scales were adopted, where "1" indicated "strongly disagree" and "5" indicated "strongly agree." A preliminary English version of the survey instrument derived from a thorough literature review of constructs and measures was translated into Chinese and back into English by two separate groups of researchers as a double check. After pre-testing the preliminary version of the survey instrument on local companies, a revised version was developed from the feedback of these executives along with comments and suggestions from industry experts and two academic colleagues who are knowledgeable about survey design.

3.3 Partial least squares (PLS) path modeling

This study adopted structural equation modeling (SEM) based on PLS modeling given the small sample size and the explorative purpose of this study (Dijkstra and Henseler, 2015a). The software used was Smart PLS 3.0. The reliability and validity of the constructs were assessed. As shown in Table II, Cronbach's α and the value of CR of each construct were found to exceed the cut-off value of 0.70 (Fornell and Larcker, 1981). Furthermore, the AVE of each construct exceeded the variance attributable to its measurement error cut-off

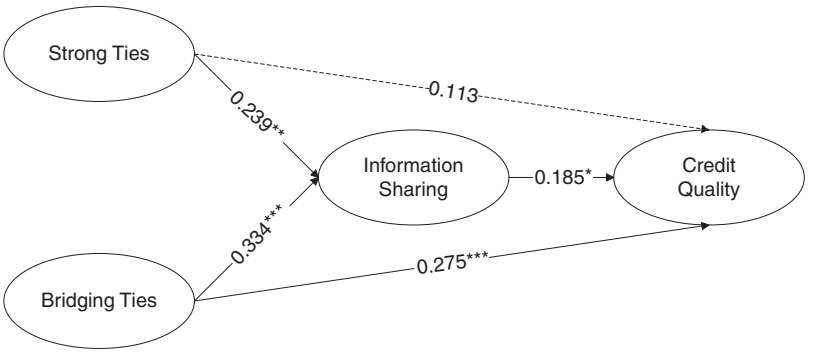
Constructs and items	Standard Loading	Weights	Cronbach's α/CR
Credit quality (CQ) (Tagoe *et al.*, 2005; Gomm, 2010)			0.880/0.918
FQ1: the availability of liquidity and working capital	0.829	0.303	
FQ2: the interest is reasonable	0.763	0.223	
FQ3: the loan volume is flexible	0.931	0.317	
FQ4: the loan period is flexible	0.902	0.314	
Information sharing (IS) (Baihaqi and Sohal, 2013; Lee and Whang, 2000; Simatupang and Sridharan, 2001; Yu *et al.*, 2001)			0.849/0.892
Lenders can access my information by following ways:			
IC1: from my primary suppliers	0.762	0.247	
IC2: from my other alternative suppliers	0.788	0.239	
IC3: from my key customers	0.793	0.214	
IC4: from my other alternative customers	0.809	0.264	
IC5: from my cooperative agents and other institutions	0.791	0.303	
Strong ties (ST) (Golicic and Mentzer, 2006)			0.853/0.901
In our relationship, the provider:			
ST1: treats my firm fairly and justly	0.822	0.295	
ST2: has high integrity	0.877	0.282	
ST3: is a firm may firm trusts completely	0.867	0.304	
ST4: well know our demands and operations	0.764	0.322	
Bridging ties (BT) (Tiwana, 2008)			0.894/0.926
Supply chain members:			
BT1: vary widely in their areas of expertise	0.795	0.230	
BT2: have a variety of different backgrounds and experiences	0.843	0.265	
BT3: have resources that complement each other	0.919	0.318	
BT4: have skills and abilities that complement each other	0.920	0.328	

Table II.
Assessment of the reliability of the measurement model

value of 0.50 (Chin, 1998; Fornell and Larcker, 1981). In addition, heterotrait-monotrait ratio (HTMT) is recommended as a better method to test discriminant validity (Henseler *et al.*, 2014). The result shows that there is neither value of the HTMT is higher than the threshold of 0.85 nor confidence interval containing the value one, indicating that all the constructs exhibit satisfactory discriminant validity (Henseler *et al.*, 2014).

The hypothesized effects in the theoretical model were tested by a SEM as shown in Figure 2. The value of SRMR which is 0.042 shows that the model fits the data quite well (Henseler *et al.*, 2014; Dijkstra and Henseler, 2015b).

As shown in Table III, the coefficient between information sharing and SMEs' credit quality has the expected sign and is significant ($\gamma = 0.185$, $t = 2.214$, $p < 0.05$), which means that *H1* was also supported. Meanwhile, *H2* was partially supported. Only bridging ties have a significant and positive effect on credit quality ($\gamma = 0.275$, $t = 3.695$, $p < 0.001$), while strong ties have no significant effect on credit quality ($\gamma = 0.113$, $t = 1.373$, ns). Thus, *H2b* was supported, but *H2a* was not supported. This finding indicates that without considering information exposure or asymmetry, the more SMEs have wide relevance and cross-boundaries in the supply chain, the more possibility that they increase liquidity and get working capital from lenders. But meanwhile, the more SMEs develop close inter-firm or inter-personal relationship, the less possibility for SMEs to get finance from lenders. As expected, the effects of both strong ties and



Notes: *$p<0.05$; **$p<0.01$; ***$p<0.001$

Figure 2.
Results of theoretical model

Hypothesis	*Relationship*	*Path coefficients*	*SD*	*t value*	*Result*
H1	Information sharing→credit quality	0.185*	0.083	2.214	Supported
H2a	Strong ties→credit quality	0.113	0.082	1.373	Not supported
H2b	Bridging ties→credit quality	0.275***	0.074	3.695	Supported
H3a	Strong ties→information sharing	0.239**	0.077	3.1074	Supported
H3b	Bridging ties→information sharing	0.334***	0.074	4.511	Supported
H4a	Strong ties→information sharing→credit quality	0.044****	0.025	1.773	Supported
H4b	Bridging ties→information sharing→credit quality	0.062****	0.033	1.878	Supported
Model fit	*SRMR = 0.042*	R^2	*t*	*Adjust* R^2	*t*
	Information sharing	0.203	3.746	0.195	3.567
	Credit quality	0.261	4.113	0.236	3.581

Notes: *$p < 0.05$ **$p < 0.01$; ***$p < 0.001$; ****$p < 0.1$

Table III.
Results of estimates and hypotheses

bridging ties on information sharing are significant and positive ($\gamma = 0.239$, $t = 3.107$, $p < 0.01$; $\gamma = 0.334$, $t = 4.511$, $p < 0.001$), which indicates that *H3a* and *H3b* were both supported. In order to test whether information sharing mediates the relationship between supply chain network and SMEs' credit quality, the indirect effects were tested. The result showed that the indirect effect of either strong ties or bridging ties on credit quality via information sharing is marginally significant ($\gamma = 0.044$, $t = 1.773$, $p < 0.1$; $\gamma = 0.062$, $t = 1.878$, $p < 0.1$). These results supported that more that SMEs are well embedded in the supply chain network, and simultaneously present more network information, the greater the possibility that they can enhance their credit quality, or more directly expressed, get more capital from lenders.

As this study relies on the same key informants to assess all constructs, common method bias may influence the validity (Podsakoff *et al.*, 2003). Ylitalo (2009) suggests an approach for PLS path modeling in which a method factor is included as a predictor for all endogenous latent constructs in the model. Since the indicators of the method factor should be theoretically unrelated to any of the constructs of interest and preferably not correlated except for the correlation caused by sharing the same method (Ylitalo, 2009), we chose the items for measuring globalization as indicators of the latent common method factor and examined the significance of the structural parameters both with and without the latent common methods variance factor in the structural model. The results show that the significance of the hypothesized path coefficients is not different between the two models, revealing that the findings are not affected by the use of the same data source.

3.4 In-depth interviews

In order to explore potential reasons for explaining the empirical result of *H1a* which was not supported, in-depth interviews were conducted on the focal firms in e-business which provide supply chain finance services for surveyed SMEs. Thus, we met with those who participated in the SME's financing with the intention of exploring significant findings in greater detail. We adopted semi-structured interview guide that covers the main topics of supply chain finance such as the structure of the supply chain, the relationship between the focal firm and the SME, the information sharing system between them and, their final performance, among others. Table IV shows the details of the qualified interviewees.

The focal firm	SMEs	Interviewee number	Position
C1	Engine oil trader	1	Vice president at the department of supply chain finance
		3	Top manager at the department of supply chain finance
C2	Swimsuit processor	1	Vice president of the company
		1	Manager of risk management at the department of supply chain finance
		2	Officer at the department of supply chain finance
C3	Clothes manufacturer	1	President of the company
		1	President of the department of supply chain finance
		2	Manager of risk management at the department of supply chain finance

Table IV.
The interviewed companies and interviewees

The interviews illustrated the complex mechanisms underlying this simple relationship, relating to ways of risk control during supply chain finance. All the informants emphasized the importance of SMEs' relationship or *Guanxi* in a supply chain network. Furthermore, they also emphasized the important role played by information sharing on controlling the risks related to the vulnerability and the potential opportunism caused by too many strong ties. For example, the manager at the department of supply chain finance in Company C1 explained that "Although the size of our customer is small, we have cooperated for many years. They distribute half of their products through our channels." Another officer at the same department emphasized that "Our information system [between the focal firm and SME] is integrated which can monitor the whole processes from procurement, distribution to storage […] we can control the cash flow." The vice president of Company C2 stated that "[…] honestly, we provide the service of supply chain finance to SMEs with whom we have cooperated for a long time. In other words, they are our strategic alliances." However, "The proposition of providing this service is that they [SMEs] need to outsource their logistics, customs, taxation etc. On one hand, we provide a package of service while on the other hand, we get the critical data." was illustrated by a manager at the department of supply chain finance in Company C2. Similarly, the vice president of Company C3 said that "we think that it is impossible that they [SMEs] do not repay the loan as it is not kidding for them to take use of the relationship maintained for so many years; many companies along the supply chain are quite familiar with us […]." The manager of risk control at the department of supply chain finance in Company C3 also highlighted the mechanism that "we provide all kinds of services like assortment, logistics, accounting etc. We know all their actions […]."

4. Conclusion and implications

This study contributes to the literature on SME financing by exploring the impact of supply chain finance and the main stream investigating the impact of information sharing in supply chains. In particular, this study provides both technological and social insight into supply chain network and consequent influence. Based on information processing theory and network theory, this study attempts to explore how supply chain network can easily generate a high level of information sharing which is usually unachievable in the traditional mode, along with illustrating the fact that both clique and bridge can help SMEs to increase their liquidity and working capital.

4.1 Theoretical implications

Compared to large companies, it is more difficult for SMEs to acquire sufficient capital. Financial institutions typically tend to lend capital to large companies (Petersen and Rajan, 1994) or companies who less spend money in R&D (Wang *et al.*, 2015; Brancati, 2015), because they consider that the average risk of financing SMEs, especially innovative SMEs, are higher than that of large companies, and it is easy for their larger counterparts to form a reliable relationship with large companies. Many researchers believe that this "financial gap" is caused by information asymmetry between the lender and the borrower (Tucker and Lean, 2003; Song and Wang, 2013). Thus, if the real condition of the firm matches what the financial institution expects, the risk will be low. Conversely, if there is a mismatch, the risk will be much higher. Therefore, it is essential to obtain enough information which can reflect SMEs capabilities or individual characteristics. However, information sharing for an effective two-way communications between downstream and

upstream organizations has only been claimed as the significant way to solve bullwhip effect or reduce supply chain costs (e.g. Hsieh, Lai and Shi, 2006; Silvestro and Lustrato, 2014; Zhang and Chen, 2013), but were never considered to facilitate financial flows. In contrast, this study integrated the information processing theory in the perspective of supply chain finance, which emphasizes that information sharing in the supply chain network in which the SMEs are embedded could initiate solutions to reduce information asymmetry and therefore enhance credit quality in the process.

Through primary data collected via survey, the current research illustrated that the credit quality of SMEs is affected by two important factors, the first one concerning information sharing in supply chain network and the other relating to the structure of supply chain network. More importantly, SMEs' strong ties with the other members in a supply chain network can bring in high level of information sharing, which in turn, enhances credit quality. It confirms that competence and closeness have become an essential embedded platform as China changes from its standardized and predictable value chains to a more innovative and learning-based supply chain network. In other words, if they have a well-constructed supply chain network (SMEs' relationship with their upstream and downstream) that helps the lender to obtain valuable information to access the SME's real condition, the SME's credit quality will be enhanced.

However, it was interesting to find that the direct effect of strong ties on credit quality is insignificant, but either the direct or indirect effect of bridging ties on credit quality is significant. SMEs' credit quality can be enhanced only when a higher level of strong ties in a supply chain network bring in rich information. In fact, this finding is coincident with the research of Day *et al.* (2013) that argues that skill enhancement, along with specific types of information sharing, empathy and dependability should be considered in order to overcome relational inertia. Also, bridging ties as open connectedness to others which bring in heterogeneous information could also enhance the level of information sharing. Since information asymmetry is the main cause of SMEs' financing problems, the provision of symmetrical information would make it easier for SMEs to obtain financing. More important, bridging ties will provide access to divergent regions of the network and then take the advantages of all kinds of resources, which weaken the dependence on certain partners and enhance credit quality directly.

4.2 Managerial implications

In the dynamic competitive market, supply chain finance is an effective way to enhance competitiveness for SMEs in supply chains. SMEs can leverage their supply chain network to increase information transparency, by which they can obtain lower cost financing and create predictable cash flow. The main reason is that through information sharing, the lender could deeply and comprehensively understand clients' business processes, SMEs' value appeal and dilemmas and transaction characteristics, among others. The current study has proven that information sharing may result in higher quality of financing, and information sharing can only be generated by SMEs' endeavor of establishing perfect supply chain network, which reflect at both strength and openness of ties within supply chain network. Moreover, the present study also found that without information sharing, even strong tie cannot enhance the efficacy of supply chain finance. For SMEs, making a strategy regarding how to develop relational and structural connectedness simultaneously can ensure high credibility of lenders. In this regards, the authors provide a set of guidelines for the SMEs.

First, if possible, SMEs should share more integrated information in their supply chain to let the focal firm fully understand their operational capability, including their

competence in the related business domain, assets, profits, market potential and management. This provides the foundation for determining the quantity and level of capital or credit offered.

Second, the ability of the SMEs to relate to business relationships embedded in supply chain network, might end up increasing credit line and reducing the risk of lending through the existent emotional and pragmatic relationships and controllability of SMEs' behavior in daily transactions.

Finally, SMEs should make their supply chain network highly robust to gain access to different kinds of resources that aids in maintaining an ecosphere and strengthen the ability to repay the loan. However, the formation of supply chain finance is not unconditional, since the effect of network connectedness can only be realized if the intersection of logistics, supply chain management, collaboration and finance exists between the SMEs and the focal firm.

4.3 Implications to academicians and future research

Although the findings from this research are expected to bear huge positive implications on the managerial front, its implications to academia cannot be overlooked. With the growing importance of supply chain financing and researches on SME credit financing and quality, the framework and findings of this paper can be expected to serve as a valuable tool to the academicians for developing theoretical- and practical-based courses on the same. These courses can be expected to arm the organization executives as well as the graduating managers with valuable knowledge in this field, which they can subsequently use to tackle problems of this nature. Additionally, this research is also expected to pave the way for further academic research as follows, which can significantly contribute to the domain of academia.

In this study, we only focussed on information sharing as a way to reduce information asymmetry, while the effect of other dimensions of information integration such as information visibility could also been investigated in the future studies. In addition, although strong tie and bridging tie were adopted in this study as the indicators of network embeddedness, other measures of network structure such as density and centrality have not been covered and could be studied in the future. Additionally, some factors that are beyond the scope of a single study could be explored to provide more comprehensive aspect. The future studies could investigate how industry-level and firm-level issues (especially the fit between SMEs and their upstream and downstream movement) and the use of agency theory impact supply chain finance. Finally, although in-depth interviews complemented the survey in this study, the complex supply chain structure and financing processes have not been explored. It is better for future studies to use a mixed method such as case studies, network simulations and so on to further investigate and compare the mechanisms behind different financial supply chains.

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About the authors

Hua Song is a Professor at the School of Business, Renmin University of China, Beijing, PR China. He received his PhD in economics from the Zhongnan University of Economics and Laws. His research interests include supply chain management, interorganizational relationships and strategic management. His research has appeared in *Asia Pacific Journal of Management*, *Transportation Journal*, *Decision Sciences*, *International Journal of Operations and Production Management*, *Chinese Management Studies*, *Industrial Marketing Management* and others.

Kangkang Yu is an Assistant Professor at the School of Agricultural Economics and Rural Development, Renmin University of China, Beijing, PR China. She received her PhD degree in marketing from the Australian School of Business, University of New South Wales, Sydney, Australia. She has research interests in the areas of alliances and networks, supply chain flexibility and distribution channel management. Her research has appeared in *Decision Sciences*, *International Journal of Production Economics*, *International Journal of Operations and Production Management*, *Psychology & Marketing*, *Industrial Marketing Management* and others. Kangkang Yu is the corresponding author and can be contacted at: yukangkang@ruc.edu.cn

Anirban Ganguly holds BSc and MBA degrees from the University of Calcutta, and also MS and PhD from Stevens Institute of Technology, USA. He is currently an Assistant Professor with the Jindal Global School of Business at the O.P. Jindal Global University, Haryana, India. His research interests include operations and supply chain management, technology and innovation management, risk analysis and knowledge management. His research has been

published in *International Journal of Production Economics*, *The Engineering Economist*, *International Journal of Knowledge Management*, *Engineering Management Journal*, *IEEE Aerospace & Electronics Systems Journal* and *International Journal of Innovation and Technology Management*, among others.

Rabia Turson currently is a Senior Lecturer of School of Business Administration, Xinjiang University of Finance and Economics, Urumqi, PR China. She received her PhD degree in logistics and supply chain management from the School of Business of the Renmin University of China, Beijing, PR China. She has research interests in the areas of supply chain safety and security, sustainable food supply chain and distribution channel management.