THE SUBSTITUTION FINANCING EFFECT OF SUPPLIERS' TRADE CREDIT ON CUSTOMERS' TRADE CREDIT: EVIDENCE FROM CHINA

Chun GUO [1, 2], Wunhong SU [1*], Xiaobao SONG [2]

[1]School of Accounting, Hangzhou Dianzi University, Hangzhou, Zhejiang, China
[2]Business School, Shantou University, Shantou, Guangdong, China

Abstract. This study investigates the substitution financing effect of suppliers' trade credit on customers' trade-credit using Chinese listed firms from 2009 to 2018. Results verify the substitution financing effect of suppliers' trade credit on customers' trade credit, indicating that firms with higher suppliers' trade credit have lower customers' trade credit. Moreover, suppliers' trade-credit substitutes customers' trade credit by alleviating financing constraints. Customer concentration weakens the substitution financing relation. Finally, the substitution financing effect of customers' trade credit on bank credit is more pronounced than that of suppliers' trade credit. As exogenous policy shock, the capital market liberalization has no significant impact on the substitution financing relation between heterogeneous trade credits. This study reveals that trade credit is heterogeneous rather than homogeneous. The substitution financing effect also exists in trade credit inside, which expands the existing literature's understanding of trade credit and the substitution financing theory's connotation.

Keywords: substitution financing effect, trade credit, suppliers' trade credit, customers' trade credit, financing constraints, customer concentration, capital market liberalization.

JEL Classification: D53, G23, G32.

Introduction

Trade credit refers to a relation formed by deferred payments to suppliers and prepayments from customers. As an informal financing channel, trade credit provides short-term credit funds (Fabbri & Klapper, 2016; Chod et al., 2019; Palacín-Sánchez et al., 2019) and alleviates firms' financing constraints (Casey & O'Toole, 2014; Huang et al., 2020). Especially in developing economies, bank loans are inadequate (Lin & Chou, 2015). Moreover, as relation loans are generated from long-term transactions, trade credit stabilizes the supply chain and enables firms to obtain market shares and product competition (Petersen & Rajan, 1997;

Zhang, 2020). Based on financial and operational motives, trade credit is favored by firms worldwide (Petersen & Rajan, 1997; Lin & Chou, 2015; Palacín-Sánchez et al., 2019).

The substitution financing effect of trade credits on bank credit is a key issue in the existing literature (e.g., Lin & Chou, 2015; Palacín-Sánchez et al., 2019; Chen et al., 2019). The substitution financing theory argues that formal financing channels are inadequate. Thus, as an informal financing channel, trade credit allows firms to obtain debt financing to alleviate financing constraints. Developing economies like China have imperfect financial markets, whose financial market development is relatively lower than that of the world average. Therefore, banks occupy a dominant position in financial markets, and bank credit discrimination is a common issue (Song et al., 2011; Lu et al., 2012; Beck et al., 2014). As a result, firms tend to take trade credit as a substitution financing channel for bank credit and other formal financing channels.

However, in existing literature, trade credit is defined as the credit provided by the suppliers to firms or firms to customers (e.g., Lin & Chou, 2015; Fabbri & Klapper, 2016; Chod et al., 2019; Zhang, 2020). Just as Fabbri and Klapper (2016) encapsulate it, firms use trade credit both to finance their input purchases (accounts payable) and offer to finance to their customers (accounts receivable). However, trade credit can be from suppliers and customers based on financing channels. As Peng et al. (2019) demonstrated, prepayments (deposit received under China accounting standard) are trade credit provided by customers to firms and accounts payable or notes payable are trade credit provided by suppliers to firms. Thus, trade credit generated from deferred payments or deposits received is provided by suppliers to firms and customers to firms.

Moreover, the existing literature (e.g., Lin & Chou, 2015; Xia et al., 2018; Chen et al., 2019; Zhang, 2020) regards trade credit as a whole, like a homogeneous "black box", but fails to subdivide trade credit from heterogeneous entities, such as trade credit from suppliers and customers. There appear significant differences in costs and difficulties between customers' and suppliers' trade credits in the market dominated by buyers. Suppliers are in an unfavorable position in the transactions or cooperation with firms and aim to sell products faster by supporting trade credits. Thus, firms can obtain suppliers' trade credit at lower costs (Fabbri & Menichini, 2010). On the contrary, customers dominate the transactions with firms in the buyer's market. With a high bargaining power, customers likely reduce trade credit supply. Therefore, firms have to afford the higher costs to gain trade credits provided by customers.

Furthermore, as shown in Figure 1, from 2009 to 2018, suppliers' trade-credit keeps increasing trends, and customers' trade credit has been on downward. Yet, the mismatch between deposit received (customers' trade credit) and accounts payable (suppliers' trade credit) are rife among Chinese firms. For example, as a manufacturing firm, *Lehui* (SH.603076) had 679 million deposits received and 128 million accounts payable in 2019, while its total assets are only 1704 million with earnings per share of –0.33. *Vcanbio* (SH.600645) is a high-tech firm with 1001 million deposits received and 70 million accounts payable in 2019. Such opposite trends and mismatch between deposit received and accounts payable in business practice provide reality inspirations to investigate the substitution financing effect between suppliers' trade credit and customers' trade credit.
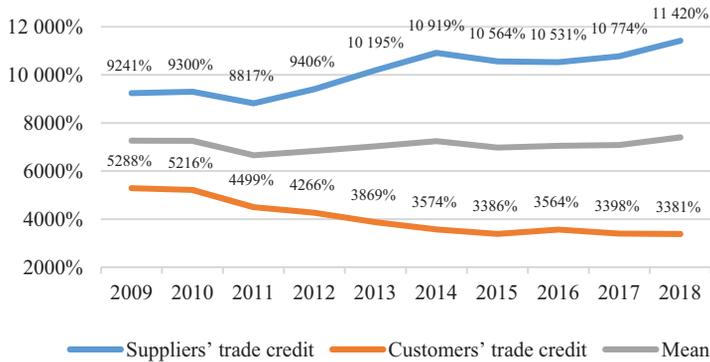
Figure 1. A line graph demonstrates suppliers' trade credit and customers' trade-credit annual trends of Chinese firms from 2009 to 2018

The Chinese capital market is imperfect, and trade credits likely exceed bank loans (Ge & Qiu, 2007). Banks dominate the financing market, and bank credit discrimination is common for Chinese firms, and they have to afford higher costs to obtain bank loans (Xia et al., 2018). The financing constraints are inevitable obstacles for Chinese firms' development (Song et al., 2011; Meng et al., 2020). As a substitution financing channel of bank loans (Lin & Chou, 2015), trade credit is widely used in China. Thus, the China context provides an appropriate market environment for the investigations of trade credits. Therefore, this study examines the substitution financing effect of suppliers' trade credit on customers' trade-credit using Chinese A-share listed firms.

This study contributes to the literature discussing substitution financing theory. Firstly, different from the existing literature regarding trade credit as a homogeneous "black box" (e.g., Lin & Chou, 2015; Xia et al., 2018; Zhang, 2020), this study subdivides trade credits into suppliers' trade credit and customers' credit, and finds suppliers' trade credit is negative with customers' trade credit. Moreover, this study reveals that trade credit is heterogeneous rather than homogeneous by denoting that the substitution financing effect of customers' trade credit on bank credit is more pronounced than that of suppliers' trade credit. Secondly, distinguished from the existing literature, which mainly examines substitution financing effect of trade credits on bank credit, this study documents that suppliers' trade credit has a substitution financing effect on customers' trade credit. Thus, this study expands the substitution financing theory's connotation and develops substitution financing effect to trade credit inside, which implies excess deposits received over accounts payable may be an abnormal signal.

Thirdly, this study finds suppliers' trade-credit alleviates financing constraints to curtail firms' demand for financing, leading to customers' trade-credit reduction, revealing the mechanism of substitution financing effect. Moreover, following the literature (e.g., Dhaliwal et al., 2016; Ma et al., 2020) that customer concentration worsens firms' financing constraints and performance, this study denotes customer concentration positively moderating effect on the substitution financing relation. This result shows that high customer concentration is a devil for Chinese firms, which deteriorates firms' operating performance and reduces equity

financing and debt financing. Thus, customer concentration aggravates financial constraints to weaken substitution financing relation. Finally, capital market liberalization alleviates financing constraints and decreases firms' demands for trade credit but fails to affect the substitution relation. This result implies that external factor hardly affects the substitution financing relation between suppliers' trade credit and customers' trade credit.

The remainder of this paper is organized as follows. In Section 1, theoretical analysis and hypotheses are developed. Section 2 presents the research design. Section 3 provides empirical results and analysis. Further investigation and discussion are displayed in Section 4. Finally, conclusions and limitations are given in the following section.

1. Theoretical analysis and hypothesis development

1.1. Suppliers' trade credit and customers' trade credit

According to buyers market theory, trade credits' widespread existence is with buyers' advantages (Fabbri & Menichini, 2010; Giannetti et al., 2011). China is a buyers market (Han et al., 2011; Li et al., 2018b). Customers dominate market transactions with firms in China. Due to customers' prepayments behaviors, deposited received has the nature of security funds, which likely appears in seller's market where demand exceeds supply. In a buyers' market that supply exceeds demand, customers likely reduce prepayments to guarantee firms' goods supply. Moreover, to enhance liquidity and cash chain turnover, customers would force firms to accept credit purchase and other conditions by lowering product prices, suspending purchases, and allying with other customers (Murfin & Njoroge, 2015). Hence, firms have to afford higher costs to obtain customers' trade credits.

However, suppliers are weak in transactions with firms under the buyers' market, where suppliers willingly provide trade credit to firms to sell products faster and prevent key customer loss (Giannetti et al., 2011; Fabbri & Klapper, 2016). Moreover, customers' trade credit is a deposit received which is a kind of cash financing, but suppliers' trade credit is a kind of physical financing (Burkart & Ellingsen, 2004). Unlike cash financing from customers, suppliers can gain information advantages and willingly allow firms to delay repaying trade credit. Thus, firms can obtain suppliers' trade credit at lower costs and difficulties (Fabbri & Menichini, 2010). Hence, based on buyers market theory, firms prefer suppliers' trade credit to customers' trade credit. When firms have access to suppliers' trade credit, they likely cut down using customers' trade credit.

As deferred payments are generated in daily transactions, suppliers' trade credit means firms' occupation of suppliers' funds, which is equal to short-term financing granted by suppliers that increases firms' cash liquidity (Amiti & Weinstein, 2011). Meanwhile, due to the prepayment behaviors, customers' trade credit generates daily transactions between firms and customers. Consistent with suppliers' trade credit, customers' trade-credit represents firms' occupation of customers' funds. Customers' trade credit is also equal to short-term financing provided by customers from the perspective of financing, which increases firms' cash liquidity (Fabbri & Menichini, 2010). Though both suppliers' and customers' trade credit belongs to trade credit, there appear pronounced differences in motivations and acquisition costs or difficulties as two different financing channels.

The substitution financing theory indicates that excessive financing demands cause the choice of financing channels. When firms have no access to one financing channel, they favor another financing channel (Petersen & Rajan, 1997). As demonstrated above, the Chinese market is a buyer market where customers have competitive advantages, and suppliers are relatively weak in the transactions with firms. Hence, firms have to afford higher costs and efforts to obtain customers' trade credit. However, suppliers willingly provide trade credit to firms to obtain suppliers' trade credit at relatively low costs and difficulties. Therefore, according to the substitution financing theory, once firms have no access to customers' trade credit, there is no doubt that firms shed light on suppliers' trade credit to meet their financing demands.

Moreover, firms' debt financing capacity is finite. Firms conduct debt financing excessively and blindly without considering actual debt capacity and operation conditions, easily leading to high leverage ratios. In the long term, if firms are with operational and investment mistakes, they hardly repay trade credits from suppliers and customers on time. Firms in the dilemma of insolvency are caught in the debt crisis and financial risks. Therefore, though both customers' trade credit and suppliers' trade-credit contribute to meet financing demands, firms have to choose between them to achieve the optimal trade credit financing structure. In other words, considering the fact firms prefer suppliers' trade credit to customers' trade credit, the increase of suppliers' trade-credit undoubtedly results in the decrease of customers' trade credit if firms' trade credit financing demands scale is certain. Accordingly, the first hypothesis of this study is as follows:

H1: *Suppliers' trade credit has a substitution financing effect on customers' trade credit.*

1.2. Suppliers' trade credit, financial constraints, and customers' trade credit

Financial constraint is an inevitable obstacle that global firms have to confront, which has become a bottleneck restricting firms' development (Song et al., 2011; Meng et al., 2020). Financial constraints can exert an impact on firms' financing decisions (Chang et al., 2019). When firms face financial constraints that cannot meet their financing demands through bank credits or other formal financing channels, trade credit becomes an effective informal financing channel. As an informal financing channel, trade credit is characterized by flexibility, low costs, and convenience, which has gradually become an essential channel for short-term debt financing (Wu et al., 2012). Especially in China, trade credit is a more effective financing channel contributing to alleviating firms' financial constraints (Casey & O'Toole, 2014; Huang et al., 2020). Thus, firms' reliance on bank credit is eased. This is exactly what substitution financing theory argues.

As trade credit's two essential components, suppliers' and customers' trade credit are beneficial to alleviating financial constraints. As demonstrated above, suppliers' trade credit refers to deferred payments generated in daily transactions, representing firms' occupation of suppliers' funds. From the perspective of financing, suppliers' trade credit is equal to short-term debt financing granted by suppliers to firms (Amiti & Weinstein, 2011), which aggrandizes firms' cash holdings liquidity. Meanwhile, customers' trade credit (deposit received under China accounting standard) is generated in advanced prepayments in daily transactions by customers to firms. Though customers' trade credit has the characteristic of

security funds, just like suppliers' trade credit, trade credit provided by customers represents firms' occupation of customers' funds, which is also equal to short-term financing provided by customers and contribute to increasing firms' cash liquidity (Fabbri & Menichini, 2010).

However, as noted above, supplier' trade credit and customers' trade credit are different in borrowing motivation, acquisition costs, and difficulties. Suppliers' trade-credit possesses prominent advantages in acquisition costs and difficulties than customers' trade credit. Like trade credit to bank credit, firms tend to reduce customers' trade credit and are inclined to suppliers' trade-credit considering acquisition difficulties and lowing financing costs. Substitution financing theory argues that firms likely abandon the pursuit of another financing method if one economic financing method can meet their financing demands and easing financial constraints (Petersen & Rajan, 1997). Thus, firms tend to give up customers' trade credit if suppliers' trade-credit contributes to easing financial constraints. Accordingly, the second hypothesis of this study is as follows:

H2: *Financing constraint has a mediation effect on the substitution financing relation between suppliers' trade credit and customers' trade credit.*

1.3. Suppliers' trade credit, customer concentration, and customers' trade credit

Customer concentration could be angels or devils for firms. Some literature shows that high customer concentrations can alleviate information asymmetry, reducing supply chain risks (Johnson et al., 2010). Customers with higher bargaining power can promote firms' technology innovation and management improvement, which increases efficiency, form scale economy, and promotes firms development (Patatoukas, 2012; Kwak & Kim, 2020). Meanwhile, some scholars denote that customer concentration likely increases firms' reliance on big customers (Fabbri & Klapper, 2016). Under customer bargaining power pressure and relation-specific investment's hold-up risks, firms have to make compromises like cutting selling price and trade credit supply, resulting in increased cash flow risks and damaging business performance (Murfin & Njoroge, 2015; Ma et al., 2020). Hence, once trading relation with main customers is interrupted, firms' operation risks are bound to increase (Dhaliwal et al., 2016; Chen & Wang, 2020).

As Modigliani and Miller (1958) noted, business risks affect the equity financing costs and choice of financing channels. Since customer concentrations have different impacts on firms' business performance and risks, customer concentration may affect the substitution financing effect of suppliers' trade credit on customers' trade credit. Shedding light on the research about the impact of customer concentration on firms' financing structure, the existing literature's conclusions are also the opposite.

Cen et al. (2018) note that big customers' reputation mechanism and regulatory role can alleviate various financial and non-financial contracts' restrictions. In China's context, Wang et al. (2016) and Li et al. (2018a) show that higher customer concentration helps firms have a higher lending capacity, reflected in the larger scale and longer-term bank loans. Thus, customer concentration can help firms gain financing from formal channels, leading to alleviating financing constraints. As discussed above, suppliers' trade credit substitutes customers' trade credit by alleviating financial constraints. Hence, the substitution relation

would be strengthened if firms' financial constraints are alleviated. In other words, customer concentration exerts a positive moderating effect on the substitution financing relation between suppliers' trade credit and customers' trade credit.

However, some scholars hold opposite views. Dhaliwal et al. (2016) expound that customer concentrations increase equity financing costs. Campello and Gao (2017) show that banks likely demand higher interest rates for firms with high customer concentration, leading to more restrictive clauses. Moreover, customers can use higher bargaining power to force firms to supply trade credit and encroach on their liquidity (Fabbri & Menichini, 2010; Giannetti et al., 2011; Peng et al., 2019). Hence, customer concentration reduces financing from formal channels and increases debt financing costs, worsening firms' financing constraints. As noted above, suppliers' trade credit substitutes customers' trade credit by alleviating financial constraints. Thus, the substitution relation would be weakened when financial constraints are aggravated. Customer concentration weakens the substitution financing relation between suppliers' trade credit and customers' trade credit. Accordingly, this study proposes the following competitive hypothesis:

H3a: *Customer concentration weakens the substitution financing relation between suppliers' trade credit and customers' trade credit.*

H3b: *Customer concentration strengthens the substitution financing relation between suppliers' trade credit and customers' trade credit.*

2. Research design

2.1. Sample selection

Due to the 2008 financial crisis and the shareholder structure reforms' possible influence on China's capital market, this study selects listed firms in China from 2009 to 2018. To ensure data validity, this study screens data in the following ways: (1) exclude ST and *ST firms; (2) exclude financial firms; (3) eliminate firms with incomplete information; (4) winsorize continuous variables at 1% and 99% level to exclude outliers. 17,922 sample observations remain. The data are extracted from the WIND financial database and the CNRDS database.

2.2. Variable measurement

2.2.1. Measuring customers' trade credit

The literature (e.g., Lu & Yang, 2011; Chen et al., 2019) regards the sum of accounts payable, notes payable, and deposit received as total trade credit. According to the contract's provisions, deposits received generated from the credit behavior that firms collect payments for goods from customers in advance. From the perspective of financing, deposit received represents firms' occupation of customers' funds or liquidity, equivalent to short-term financing provided by customers to firm and contributed to increasing firms' cash liquidity (Fabbri & Menichini, 2010). Accordingly, consistent with Peng et al. (2019), this study employs deposit received scaled by total assets (*CTC1*) to measure customers' trade credit. This study utilizes deposit received scaled by total liabilities (*CTC2*) to redefine customers' trade credit to ensure the robustness of regression results.

2.2.2. Measuring suppliers' trade credit

Suppliers' trade credit is the short-term credit formed due to deferred payments when suppliers sell products or provide services to firms. The literature generally uses accounts payable (Chod et al., 2019; Norden et al., 2020) or the sum of accounts payable and notes payable (Petersen & Rajan, 1997; Giannetti et al., 2011; Xia et al., 2018) as a proxy for suppliers' trade credit. However, based on Chinese accounting standards, the prepayments arise from the market transaction that firms pay in advance with cash or cash equivalent, which can be credited in a prepayment account or debited in accounts payable prepayment is on a small scale. Thus, this study adjusts accounts payable by deducting firms' prepayments to suppliers to enhance the comparability of accounts payable among different firms. Accordingly, this study utilizes the sum of adjusted accounts payable and notes payable scaled by total assets (*STC*) to measure suppliers' trade credit.

2.2.3. Control variables

Following the literature (e.g., Xia et al., 2018; Norden et al., 2020), this study uses firm size (*SIZE*), earnings power (*ROA*), leverage (*LEV*), growth ability (*GROWTH*), and firm age (*AGE*) to control firms' financial characteristics. This study employs ownership of top ten shareholders (*TOP10*), internal control (*IC*), senior manager change (*CHANGE*), an audit institution (*BIG4*) to control corporate governance characteristics. This study also includes industry dummy and year dummy to control the invariant industry effect and time trends. Variables definitions are shown in Table 1.

Table 1. Definition of variables

Name	Abbreviation	Definition
Customer's trade credit	CTC1	Deposit received / Total assets
	CTC2	Deposit received / Total liabilities
Supplier's trade credit	STC	(Accounts payable+Notes payable–Prepayments) / Total assets
Financing constraint	FC	*KZ* index (Kaplan & Zingales, 1997; Xia et al., 2018)
Customer concentration	CC	Firm's sales of top 5 customers / Total sales
Firm size	SIZE	Natural logarithm of the firm's total assets
Earnings power	ROA	Net revenue / Total assets
Leverage	LEV	Total liabilities / Total assets
Growth ability	GROWTH	The growth rate of main operating revenue
Firm age	AGE	Current year + One – Listing year
Ownership concentration	TOP10	The total shareholding ratio of the top ten shareholders
Internal control	IC	Natural logarithm of internal control index of the Chinese listed firms from DIB database
Management change	CHANGE	One if the chairman or general manager is changed in the current year; zero otherwise
Audit institution	BIG4	One if the auditing institution is one of the top four accounting firms; zero otherwise

2.3. Research methodology

2.3.1. Basic regression model

Following the literature of trade credits (e.g., Xia et al., 2018; Norden et al., 2020), this study constructs the model to examine the substitution financing effect of suppliers' trade credit on customers' trade credit.

$$CTC_{it} = \beta_0 + \beta_1 \times STC_{it} + \beta_2 \times CONTROL_{it} + \Sigma IND + \Sigma YEAR + \varepsilon_{it}, \quad (1)$$

where CTC_{it} denotes the customers' trade credit of firm i in year t. STC_{it} is the suppliers' trade credit of firm i in year t. $CONTROL_{it}$ represents control variables, and ε_{it} is the error term.

2.3.2. Stepwise regression to examine financial constraints' mediation effect

Consistent with the literature (e.g., Kaplan & Zingales, 1997; Xia et al., 2018), this study utilizes the *KZ* index to measure firms' financing constraints. Following Baron and Kenny (1986), this study conducts a stepwise regression model:

$$CTC_{it} = \beta_0 + \beta_1 \times STC_{it} + \beta_2 \times CONTROL_{it} + \Sigma IND + \Sigma YEAR + \varepsilon_{it}; \quad (1)$$

$$FC_{it} = \beta_0 + \beta_1 \times STC_{it} + \beta_2 \times CONTROL_{it} + \Sigma IND + \Sigma YEAR + \varepsilon_{it}; \quad (2)$$

$$CTC_{it} = \beta_0 + \beta_1 \times STC_{it} + \beta_2 \times FC_{it} + \beta_3 \times CONTROL_{it} + \Sigma IND + \Sigma YEAR + \varepsilon_{it}, \quad (3)$$

where FC_{it}, moderation variable, is the financing constraint of firm i in year t.

2.3.3. Regression model for customer concentration's moderating effect

Following the literature (e.g., Peng et al., 2019; Liu et al., 2020), this study uses the firm's sales to the top 5 customers divided by total sales to measure customer concentration. Following Baron and Kenny (1986), this study constructs the model as follows:

$$CTC_{it} = \beta_0 + \beta_1 \times STC_{it} + \beta_2 \times CC_{it} + \beta_3 \times CC_{it} \times STC_{it} + \beta_4 \times CONTROL_{it} + \Sigma IND + \Sigma YEAR + \varepsilon_{it}, \quad (4)$$

where CC_{it}, moderating variable, is the customer concentration of firm i in year t.

3. Results

3.1. Descriptive statistics

Table 2 presents descriptive statistics. Results show that *CTC1* ranging from 0.012% to 32.877%, has a mean of 3.901% and a median of 1.530% with a standard deviation of 5.999. *CTC2*, with a mean of 7.815% and a median of 3.599%, is larger than *CTC1*. *STC* varies from –9.682% to 41.829%, with a mean of 10.279% and a median of 8.162%. Thus, compared with customers, suppliers provide more trade credit to firms. The mean of *LEV* is 48.393%, and the mean of total trade credit (the sum of both trade credits) is up to 14.180%, indicating trade credit is important for Chinese firms' debt financing structure.

Table 2. Descriptive statistics for regression variables

Variables	N	Mean	SD	MIN	Median	MAX
CTC1	17,922	3.901	5.999	0.012	1.530	32.877
CTC2	17,922	7.815	10.260	0.027	3.599	51.200
STC	17,922	10.279	9.827	−9.682	8.162	41.829
SIZE	17,922	22.255	1.272	19.880	22.074	26.179
ROA	17,922	5.383	5.887	−18.811	5.082	22.843
LEV	17,922	48.393	19.518	9.974	48.111	94.332
GROWTH	17,922	16.689	34.803	−53.299	11.533	187.670
AGE	17,922	15.284	6.860	2.000	15.000	29.000
TOP10	17,922	56.685	15.354	22.050	57.330	89.650
IC	17,922	6.268	1.185	0.000	6.510	6.794
CHANGE	17,922	0.262	0.439	0.000	0.000	1.000
BIG4	17,922	0.096	0.294	0.000	0.000	1.000

3.2. Empirical results

3.2.1. Suppliers' trade credit and customers' trade credit

Table 3 presents the results of the relation between suppliers' trade credit and customers' trade credit. Column (1) reports a significantly negative association between suppliers' trade credit and customers' trade credits (*CTC1*), suggesting that firms with more suppliers' trade credit have fewer customers' trade credit. Suppliers' trade credit has a substitution financing effect on customers' trade credit. Thus, hypothesis 1 is verified. To check the robustness of research conclusions, *CTC2* is used as an alternative indicator in column (2), and the result is consistent with column (1). Moreover, customers' trade credit with a one-year lag is used in columns (3) and (4) to enhance the reliability of empirical results and reduce potential simultaneity's impact on research conclusions. The results are robust.

Table 3. Testing the substituting financing effect of suppliers' trade credit on customers' trade credit

Variables	(1)	(2)	(3)	(4)
	$CTC1_t$	$CTC2_t$	$CTC1_{t+1}$	$CTC2_{t+1}$
STC_t	−0.047*** (−9.52)	−0.075*** (−9.16)	−0.028*** (v4.96)	−0.043*** (−4.75)
CONSTANT	−6.236*** (−6.48)	0.949 (0.58)	−7.355*** (−6.92)	−0.593 (−0.33)
$CONTROL_t$	Yes	Yes	Yes	Yes
IND / YEAR	Yes	Yes	Yes	Yes
N	17922	17922	14243	14243
F	80.17	47.47	67.55	40.08
Adj-R^2	0.248	0.131	0.245	0.135

Note: T-statistics are in parentheses. All t-statistics are corrected for heteroskedasticity using White correction. *, **, and *** indicate 10%, 5%, and 1% significant, respectively.

To find why suppliers' trade credit has a substitution financing effect on customers' trade credit, the reason is that suppliers' and customers' trade credit have significant differences in motivation, difficulty, and cost of acquisition, just like trade credit and bank credit. According to substitution financing theory, because the bank has credit discrimination and firms have to afford high costs and difficulties to obtain bank credit, trade credit as an informal financing channel can substitute bank credit. Moreover, in a buyers market, customers dominate in transactions with firms, while suppliers cannot. Thus, firms' costs and difficulties in obtaining customers' trade credit are higher than that of suppliers' trade credit. Hence, as two components of trade credit, suppliers' trade credit can have the substitution financing effect on customers' trade credit.

3.2.2. Suppliers' trade credit, financing constraints, and customers' trade credit

Table 4 presents financing constraints' mediation effect on substitution financing effect of suppliers' trade credit on customers' trade credits. Column (1) shows the results of the stepwise regression's first step, indicating that suppliers' trade-credit negatively impacts customers' trade credit. Column (2) denotes the results of stepwise regression's second step that suppliers' trade credit is negative with financing constraints at 1%, which implies that suppliers' trade-credit alleviates firms' financing constraints. Column (3) shows the stepwise regression's third step when financing constraints and suppliers' trade credit are involved in regression. Results show that both suppliers' trade credit and financing constraints are positive, with customers' trade credit at 1%. The *Sobel* mediation test is significant at 1%. Moreover, *CTC2* is utilized in columns (3), (4), and (5) to enhance the reliability of the empirical results, and the results are robust. Thus, financing constraints affect the substitution financing effect of suppliers' trade credit on customers' trade credit.

Table 4. Testing financial constraints' mediation effect on the relation between supplier's trade credit and customer's trade credit

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	CTC1	*FC*	*CTC1*	*CTC2*	*FC*	*CTC2*
STC	−0.047***	−0.014***	−0.054***	−0.075***	−0.014***	−0.087***
	(−9.52)	(−14.38)	(−10.79)	(−9.16)	(−14.38)	(−10.59)
FC	/	/	−0.487***	/	/	−0.898***
			(−11.30)			(−11.67)
CONSTANT	−6.236***	4.405***	−4.093***	0.949	4.405***	4.904***
	(−6.48)	(24.99)	(−4.14)	(0.58)	(24.99)	(2.90)
CONTROL	Yes	Yes	Yes	Yes	Yes	Yes
IND / YEAR	Yes	Yes	Yes	Yes	Yes	Yes
N	17922	17922	17922	17922	17922	17922
F	80.17	281.61	79.43	47.47	281.61	48.80
Adj-R²	0.248	0.426	0.256	0.131	0.426	0.140
Sobel Test	0.006*** (9.16)			0.011*** (9.45)		

Note: T-statistics are in parentheses. All t-statistics are corrected for heteroskedasticity using White correction. *, **, and *** indicate 10%, 5%, and 1% significant, respectively.

3.2.3. Suppliers' trade credit,　customer concentration, and customers' trade credit

Table 5 presents customer concentration's moderating effect on the substitution financing effect of suppliers' trade credit on customers' trade credit. The coefficient of *STC*CC* in column (1) is positive at 1%, implying that customer concentration moderates suppliers' trade credit has a substitution financing effect on customers' trade credit. To check results' robustness, *CTC2* is used, and results are robust. Thus, high customer concentration is a devil for Chinese firms, and customer concentration aggravates financing constraints to weaken the substitution financing relation between suppliers' trade credit and customers' trade credit. Therefore, hypothesis 3a is verified.

Table 5. Testing customer concentration's mediating effect on the relation between supplier's trade credit and customer's trade credit

Variable	(1)	(2)	(3)	(4)
	$CTC1_t$	$CTC2_t$	$CTC1_{t+1}$	$CTC2_{t+1}$
STC_t	−0.082*** (−9.71)	−0.140*** (−10.20)	−0.064*** (−6.62)	−0.109*** (−6.99)
CC_t	−0.055*** (−18.79)	−0.109*** (−19.95)	−0.056*** (−16.54)	−0.105*** (−17.25)
$STC_t{}^*CC_t$	0.001*** (6.68)	0.003*** (7.68)	0.001*** (5.93)	0.003*** (6.58)
$CONSTANT_t$	−1.950** (−2.02)	9.399*** (5.66)	−3.342*** (−3.15)	7.005*** (3.86)
$CONTROL_t$	Yes	Yes	Yes	Yes
IND / YEAR	Yes	Yes	Yes	Yes
N	17922	17922	14243	14243
F	83.75	59.76	70.39	50.17
$Adj\text{-}R^2$	0.268	0.157	0.264	0.159

Note: T-statistics are in parentheses. All t-statistics are corrected for heteroskedasticity using White correction. *, **, and *** indicate 10%, 5%, and 1% significant, respectively.

3.3. Endogeneity analysis

As substitution financing theory demonstrates, access to one financing channel can influence the choice of another financing channel, just like trade credit to bank credit. Some scholars document that trade credit can substitute bank credit (Chen et al., 2019; Norden et al., 2020). Meanwhile, bank credit facilitates firms' access to trade credit (Lin & Chou, 2015). Thus, trade credit and bank act as firms' two important external financing channels (Palacín-Sánchez et al., 2019), which influence each other. Likewise, as two essential components of trade credit, suppliers' trade credit and customers' trade credit can influence mutually. Hence, there appears the possibility that the amount of trade credits provided by customers to firms is based on the number of trade credits provided by suppliers, and there is a cause and effect endogenous problem.

Following Itzkowitz (2013) and Dhaliwal et al. (2016), this study employs suppliers' trade credit with one-year lagged and two-year lagged as instrumental variables. The two

instrumental variables pass the Hausman test, the overidentification test, and the weak instrumental variables test. Therefore, the two instrument variables selected in this study are appropriate in a theoretical and statistical sense. Table 6 presents instrumental 2SLS estimation regression results. Columns (2) or (4) show that suppliers' trade-credit negatively affects customers' trade credit at 1%. Thus, suppliers' trade credit has the substitution financing effect on customers' trade credit under the consideration of cause and effect endogenous problem.

Table 6. Testing supplier's trade credit's relation with customer's trade credit under cause and effect

Variables	$CTC1_t$		$CTC2_t$	
	(1)	(2)	(3)	(4)
	1st Stage	*2nd Stage*	*1st Stage*	*2nd Stage*
STC_t	/	−0.052*** (−7.22)	/	−0.068*** (−5.91)
STC_{t-1}	0.734*** (51.72)	/	0.734*** (51.72)	/
STC_{t-2}	0.125*** (9.17)	/	0.125*** (9.17)	/
CONSTANT	1.559* (1.70)	−6.004*** (−5.03)	1.559* (1.70)	1.183 (0.58)
CONTROL	Yes	Yes	Yes	Yes
IND / YEAR	Yes	Yes	Yes	Yes
N	11438	11438	11438	11438
F	1075.23	1962.86	1075.23	1306.52
Adjusted R^2	0.806	0.262	0.806	0.157
Hausman test	172.61***		178.28***	
Sargan overidentification test	2.296 (p = 0.130)		1.480 (p = 0.224)	
Minimum Eigenvalue Statistic	19615.800		19615.800	

Note: z-statistics are in parentheses. All z-statistics are corrected for heteroskedasticity using White correction. *, **, and *** indicate 10%, 5%, and 1% significant, respectively.

4. Further analysis and discussion

4.1. Heterogeneous trade credit and bank credit

Existing literature (e.g., Lin & Chou, 2015; Xia et al., 2018; Chen et al., 2019; Zhang, 2020) regards trade credit as a whole "black box" but fails to subdivide trade credit from the perspective of heterogeneous entities. To investigate its theoretical reason, the debt homogeneity hypothesis cannot be ignored. The term "debt" usually refers to financial liabilities like bonds in capital structure theory. Whereas operating liabilities, such as accounts receivable and accounts payable, are neglected. This can be verified from several capital structure research (Myers & Majluf, 1984; Myers, 1984).

However, operating liabilities strike debt homogeneity, especially in China with low trust. This makes capital structure selection theory based on debt homogeneity somewhat inappli-

cable in China. As noted above, China is a buyers market. There are pronounced differences in market positions between suppliers and customers in transactions. Thus, bargaining power varies among suppliers, firms, and customers. There appear differences in motivations, costs, and difficulties between trade credit provided by suppliers and customers. Hence, trade credit heterogeneity appears. Moreover, heterogeneous trade credit can exert discrepant shock on firms' existing capital structure (or formal financing methods like bank credit). This is none other than the premise of this study.

Existing literature regards trade credit as homogeneous, which implies no difference in the substitution effect of heterogeneous trade credit on bank credit. To verify different substitution financing effects of suppliers' trade credit and customers' trade credit on bank credit. Following Johnston (2012), this study incorporates suppliers' trade credit and customers' trade credit into the model (6) and designs the model :

$$BANK_{it} = \beta_0 + \beta_1 \times CTC_{it} + \beta_2 \times STC_{it} + \beta_3 \times \text{CONTROL}_{it} + \Sigma\text{IND} + \Sigma\text{YEAR} + \varepsilon_{it}, \quad (5)$$

where $BANK_{it}$ denotes the bank credit of firm i in year t. Following the existing literature (McGuinness & Hogan, 2016; Palacín-Sánchez et al., 2019), this study uses short-term debts to measure bank credit and use the sum of short-term debts and long-term debts as a replacement indicator for robustness tests.

Table 7 shows the different effects of heterogeneous trade credit on bank credits. Column (1) denotes compared with suppliers' trade credit, customers' trade credits have a more significant negative effect on bank credits, and the regression coefficient difference test is significant at 1%. Thus, there appears a pronounced difference in the effect of trade credit provided by suppliers and customers on bank credit. Moreover, as shown in columns (2), (3), (4), the results are consistent with column (1) through measurement method of bank credit has been changed. Therefore, there exist significant differences between suppliers' trade credit and customers' trade credit, and the research premise of this study is valid.

Table 7. Testing heterogeneous trade credit' effect on bank credit

Variables	(1)	(2)	(3)	(4)
	$BANK1_t$	$BANK2_t$	$BANK1_{t+1}$	$BANK2_{t+1}$
$CTC1_t$	−0.480*** (−29.89)	−1.092*** (−52.04)	−0.423*** (−21.03)	−0.998*** (−37.85)
STC_t	−0.218*** (−21.51)	−0.725*** (−53.97)	−0.205*** (−17.30)	−0.679*** (−42.65)
$CONSTANT_t$	−43.730*** (−20.48)	13.710*** (4.97)	−36.334*** (−14.86)	28.638*** (9.11)
$CONTROL_t$	Yes	Yes	Yes	Yes
$IND / YEAR$	Yes	Yes	Yes	Yes
N	17922	17922	14243	14243
F	178.57	218.96	121.03	145.77
Adjusted R^2	0.271	0.263	0.231	0.235
Coefficient test ($\beta_1 = \beta_2$)	203.15***	242.45***	93.14***	116.40***

Note: T-statistics are in parentheses. All t-statistics are corrected for heteroskedasticity using White correction. *, **, and *** indicate 10%, 5%, and 1% significant, respectively.

4.2. Capital market liberalization

There are three milestones for China's capital market liberalization from 2009 to 2018. China securities regulatory commission and the state administration of Foreign exchange launched RMB Qualified Foreign Institutional Investors (RQFII) in 2011. Then, China securities regulatory commission and Hongkong securities regulatory commission opened the Shanghai-Hongkong share market trading connect mechanism on 17 November 2014. On 5 December 2016, China securities regulatory commission and Hongkong securities regulatory commission launched Shenzhen-Hongkong stock connect. As Figure 1 shown, total trade credit obtained by Chinese firms declined from 2010 to 2011, 2014 to 2015, and 2016 to 2017, which is in line with the capital market liberalization.

Capital market liberalization exerts influence on the Chinese financing market (Wu et al., 2017). Capital market liberalization attracts foreign investors, enables firms to obtain foreign funds, and reduces financing costs (Bekaert et al., 2005). Moreover, foreign investors improve information disclosure quality and share price information efficiency (Bae et al., 2012; Li et al., 2014). The capital market liberalization enables firms to obtain investment funds directly from foreign investors, thus alleviating firms' financing constraints (Gupta & Yuan, 2009) and reducing the demand for trade credit.

As shown in Figure 1, capital market liberalization affects trade credits. However, an interesting issue is whether capital market liberalization affects the relation between suppliers' trade credit and customers' trade credit. This study divides data from 2009 to 2018 into four sample intervals of 2009–2010 (no capital market liberalization), 2011–2014 (RQFII), 2015–2016 (Shanghai-Hong Kong), and 2017–2018 (Shenzhen-Hong Kong). The model is constructed as follows:

$$CTC_{it} = \beta_0 + \beta_1 \times STC_{it} + \beta_2 \times POST_j + \beta_3 \times POST_j \times STC_{it} + \beta_3 \times CONTROL_{it} + \\ \Sigma IND + \Sigma YEAR + \varepsilon_{it}, \tag{6}$$

where $POST_j$ denotes the step of the Chinese capital market liberalization for firm j.

Table 8 presents capital market liberalization's effect on the substitution financing relation between suppliers' trade credit and customers' trade credit. Column (1) shows suppliers'

Table 8. Testing capital market liberalization's effect on the substitution financing effect of suppliers' trade credit on customers' trade credit

Variables	(1) 2009–2010 CTC1 (None)	(2) 2009–2014 CTC1 (RQFII)	(3) 2012–2015 CTC1 (Shanghai-Hong Kong)	(4) 2015–2018 CTC1 (Shenzhen-Hong Kong)
STC	−0.075*** (−5.57)	−0.047*** (−3.87)	−0.046*** (−5.52)	−0.030** (−2.43)
POST	/	−0.484* (−1.74)	−0.435** (−2.02)	0.323 (1.57)
POST*STC	/	−0.011 (−0.79)	−0.003 (−0.25)	−0.008 (−0.65)

End of Table 8

Variables	(1) *2009–2010*	(2) *2009–2014*	(3) *2012–2015*	(4) *2015–2018*
	CTC1 *(None)*	*CTC1* *(RQFII)*	*CTC1* *(Shanghai-Hong Kong)*	*CTC1* *(Shenzhen-Hong Kong)*
CONSTANT	–13.773*** (–4.21)	–9.411*** (–6.83)	–7.133*** (–5.61)	–2.839** (–2.25)
CONTROL	Yes	Yes	Yes	Yes
IND / YEAR	Yes	Yes	Yes	Yes
N	2429	9220	9358	8702
F	23.54	55.17	54.02	41.30
Adj-R²	0.234	0.242	0.289	0.284

Note: T-statistics are in parentheses. All t-statistics are corrected for heteroskedasticity using White correction. *, **, and *** indicate 10%, 5%, and 1% significant, respectively.

trade-credit negatively relates to customers' trade-credit excluding the capital market liberalization. Moreover, after considering the capital market liberalization, columns (2), (3), and (4) denote that the coefficients of *POST*STC* are insignificantly negative, indicating that the Chinese capital market liberalization has an insignificantly negative impact on the substitution financing relation between both trade credits. Moreover, *CTC2* is utilized in this study to examine the robustness of the results (As space is limited, *CTC2*'s results are not presented). The results are robust with *CTC1*.

Conclusions and limitations

As an informal financial channel, trade credit appears to be an important substitution financing channel for formal financing channels like bank loans worldwide, especially in developing countries like China. This study explores the substitution financing effect in internal trade credit by using Chinese listed firms' data from 2009 to 2018. There is evidence of the substitution financing effect of suppliers' trade credit on customers' trade credit. The findings shed light on the "black box" inside named trade credit and reveal trade credit is heterogeneous rather than homogeneous, which extends the substitution financing theory connotation. Moreover, this study demonstrates the excess of deposit received over accounts payable may be an abnormal signal. Thus, except for a few firms with the pre-sale system, stakeholders should be cautious when firms' deposits received are greater than accounts payable.

Furthermore, this study finds that financing constraints have a mediation effect on the substitution financing relation between heterogeneous trade credit. Suppliers' trade credit meets firms' financing demands, which alleviates its financial constraints, reducing customers' trade-credit demands. Customer concentration weakens the substitution financing relation between heterogeneous trade credit. Finally, the substitution financing effect of customers' trade credit on bank credit is more pronounced than that of suppliers' trade credit. The Chinese capital market liberalization affects firms' trade credit but does not affect the

substitution financing relation between both trade credits. This study guide firms worldwide to use trade credits and set financing structures reasonably, especially for emerging market countries with imperfect financial markets like China.

However, there appear some limitations. Firstly, firms may have associated relations with suppliers and customers, and related relations are different from those between firms in the general market regarding motivations and bargaining powers. The transactions between non-related suppliers or customers and firms in the market are often based on their interests. In contrast, related transactions between related suppliers or customers and firms are based on both interest maximization. Further research could investigate trade credits caused by related suppliers and customers.

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Author contributions

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