Research in International Business and Finance 57 (2021) 101406

Contents lists available at ScienceDirect

Research in International Business and Finance

journal homepage: www.elsevier.com/locate/ribaf

Full length Article

Ownership discrimination and private firms financing in China

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ARTICLE INFO

JEL classification:
G21
G32
G38

Keywords:
Ownership discrimination
Trade credit
Bank loan
Private Sector
Operating performance

ABSTRACT

This study examines the financing/funding of private firms in China. Our results show that private firms are significantly less funded through formal financing channels such as bank loans than state-owned firms, and hence have to resort to alternative financing such as trade credit. Consistent with the theoretical expectation and literature, there is a substitution effect between trade credit and bank loans for private firms, but this effect is much weaker compared to that of state-owned firms. Moreover, while the univariate comparisons indicate that private firms obtain more notes payable than state-owned firms, the multivariate regression analyses show that the relation between bank loan and notes payable is positive and indifferent between private and state-owned firms.

1. Introduction

The Chinese economy had been dominated by state ownership and central planning before the Chinese economic reform in 1978. After that, the privatization and contracting out of much state-owned industry has remarkably boosted the rapid growth of the private sector which accounted for as much as 70 % of China's GDP (Engardio, 2005). In the last decade, the private firms, mainly composed of family or individual-owned firms, have become an important force to promote China's economic growth by expanding employment, promoting technological innovation, and contributing to the government tax revenues (Li et al., 2006; Allen et al., 2005; Tsai, 2002).

Despite its fast growth and the increasing importance in the Chinese economy, the private sector encountered many challenges in the due course. One of the biggest challenges is the difficulty in obtaining sufficient financing. Chinese authorities give priority to the financing demand of the state-owned firms by imposing financial constraints on private sectors and ownership discrimination in financial policies. The financial constraints and ownership discrimination make it very difficult for the private firms to be financed by the banking sector which tends to supply most credit resources to the inefficient state-owned companies. Also, the credit rationing in the capital market also limits the sources of funds available to private firms. The ownership discrimination in the capital markets results in the "resource misallocation" that would adversely affect the private firms' performance and the economic growth in China.

Some studies argue that the Chinese capital market provides alternative financing channels and governance mechanisms for private firms. For example, Allen et al., 2005 find that the system of alternative mechanisms and institutions based on reputation and relationships effectively support the growth of the private sector. One stream of literature finds that trade credit might be an important indirect way to provide financing to fast-growing private companies. According to the substitution hypothesis (Meltzer, 1960; Schwartz, 1974; Petersen and Rajan, 1997; Burkart and Ellingsen, 2004; Pattnaik et al., 2020) which is built on the pecking order

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https://doi.org/10.1016/j.ribaf.2021.101406
Received 11 December 2019; Received in revised form 26 December 2020; Accepted 22 February 2021
Available online 2 March 2021
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assumption, because the cost of trade credit can be very high, firms first use relatively inexpensive bank loans and then expensive trade credit after bank loans become unavailable (e.g., Smith, 1987; Petersen and Rajan, 1994). Empirical evidence shows that small U.S. firms that are subjected to bank credit rationing tend to use more trade credit. Hence, trade credit has become one of the most important sources of short-term financing around the world (Rajan and Zingales, 1995; Seifert et al., 2013; Wu et al., 2014; Chen et al., 2019). For example, Levine et al. (2018) show that trade credit accounts for 25 % of the average firm's total debt liabilities in their sample of more than 3500 firms across 34 countries from 1990 to 2011. On the other hand, trade credit provides a channel to alleviate the negative impacts of the financing crisis. When a systemic banking crisis impedes the normal bank-lending mechanism, access to the trade credit could partially offset the reduction in bank loans and alleviate the impact of the crisis on corporate profits and employment (Cornett et al., 2011; Campello et al., 2010). This is particularly true for private firms who are in a relatively inferior position in the financing markets.

The suppliers of trade credit are usually those firms that can easily obtain loans from formal financial institutions such as commercial banks. He et al. (2019) document when bank loans are scarce or rationed, firms with better access are not only able, but also willing, to re-allocate their funds to the firms with low access but high creditworthiness through trade credit for the following reasons: First, compared with specialized financial institutions, they have advantages in evaluating and controlling the credit risk of their buyers; Second, they can indirectly price discriminate through the using of trade credit when the direct price discrimination is legally not allowed; And third, offering trade credit is commonly regarded as a source of competitive advantage for the suppliers (Petersen and Rajan, 1997; Cull et al., 2009; Chod et al., 2019). Such a practice can effectively alleviate the problems of cash-starved firms with limited financing. Similarly, Demirgüç-Kunt and Maksimovic (2002) document that non-financial firms with lower credit constraints act as financial intermediaries by channeling short-term funds to firms with high credit constraints via offering trade credit. In addition, Fisman and Love (2007) find that trade credit can substitute bank loans to support firms' growth in developing capital/-financial markets. By examining Chinese rural firms from 1999 to 2006, Yano and Shiraishi (2012) find that financing by trade credit is more efficient than bank loans for their sample firms. Trade credit and its transmission mechanisms can also reduce the negative effect of undeveloped and inefficient financial systems in developing countries. They believe that trade credit has become one of the most important factors to promote a country's economic growth, especially in private firms. McMillan and Woodruff (1999) show in a survey study that when asked about the preferred least costly financing sources, 60 % of the firm's selected trade credit. In China, Triangular Debt[1] issue in 1990s provides incentive of using trade credit as an informal financing channel, that is, state-owned firms with excess capital are very likely to lend through various non-bank channels to private firms who are not able to borrow from banks.

On the other hand, however, another stream of literature believes that trade credit is often linked to the purchase of products on a short-term basis, thus causing its flexibility to clearly inferior to that of bank loans (Ge and Qiu, 2007; Pattnaik et al., 2020). Some research documents the disadvantages of trade credit such as shorter financing maturity, smaller financing scales, higher financing costs, more stringent extra terms and conditions imposed by the providers, etc. (Sun et al., 2017). Fisman (2001), looking at firm-level data from five African countries, shows that supplier credit is positively related to capacity utilization. Hence, providing trade credit to firms that currently do not receive access to credit may not be socially optimal. For private firms, trade credit might be a costly substitute for bank loans (Danielson and Scott, 2004).

Therefore, while enabling private firms to obtain indirectly external financing and thus boosting the development of the private sector in China, as well as partially correcting the biases and inefficiency of the initial allocation of credit funds, trade credit might also be a costly substitute of bank loans for private firms. From the perspective of the cost of capital for a private firm, unless the firm is confronted with credit rationing and discrimination in the financial markets, trade credit is a suboptimal financing choice and is rarely employed by firms to alleviate the shortage of funds. On the other hand, some researchers find that the amount of funds from the trade credit channel is relatively small compared with the financing via normal financing channels (Cull et al., 2009). It is arguable that the role of trade credit in providing external finance to improve firms' performance, growth, and reinvestment is much less important than that of formal bank loans (Du, Lu, and Tao, 2008). Therefore, as a typical informal financing way, trade credit cannot effectively substitute for formal bank loans. It is not likely for private companies to meet their needs of funds by only using trade credit financing in China (Du, Lu, and Tao, 2008).

In this study, we try to add to the literature on trade credit and its role in promoting the development of Chinese private firms by examining their usage of trade credit. In particular, we focus on the following questions: 1) Do Chinese private firms rely more on the expensive trade credit compared with SOEs? 2) Do Chinese private firms use trade credit to substitute bank loans to meet their financing needs? 3) Does trade credit provide more effective and efficient financing to the growth of Chinese private firms? China provides us an ideal setting to explore these research questions. After more than thirty years of' reform and openness, China has made tremendous progress in its economic development and has become one of the fastest-growing economies in the world. In contrast, China's financial system is not as fast as developing as other economic sectors in two aspects. First, China's financial system is dominated by a large but underdeveloped banking system. Allen, Qian, and Qian (2005) show that China's banking section is significantly larger than the stock market, and the bank's dominance over the market is the strongest among all their sample countries. Chen, Ma, and Wu (2019) note that in 2015, the ratio of the total bank credit to GDP surpassed 2.5 in China and was the highest in the world. Second, the banking system in China is mainly controlled by the four largest state-owned banks. Giannetti et al. (2011) show that SOEs have preferential access to formal bank loans, and SOEs, therefore, can become intermediaries by providing trade credit to other firms especially when non-SOEs dash for liquidity. The un-matched development pace of the formal financing and the overall

[1] Triangle debt is a debt default affecting two parties as a result of a third party being unable or unwilling to repay a loan.

economies results in the growth in a series of alternative financing channels, such as informal financial intermediaries, internal financing and trade credits, and coalitions of various forms among firms, investors, and local governments (Allen et al., 2007). These alternative financings provide the most successful support to the growth of the overall economy, particularly the private sectors. Allen, Qian, and Qian (2005)'s survey shows that trade credit from business partners is one of the most important sources of financing for private sectors in China, particularly during their growth period. Chen, Ma, and Wu (2019) document that in China, the average net accounts payable is about 30.4 % of the cost of goods sold during 2011–2015, compared to an average of 25.1 % during 2002−2006. Such a background makes China an ideal setting to explore our research questions.

Our results show that private firms are significantly less funded by banks than state-owned firms in China. Consistent with theoretical expectation and findings of Allen, Qian, and Qian (2005) as well as of Ge and Qiu (2007), there is evidence showing that private firms use trade credit to substitute for bank loans. Specifically, the bank loan is significantly negatively associated with trade credit for private firms. More interestingly, we find that this effect also exists and is stronger among state-owned firms. Moreover, though private firms obtain more notes payable than state-owned firms, multivariate regression analyses show that the relationship between bank loans and notes payable is positive and such relation is statistically indifferent from that of state-owned firms. Further analysis reveals that the financial development of a region does not enhance the availability of bank loans to private firms and thus reduces their dependence on trade credit. This result suggests that the role of financial development in relieving the credit rationing and ownership discrimination suffered by private firms in the formal financial markets is still very limited in China. In addition, we find that bank loans and trade credit have an adverse effect on private firms when we look at both Tobin's q and return on assets (ROA) which are common proxies for the firms' performance. One possible explanation is that there exists serious agency problems between managers (majority shareholders) and external shareholders (minority shareholders) in private firms which restrict the effective use of bank loans and trade credit.

This study contributes to the literature on financing institutions, ownership structures, and alternative financings. First, we provide empirical evidence on financial rationing and ownership discrimination against private firms in accessing formal financing sources such as bank loans. Such empirical evidence is an important and inevitable part of the supporting chains to the substitution theory of financing (Meltzer, 1960; Schwartz, 1974; Petersen and Rajan, 1997; Burkart and Ellingsen, 2004), and complements the current empirical studies such as Petersen and Rajan (1997) and particularly the empirical analysis regarding Chinese market (Wang et al., 2019; Chen et al., 2019; and Allen et al., 2019). Second, our study adds to the literature on alternative financings, especially on trade credit. Our findings suggest that trade credit is not only important as a substitutive source of financing for private firms who cannot easily obtain bank loans as SOEs, it also plays an important role in supporting SOEs' growth. Such finding is consistent with Allen, Qian, and Qian (2019)'s argument based on survey results that informal financing plays a very important role in supporting the growth of firms and the economy in China and other emerging countries. Our study provides direct evidence to support their conclusions. Third, our study contributes to the literature on the economic development of emerging markets and particularly private firms. Our results indicate that the private firms in China, while facing financing rationing and ownership discrimination, also lack the efficiency in using alternative financing such as trade credit. Hence, our study has important implications for the regulators regarding the efficiency of financing allocation.

The remainder of this paper is organized as follows. Section 2 offers theoretical debates and hypotheses construction. Section 3 describes the sample selection, defines the variables, and specifies the methodology. The main results and analysis are reported in section 4. Section 5 concludes the study.

2. Theoretical debates and research hypotheses

2.1. Credit rationing, bank discrimination and trade credit

Recently, a growing amount of research documents that the accessibility to external funds is a key factor to promote firm growth (Cull and Xu, 2005). However, due to the lack of a market-supporting mechanism, formal financing channels are not as readily accessible to private firms as to state-owned firms and thus constrain the growth of the private sector. In addition, Chinese authorities adopt powerful financial control policies to support their state-owned firms. Credit rationing and ownership discrimination make it very difficult for financing private firms through formal financing channels, leading private firms to suffer from much more severe financing constraints for their growth.

Besides, the lack of effective legal protection is another issue for Chinese private firms (Bai et al., 2006; Johnson et al., 2002). The role of regulations in protecting private firms is still relatively weak in China (Walder, 1995) and the operating risk of private firms is still high, which thus causes the banks to be reluctant to lend funds to private firms. This obviously aggravates the hard situation faced by private firms.

In an effort to acquire the required funds for their development, private firms seek informal financing even at the expense of much higher cost. Informal financing has seriously impaired the operating efficiency of private firms. When an enterprise is subject to credit rationing and ownership discrimination in the formal financial markets, implicit borrowings in the form of trade credit from suppliers, as informal financing sources are widely used by those companies. As a result, private firms use it to alleviate the shortage of funds in the event that the enterprise is unable to obtain loans directly from banks even the lending costs through trade credit are very high. Petersen and Rajan (1997) find that firms use more trade credit when credits from financial institutions are unavailable and firms with better access to credits offer more trade credit. Fisman and Love (2003) show that industries with higher dependence on trade credit financing exhibit higher growth rates in countries with weaker financial institutions, and the logical premise underlying their results is that firms in certain industries can be better able to substitute trade credit for bank loans. Danielson and Scott (2004), using firm-level

data from the 1995 Credit, Banks, and Small Business Survey, investigate the effects of bank loan availability on the trade credit and credit card demand of small firms and find that firms increase their reliance on potentially expensive sources of funds such as trade credit and credit card debt when bank loans are unavailable. Their research results thus provide direct evidence of a link between bank credit constraints and trade credit demand. Brand and Li (2003), employing matching bank-firm survey data from China, find that private and privatized firms are discriminated against in the formal loan markets, private (privatized) firms are forced to resort to more expensive trade credits to finance their growth. Ge and Qiu (2007) compare the use of an important non-formal financial channel, trade credit, between state and non-state-owned firms in China and find that non-state-owned firms use more trade credit primarily for financing rather than transactional purposes.

Based on the literature, we propose our first hypothesis regarding the substitution effect of the trade credit as follows:

Hypothesis 1. *Trade credit of private firms is significantly negatively related to their bank loans obtained in the formal financial markets.*

In practice, trade credit, as an alternative funding source to private firms, can have different forms according to its sources (providers) and nature, such as accounts payable, notes payable, and receipts in advance.[2] Among these specific forms of trade credit, both accounts payable and notes payable are mainly provided by the firms' suppliers, and receipts in advance are from the firms' customers. Receipts in advance enable the private firms to immediately receive full or part of payments before formally delivering the goods to customers and thus bring a cash inflow to the private firms, virtually equivalent to first borrowing funds from the customers and then repaying them with product sales. It not only satisfies part of the financing needs of an enterprise but also avoids the risk of delinquent payments. It is, therefore, a relatively safe financing mode of trade credit with fewer restrictions. On the contrary, both accounts payable and notes payable enable the firms to obtain the goods from suppliers first and then pay the suppliers later, equivalent to an enterprise using borrowed funds from suppliers to purchase required inventories, which can also at least partially meet the firms' funds demand. Moreover, different from accounts payable, notes payable require that firms use commercial papers with the exact drawee and date of payment as collateral, and must be fully repaid at the due date. If a default occurs, the firms will face very severe punishment such as penalty interests and lawsuits. Contracting costs of notes payable are thus much higher than those of accounts payable. Therefore, from the perspective of financing sources, among these three forms of trade credit that are available to the firms, receipts in advance are the best, followed by accounts payable, and then notes payable. These discrepancies are also reflected in the normal accounting treatment of the firms for accounts payable, notes payable and receipts in advance. If bank loans from financial institutions are unavailable, private firms are expected to adopt an optimal financing model of trade credit to substitute for bank loans. This leads to the following hypothesis:

Hypothesis 2. *ceteris paribus, the negative (substitution) relationship between bank loans and receipts in advance is stronger than that between bank loans and accounts payable or notes payable.*

2.2. Trade credit, bank loan and firm performance

As discussed earlier, trade credit enables private firms to obtain funds indirectly. Nevertheless, trade credit is often related to the purchase of products, which thus causes its flexibility to clearly inferior to that of bank loans (Ge and Qiu, 2007). Moreover, trade credit does have some disadvantages such as shorter financing maturity, smaller financing scales, higher financing costs as well as much more stringent additional terms and conditions imposed by the providers. Therefore, trade credit might be a costly substitute for bank loans (Danielson and Scott, 2004).

On the other hand, though financial leakage peculiar to the state-owned sector during the economic transition period in China provides funding support for the growth of private firms, one would overserve a huge loss of state-owned assets due to the irregularities of origin of financial leakage as well as a variety of rent-seeking and corruptions occurring in the process of informal supply of funds. The risk arising from financial leakage will continue to enlarge, which thus harms the entire social and economic development. Ayyagari et al. (2010) find that a relatively small percentage of firms utilize bank loans, firms with bank financing experience faster growth and higher reinvestment rates, and have productivity growth at least equal to that of similar firms financed from non-bank sources. These findings suggest that the role of reputation and relationship-based informal financing and governance mechanisms in supporting the growth of private firms is likely to be very limited and unlikely to substitute for formal financing mechanisms. Using World Bank data of Chinese firms, Du, Lu, and Tao (2008), directly test the importance of bank loans and trade credit in promoting firm performance and find that bank loans are significantly associated with firm performance and growth, while the availability of trade credit is much less associated. Their results suggest that trade credit cannot effectively substitute for bank loans and informal financing cannot well accommodate the fund needs of the fast-growing non-state firms in China.

McMillan and Woodruff (1999) argue that the substitution effect indicates that trade credit can alleviate the problems of fund shortage faced by private firms in the short term. However, it is not likely to meet the fund needs of private firms in the long run. Thus, even though trade credit could play an important role in offering external finance to support the growth of firms, an effective formal financial system may be necessary to sustain a country's economic long-run growth (Ge and Qiu, 2007). In other words, the importance of formal loans to the growth of private firms is higher than that of trade credit. Accordingly, our third hypothesis is:

[2] According to the standard definition of modern corporate finance, trade credit refers to the lending relationship between the firms which is formed in the exchange of goods as a result of the payment ahead of time or behind time, and specific forms include accounts payable, notes payable, and receipts in advance.

Hypothesis 3. *The positive effect of trade credit on the operating performance of private firms is significantly weaker than that of bank loans.*

Different from accounts payable and notes payable, receipts in advance have the advantages of higher flexibility and fewer limitations of fund use. Receipts in advance are ideal financing modes of trade credit for the firms that are confronted with more severe credit rationing and discrimination in the formal financial markets. However, since the firms and their customers are usually in a zero-sum game relationship in the specific mode of payment, consequently, a specific form of trade credit is optimal for one party only. As compensation for customers' pay in advance, it often requires the firms to make a large price concession, suggesting that receipts in advance have a higher implicit cost. Furthermore, the more significant substitution relationship between bank loans and receipts in advance means that if the firms can increase the availability of their bank loans, they will evidently reduce the dependence on the receipts in advance. Hence, our fourth hypothesis is:

Hypothesis 4. *ceteris paribus, the impact of receipts in advance as trade credit on the operating performance of private firms is weaker than that of accounts payable and notes payable.*

3. Sample selection and research design

3.1. Sample selection and data sources

In this study, our sample covers all non-financial state-owned and private companies[3] listed in Shanghai and Shenzhen stock exchanges over the period from 2003 to 2015.[4] To ensure the validity of the data obtained and simultaneously minimize the potential effects of other factors on the research results, we first exclude companies whose main operational business has ever experienced substantial changes. We also exclude companies with insufficient financial information, or the information is obviously misreported. These filtering processes leave us a pooled sample of 21,749 firm-year observations over 13 years.

The accounting data is obtained from the companies' annual reports published by the Shanghai Wind database and CSMAR (China Stock Market & Accounting Research) database. In addition, the data on the identity of an enterprise's ultimate controlling shareholder are manually collected from the depth of information about senior executives provided by the database of Resset Finance Research of China. When a company's ultimate controlling shareholder is the governments at all levels, such as the bureaus of state assets management, finance bureaus and bureaus in charge of different industries or other government agencies et al., we take it as a state-controlled company. On the contrary, if a company's ultimate controlling shareholder is private entities or individuals at the time of the firm's IPO, such as private entrepreneurs, townships and villages, and family or individual, it is correspondingly treated as a private-controlled company. The identification of an enterprise's ownership is based on the information about the firm's senior executives that is manually collected from the database of Resset Finance Research of China.

3.2. Model specification and variable definitions

Our basic regression equations are specified as follows:

$$\begin{aligned} Tradpay_{i,t} = {} & \alpha_0 + \alpha_1 Bank_{i,t-1} + \alpha_2 \mathrm{Priv}_{i,t} + \alpha_3 \mathrm{P}riv_{i,t} \times Bank_{i,t-1} + \alpha_4 Growth_{i,t-1} + \alpha_5 Roa_{i,t-1} + \alpha_6 Cash_{i,t-1} \\ & + \alpha_7 INV_{i,t-1} + \alpha_8 LnTA_{i,t-1} + \alpha_9 Tradrec_{i,t-1} + \alpha_{10} \mathrm{Larg}_{i,t} + \alpha_{14} LnAge_{i,t} + \Sigma Ind + \Sigma Year + \varepsilon_{it} \end{aligned} \tag{1}$$

$$\begin{aligned} Firm\ Perf_{i,t} = {} & \beta_0 + \beta_1 Bank_{i,t-1} + \beta_2 Tradpay_{i,t-1} + \beta_3 Bank_{i,t-1} \times Tradpay_{i,t-1} + \beta_4 Growth_{i,t-1} \\ & + \beta_5 Roa_{i,t-1} + \beta_6 LnTA_{i,t-1} + \alpha_7 \mathrm{Larg}_{i,t} + \alpha_8 LnAge_{i,t} + \Sigma Ind + \Sigma Year + \varepsilon_{it} \end{aligned} \tag{2}$$

In Eq. (1), the subscripts i and t denote firms and years respectively. *Tradpay* is the enterprise's total trade credit acquired from its suppliers or customers in year t, measured by the sum of the accounts payable, notes payable and receipts in advance in year t scaled by the book value of total assets at the end of year t.

Bank is the enterprise's bank loans in year t-1, calculated as the sum of short-term and long-term bank loans in year t-1 deflated by the book value of total assets as of the end of year t-1. If the coefficient of *Bank* is significant and negative, it suggests that the lack of bank loans leads to private firms to use more trade credit, and thus supports the first hypothesis.

Priv is a dummy variable, taking the value of 1 if the enterprise is owned by some private entities or individuals during their IPO stage, or 0 otherwise. In regression Eq. (1), the interaction term, *Priv*Bank*, is to further examine the effect of financial discrimination of a region in China on the substitution relationship between bank loans and trade credit of private firms. If a private company suffers from more serious credit rationing and ownership discrimination in China, one would expect the coefficient of the interaction term, *Priv*Bank,* to be significantly negative.

[3] In principle, compared to non-listed private firms, listed private firms could use equity financings such as the right issue and seasoned equity offerings to alleviate their fund shortage. However, under the conditions where equity financing is strictly controlled by the central government in China, not all state-owned firms which possess the qualifications of equity financing in form can successfully achieve their equity financing plan. Moreover, a potential advantage for selecting listed private firms as a sample is that if research results confirm that listed private firms are subjected to credit rationing and ownership discrimination in the formal financial markets, we can conclude that non-listed private firms with limited financing channels will suffer much more serious credit rationing and ownership discrimination in the formal financial markets in China.

[4] Due to the data availability and quality of the Resset database, our data sample covers from the beginning of 2003 to the end of 2015.

Table 1
Descriptive Statistics for Main Variables.

Variables	No. of obs	Mean	Median	Min	25 % percentile	75 % percentile	Max	Std
$Tradpay_{i,t}$	21,749	0.167	0.135	0.000	0.073	0.227	0.852	0.126
$Accpay_{i,t}$	21,749	0.089	0.072	0.000	0.040	0.122	0.655	0.070
$Notpay_{i,t}$	21,749	0.035	0.011	0.000	0.000	0.048	0.498	0.054
$Adrec_{i,t}$	21,749	0.043	0.018	0.000	0.006	0.048	0.774	0.068
$Tradrec_{i,t-1}$	21,749	0.166	0.149	0.000	0.082	0.230	0.930	0.110
$Accrec_{i,t-1}$	21,749	0.106	0.085	0.000	0.034	0.152	0.928	0.095
$Notrec_{i,t-1}$	21,749	0.023	0.006	0.000	0.000	0.026	0.434	0.042
$Adpay_{i,t-1}$	21,749	0.037	0.024	0.000	0.010	0.048	0.602	0.043
$Bank_{i,t-1}$	21,749	0.207	0.198	0.000	0.082	0.313	0.801	0.148
$Growth_{i,t-1}$	21,749	0.178	0.163	−0.973	0.028	0.322	1.000	0.257
$Roa_{i,t-1}$	21,749	0.036	0.035	−0.984	0.014	0.062	0.457	0.062
$Cash_{i,t-1}$	21,749	0.181	0.144	0.001	0.086	0.237	0.869	0.137
$Inv_{i,t-1}$	21,749	0.157	0.131	0.000	0.069	0.210	0.897	0.130
$LnTA_{i,t-1}$	21,749	21.581	21.421	18.602	20.776	22.177	28.136	1.151
$Age_{i,t}$	21,749	7.810	8.000	1.000	4.000	11.000	21.000	4.512
$Larg_{i,t}$	21,749	0.410	0.403	0.022	0.285	0.528	0.894	0.158

Growth captures the enterprise's growth opportunities in the year t-1, measured by the growth ratio of sales. *Roa* is the enterprise's return on assets in year t-1, proxied by the ratio of the profit after tax to the book value of total assets, reflecting an enterprise's profitability. *Cash* is the enterprise's cash and cash equivalent divided by the book value of total assets as of the end of year t-1. *INV* is the enterprise's ratio of inventory to the book value of total assets as of the end of year t-1. *LnTA* is the enterprise's natural logarithm of the book value of total assets as of the end of year t-1, used to control for the size effect of enterprise on the availability of trade credit or operational performance of private firms.

Tradrec is trade credit that a firm offers to other firms externally at the end of year t-1, measured by the sum of accounts receivable, notes receivable and payments in advance in year t-1 scaled by the book value of total assets as of year t-1

Larg is the proportion of shares held by the enterprise's first largest shareholder as of the end of year t. *LnAge* is the natural logarithm of the number of years the firm has been listed on the stock exchanges in China since IPO. We take the natural logarithm on age to reduce the skewness of the measure.

Besides, we control for industry and year effects by including the industry and year indicators *Ind* and *Year*, to mitigate the effect of changes in macro factors. To this end, we adopt the 2001 year's Standard Industry Classification Code of China Securities Regulatory Commission (CSRC) to construct 20 industry dummy variables by following Xia and Fang (2005). ε is the error term.

In Eq. (2), *FirmPerf* measures the enterprise's performance in year t. We use two proxies in our study to obtain more robustness in our results. The first one is the natural logarithm of Tobin's q[5], *LnTobin's q*, where Tobin's q is computed as the enterprise value (defined as the market value of equity plus the book values of long-term debt, short-term debt, preferred stock, and convertible securities) divided by the ending book value of total assets. The second one is return on asset, *Roa*.

In specification (2), for our third hypothesis to be supported, we expect the coefficient of *Bank* to be significantly positive and far greater than that of *Tradpay*, suggesting that the importance of trade credit is less than that of bank loans in improving the operational performance of private firms. Also, a negative relationship between bank loans and trade credit, *Bank*Tradpay*, is expected from the test.

To further investigate the substitution relationship between the specific forms of trade credit with bank loans, we further use different forms of trade credit, that is, accounts payable, notes payable and receipts in advance, to re-estimate the regression Eq. (1) and (2), respectively. In addition, we follow Cull, Xu, and Zhu (2009) to use one-year lagged observations to mitigate the causality effect. Moreover, the independent variables such as *Bank* and *Tradpay* (*Accpay*, *Notpay* and *Adrec)* are both designed to address the concerns about the multicollinearity problem.

4. Results and analysis

4.1. Descriptive statistics for the variables and univariate test

Table 1 provides the descriptive statistics of our main variables. We can see that the mean (median) of $Tradpay_{i,t}$ is 0.166 (0.135) with a range of standard deviation, indicating that there is a variation in trade credit acquired from the suppliers or customers among firms during the sample period. $Accpay_{i,t}$, $Notpay_{i,t}$ and $Adrec_{i,t}$ have an average (median) of 0.089 (0.071), 0.034 (0.011) and 0.042 (0.017), showing the sum of accounts payable and notes payable is much higher than receipts in advance, suggesting that firms obtain

[5] We follow Hirsch and Seaks (1993), and Havakhor et al. (2019) to adopt the natural logarithm of Tobin's q in our study.

Table 2
Univariate Tests of Differences between State-owned and Private Firms.

Variables	Mean			Median		
	State-owned firms	Private firms	t-values	State-owned firms	Private firms	Wilcoxon z-values
$Tradpay_{i,t}$	0.171	0.154	5.760***	0.138	0.127	4.473***
$Accpay_{i,t}$	0.092	0.082	5.561***	0.074	0.065	5.164***
$Notpay_{i,t}$	0.034	0.037	−1.991**	0.010	0.014	−3.423***
$Adrec_{i,t}$	0.045	0.035	6.471***	0.020	0.012	10.950***
$Tradrec_{i,t-1}$	0.159	0.186	−9.921***	0.140	0.170	−11.513***
$Accrec_{i,t-1}$	0.100	0.126	−11.277***	0.074	0.109	−14.549***
$Notrec_{i,t-1}$	0.023	0.021	2.520**	0.006	0.006	3.076***
$Adpay_{i,t-1}$	0.036	0.039	−2.412**	0.023	0.025	−3.796***
$Bank_{i,t-1}$	0.216	0.180	10.169***	0.209	0.168	10.006***
$Growth_{i,t-1}$	0.174	0.192	−2.853***	0.158	0.179	−3.353***
$Roa_{i,t-1}$	0.032	0.048	−10.661***	0.031	0.049	−17.178***
$Larg_{i,t}$	0.424	0.370	14.166***	0.421	0.353	13.917***
$Age_{i,t}$	8.630	5.450	29.264***	9.000	4.000	29.720***
$Cash_{i,t-1}$	0.162	0.238	−19.486***	0.132	0.195	−19.374***
$Inv_{i,t-1}$	0.156	0.162	−2.119**	0.128	0.137	−4.509***
$LnTA_{i,t-1}$	21.732	21.144	24.192***	21.566	21.037	20.915***

more trade credit from their suppliers rather than from customers.

The mean (median) of $Tradrec_{i,t-1}$ is 0.165 (0.149). Accreci,t-1 and Adpayi,t-1 have the means (medians) of 0.106 (0.084) and 0.036 (0.023) respectively, suggesting that companies with extra funds will lend to others in the forms of accounts receivable, notes receivable and pay in advance through trade credit channel.

The Standard Deviation of bank loan to total assets ($Bank_{i,t-1}$) is 0.148, indicating that there is a big difference in the ability to obtain bank borrowings among the firms. State-owned banks in China are very likely to take discriminatory strategies to cope with borrowing needs for different ownerships.

$Growth_{i,t-1}$ has an average (median) equal to 0.178 (0.163) and ranges from -0.973 to 0.999, indicating a huge difference in growth opportunities among tested firms. The mean and median of ($Roa_{i,t-1}$) are 0.036 and 0.035, respectively, with the minimum at -0.983 and maximum at 0.457, indicating that, majority of firms performed poorly during the sample period and some firms have suffered from an even more serious loss (the lowest return on assets is at -98.380 percent of book value of total asset).

The mean (median) cash and cash equivalent ($Cash_{i,t-1}$) across all firm-years stands at 0.181 (0.143) with a minimum of 0.001 and a maximum of 0.868 of book value of total assets as of the end of year t-1. The natural log transformation of sample firms average (median) size (total assets as of the end of year t-1) is 21.581 (21.420) with a minimum of 18.601 and a maximum of 28.135. The ownership of the first largest shareholder averages 41.000 percent and ranges from 2.197 percent to 89.410 percent of total shares outstanding. On average, our sample firms have been listed for 7.810 years on the stock exchanges in China. Given the variations in firm characteristics, controlling for the effects of these attributes is very important in the following multivariate regression analyses.

Table 2 tabulates the results for the univariate tests of mean and median differences for all regression variables used in Model (1) between state-owned and private firms. The table shows, both mean and median differences for variables between the two groups of firms are statistically significant at the 5 percent level.

For $Tradpay_{i,t}$, the mean and median of private firms are 0.154 and 0.126, respectively, which are substantially lower than those of state-owned firms, 0.171 and 0.138, at 1 percent level, indicating that trade credit that private firms obtain from their suppliers or customers is far lower than that of state-owned firms. These findings suggest that private firms are subject to far severer credit rationing and ownership discrimination in the formal financial markets in China. It provides supportive evidence to previous studies (Ge and Qiu, 2007; Brand and Li, 2003). Moreover, when using different forms of $Tradpay_{i,t}$, we find that the means and medians of $Accpay_{i,t}$ and $Adrec_{i,t}$ for state-owned firms are both statistically significantly higher than those of private firms, showing that, state-owned firms obtain much more accounts payable and receipts in advance from their suppliers and customers. On the contrary, the means and medians of $Notpay_{i,t}$ for private firms are 0.036 and 0.014, which are both statistically significantly greater than those of state-owned firms, indicating that private firms get access to much more notes payable from their suppliers than state-owned firms.

The mean (median) of trade credit, $Tradrec_{i,t-1}$, is 0.185 (0.169) for private firms and 0.159 (0.140) for state-owned firms, with the difference statistically significant at 1 percent level. This means private firms provide much more trade credit in the forms of accounts receivable, notes receivable, or payments in advance to their counterparties. More interestingly, when using different forms of $Tradrec_{i,t-1}$, such as accounts receivable, notes receivable or payments in advance, we find that the means and medians of $Accpay_{i,-1t}$, and $Adrec_{i,t-1}$ are both higher for private firms than for state-owned firms, with the differences statistically significant at the 1 percent level. Collectively, the results suggest that private firms are seriously discriminated against in the formal financial markets. This effect leads the private firms to get no or less trade credit from their suppliers and customers.

In addition, Table 2 also shows that private firms have much higher growth ratio of sales ($Growth_{i,t-1}$), profitability ($Roa_{i,t-1}$), cash holdings ($Cash_{i,t-1}$) and inventory level ($INV_{i,t-1}$), but have a smaller size ($LnTA_{i,t-1}$), lower ownership of ultimate controlling

Table 3
Pearson and Spearman Correlation Coefficient Matrix between the Regression Variables (*p*-value, two-tailed).

Variables}	$Tradpay_{i,t}$}	$Accpay_{i,t}$}	$Notpay_{i,t}$}	$Adrec_{i,t}$}	$Bank_{i,t-1}$}	$Tradrec_{i,t-1}$}	$Accrec_{i,t-1}$}	$Notrec_{i,t-1}$}	$Adpay_{i,t-1}$}	$Roa_{i,t-1}$}	$Growth_{i,t-1}$}	$Cash_{i,t-1}$}	$Inv_{i,t-1}$}	$Larg_{i,t}$}	$LnTA_{i,t-1}$}	$LnAge_{i,t}$}
$Tradpay_{i,t}$	(-)	0.794***	0.597***	0.589***	−0.104***	0.379***	0.246***	0.243	0.275***	−0.116***	0.121***	0.119***	0.444***	0.007	0.140***	0.051***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.496)	(0.000)	(0.000)
$Accpay_{i,t}$	0.752***	(-)	0.390***	0.280***	−0.115***	0.396***	0.341***	0.275***	0.148***	−0.100***	0.088***	0.082***	0.310***	0.020*	0.081***	0.021*
	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.071)	(0.000)	(0.056)
$Notpay_{i,t}$	0.571***	0.263***	(-)	0.102***	0.090***	0.335***	0.239***	0.326***	0.234***	−0.081***	0.121***	0.034***	0.203***	−0.025**	0.111***	−0.047***
	(0.000)	(0.000)		(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.020)	(0.000)	(0.000)
$Adrec_{i,t}$	0.624***	0.155***	−0.007	(-)	−0.095***	0.121***	−0.011	0.035***	0.276***	−0.081***	0.058***	0.079***	0.397***	0.004	0.142***	0.147***
	(0.000)	(0.000)	(0.498)		(0.000)	(0.000)	(0.291)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.704)	(0.000)	(0.000)
$Bank_{i,t-1}$	−0.172***	−0.165***	0.010	−0.158***	(-)	−0.050***	−0.029***	−0.086***	0.127***	−0.261***	−0.013	−0.454***	−0.016	−0.095***	0.196***	0.156***
	(0.000)	(0.000)	(0.347)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.236)	(0.000)	(0.139)	(0.000)	(0.000)	(0.000)
$Tradrec_{i,t-1}$	0.346***	0.378***	0.253***	0.051***	−0.046***	(-)	0.833***	0.377***	0.395***	−0.145***	0.044***	0.054***	0.232***	−0.026**	−0.190***	−0.120***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.015)	(0.000)	(0.000)
$Accrec_{i,t-1}$	0.214***	0.335***	0.119***	−0.042***	−0.015	0.852***	(-)	0.153***	0.096***	−0.188***	−0.013	0.065***	0.168***	−0.054***	−0.314***	−0.172***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.165)	(0.000)		(0.000)	(0.000)	(0.000)	(0.244)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Notrec_{i,t-1}$	0.199***	0.204***	0.207***	−0.006	−0.172***	0.329***	−0.023**	(-)	0.036***	0.088***	0.113***	0.018	0.093***	0.060***	0.117***	0.000
	(0.000)	(0.000)	(0.000)	(0.561)	(0.000)	(0.000)	(0.031)		(0.001)	(0.000)	(0.000)	(0.104)	(0.000)	(0.000)	(0.000)	(0.954)
$Adpay_{i,t-1}$	0.220***	0.032***	0.185***	0.227***	0.081***	0.364***	0.001	−0.074***	(-)	−0.082***	0.105***	0.017	0.236***	−0.070***	0.003	−0.023**
	(0.000)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.950)			(0.000)	(0.000)	(0.108)	(0.000)	(0.000)	(0.799)	(0.035)
$Roa_{i,t-1}$	−0.081***	−0.084***	−0.074***	−0.005	−0.243***	−0.121***	−0.172***	0.122***	−0.049***	(-)	0.313***	0.232***	−0.104***	0.117***	0.111***	−0.193***
	(0.000)	(0.000)	(0.000)	(0.669)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Growth_{i,t-1}$	0.126***	0.083***	0.096***	0.071***	−0.017	0.036***	−0.016	0.076***	0.054***	0.295***	(-)	0.069***	0.048***	0.071***	0.110***	−0.145***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.123)	(0.001)	(0.131)	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Cash_{i,t-1}$	0.056***	0.021*	0.008	0.075***	−0.459***	−0.052***	−0.032***	−0.013	−0.049***	0.223***	0.065***	(-)	−0.020*	0.052***	−0.174***	−0.296***
	(0.000)	(0.055)	(0.439)	(0.000)	(0.000)	(0.000)	(0.003)	(0.228)	(0.000)	(0.000)	(0.000)		(0.066)	(0.000)	(0.000)	(0.000)
$Inv_{i,t-1}$	0.324***	0.164***	0.093***	0.357***	−0.002	0.051***	0.008	−0.006	0.119***	−0.064***	0.032***	−0.123***	(-)	−0.021**	−0.006	0.048***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.860)	(0.000)	(0.482)	(0.589)	(0.000)	(0.000)	(0.003)	(0.000)		(0.050)	(0.579)	(0.000)
$Larg_{i,t}$	0.010	0.023**	−0.026**	0.016	−0.097***	−0.013	−0.030***	0.066***	−0.033***	0.119***	0.071***	0.066***	−0.020*	(-)	0.126***	−0.212***
	(0.339)	(0.034)	(0.015)	(0.128)	(0.000)	(0.219)	(0.006)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.059)		(0.000)	(0.000)
$LnTA_{i,t-1}$	0.149***	0.085***	0.051***	0.147***	0.175***	−0.181***	−0.269***	0.123***	0.009	0.139***	0.111***	−0.185***	0.040***	0.168***	(-)	0.313***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.428)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)
$LnAge_{i,t}$	0.059***	0.043***	−0.006	0.070***	0.196***	−0.061***	−0.094***	0.043***	0.009	−0.149***	−0.136***	−0.439***	0.091***	−0.198***	0.252***	(-)
	(0.000)	(0.000)	(0.574)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.426)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	

Note: This table reports both Pearson and Spearman correlation coefficients for the variables for a sample of 21,749 year-level observations over the period 2003−2015. Pearson (Spearman) correlation coefficients are presented below (above) the main diagonal. ***, **, and * denote two-tailed statistical significance at the 1%, 5%, and 10 % level, respectively. All variable definitions appear in Table 1.

Table 4
Multivariate Results for Credit Rationing, Bank Discrimination and Trade Credit.

Variables	$Tradpay_{i,t}$ (1)	$Accpay_{i,t}$ (2)	$Notpay_{i,t}$ (3)	$Adrec_{i,t}$ (4)
Intercept	−0.504***	−0.205***	−0.237***	−0.165***
	−20.110	−14.220	−13.290	−9.760
$Priv_{i,t}$	−0.021***	−0.015***	0.004**	−0.008***
	−7.490	−9.560	2.400	−4.810
$Bank_{i,t-1}$	−0.151***	−0.081***	0.046***	−0.090***
	−15.900	−14.930	6.760	−15.110
$Priv \times Bank_{i,t-1}$	0.064***	0.018**	−0.013	0.046***
	3.930	2.000	−1.130	4.460
$Roa_{i,t-1}$	−0.254***	−0.101***	−0.118***	−0.068***
	−9.310	−6.720	−6.640	−6.260
$Growth_{i,t-1}$	0.056***	0.021***	0.028***	0.017***
	11.940	7.920	8.340	5.390
$Tradrec_{i,t-1}$	0.309***			
	22.850			
$Accrec_{i,t-1}$		0.203***		
		13.160		
$Notrec_{i,t-1}$			0.255***	
			10.330	
$Adpay_{i,t-1}$				0.292***
				12.620
$Cash_{i,t-1}$	0.089***	−0.007	0.017**	0.061***
	8.360	−1.230	2.280	7.710
$Larg_{i,t}$	0.314***	0.080***	0.088***	0.169***
	26.010	11.490	10.060	18.340
$Inv_{i,t-1}$	−0.009	0.005	−0.0198***	−0.0011
	−1.33	1.36	−3.94	−0.30
$LnTA_{i,t-1}$	0.0250***	0.0103***	0.010***	0.008***
	22.560	15.250	13.790	11.610
$LnAge_{i,t}$	0.002	0.001	−0.004***	0.003***
	1.400	0.790	−3.950	2.790
Ind	Included	Included	Included	Included
Year	Included	Included	Included	Included
$PseudoR^2$	0.4852	0.1977	0.2269	0.1453
F	155.890***	116.070***	42.170***	44.790***
No. of obs	21,749	21,749	21,749	21,749

This table presents the regression results from the model below.
Notes : ***, **, and * denote statistical significance at the 1%, 5%, and 10 % level, respectively.

shareholder ($Larg_{i,t}$) and shorter time listed on the stock exchanges ($LnAge_{i,t}$), and the differences in means and medians of the variables outlined above are all statistically significant at the conventional levels.

4.2. Analysis of correlation coefficients

Table 3 reports both Pearson and Spearman correlation coefficients between the variables used to estimate the regression Eq. (1).

It is important to note that $Tradpay_{i,t}$ is significantly and negatively associated with $Bank_{i,t-1}$ with the Pearson correlation coefficient of -0.172 that is statistically significant at the 1 percent level, indicating that there is a substitution effect between bank loans and trade credit financing. We also find that both $Accpay_{i,t}$ and $Adrec_{i,t}$ are significantly negatively related to $Bank_{i,t-1}$ at the 1 percent level. In addition, $Notpay_{i,t}$ is significantly and positively associated with prior period's trade credit ($Tradrec_{i,t-1}$), growth ratio of sales ($Growth_{i,t-1}$), cash holdings ($Cash_{i,t-1}$), inventory level ($Inv_{i,t-1}$), firm size ($LnTA_{i,t-1}$), number of years listed ($LnAge_{i,t}$), but substantially negatively related to profitability ($Roa_{i,t-1}$).

We find that the Pearson correlation coefficients between our independent variables are generally small, with the highest coefficient (lowest) being 0.295 (-0.459) between $Roa_{i,t-1}$ ($Bank_{i,t-1}$) and $Growth_{i,t-1}$ ($Cash_{i,t-1}$), which minimizes the concern over multicollinearity. The Spearman correlation coefficients show similar results to the Pearson test.

4.3. Multivariate analysis

4.3.1. Credit rationing, bank discrimination and trade credit

The multiple regression results from Model (1) are presented in Table 4.

In columns (1), (2), (3) and (4), the dependent variables are $Tradpay_{i,t}$, $Accpay_{i,t}$, $Notpay_{i,t}$ and $Adrec_{i,t}$ in year t, respectively. As our main variables, $Tradpay_{i,t}$, $Accpay_{i,t}$, $Notpay_{i,t}$ and $Adrec_{i,t}$, are approximately left-censored at zero and they are not normally distributed. To avoid potential bias from OLS regression, we adopt the Tobit model to test our hypothesis. The F-statistics shows all specifications are statistically significant at the 1 percent level, suggesting that there is a significant relationship between the dependent

Table 5a
Multivariate Results for Trade Credit, Bank Loan, and Firm Performance: (Dependent variable= *LnTobin's* $q_{i,t}$).

Variables	$Tradpay_{i,t}$ (1)	$Accpay_{i,t}$ (2)	$Notpay_{i,t}$ (3)	$Adrec_{i,t}$ (4)
Intercept	3.604***	3.601***	3.650***	3.675***
	17.970	19.060	19.500	19.740
$Bank_{i,t-1}$	−0.366***	−0.354***	−0.332***	−0.355***
	−4.910	−4.980	−4.810	−4.870
$Tradpay_{i,t-1}$	−0.141			
	−1.620			
$Tradpay_{i,t-1} \times Bank_{i,t-1}$	−0.621			
	−1.220			
$Accpay_{i,t-1}$		−0.311**		
		−2.200		
$Accpay_{i,t-1} \times Bank_{i,t-1}$		−0.269		
		−0.280		
$Notpay_{i,t-1}$			−0.106	
			−0.710	
$Notpay_{i,t-1} \times Bank_{i,t-1}$			−0.309	
			−0.310	
$Adrec_{i,t-1}$				−0.084
				−0.600
$Adrec_{i,t-1} \times Bnak_{i,t-1}$				−1.9959
				−1.62
$Roa_{i,t-1}$	0.864***	0.866***	0.884***	0.898***
	2.580	2.650	2.650	2.700
$Growth_{i,t-1}$	0.129***	0.132***	0.124***	0.121***
	4.120	4.360	4.090	3.960
$Larg_{i,t}$	−0.151***	−0.144***	−0.151***	−0.152***
	−3.150	−3.020	−3.150	−3.170
$LnTA_{i,t-1}$	−0.175***	−0.175***	−0.177***	−0.178***
	−18.210	−19.370	−19.710	−19.740
$LnAge_{i,t}$	0.135***	0.135***	0.135***	0.134***
	15.250	15.190	15.150	15.330
Ind	Included	Included	Included	Included
Year	Included	Included	Included	Included
$PseudoR^2$	0.583	0.584	0.583	0.584
F	87.800***	88.040***	88.220***	88.090***
No. of obs	9894	9894	9894	9894
*F*difference (p)	6.610(0.010)	0.100(0.754)	2.300(0.129)	3.930(0.047)

This table presents the regression results from the model below.
Notes : ***, **, and * denote statistical significance at the 1%, 5%, and 10 % level, respectively.

variable and independent variables. The Pseudo R-square ranges from 0.145 to 0.485, indicating that variables used in Model (1) explain about 48.520 %, 19.770 %, 22.690 % and 14.530 % of the variations in $Tradpay_{i,t}$, $Accpay_{i,t}$, $Notpay_{i,t}$ and $Adrec_{i,t}$, respectively during our sample period.

After controlling for other effects, Column (1) shows us the coefficient of $Priv_{i,t}$ is -0.021 and statistically significant at the 1 percent level, indicating that on average, private firms acquire trade credit from their suppliers or customers 2.120 % less than the state-owned firms. The coefficient of $Bank_{i,t-1}$ is -0.151 and is statistically significant at 1 percent level, suggesting that an increase of 1% in bank borrowings will reduce the dependence of an average on trade credit by 0.152 %, whereas the estimated coefficient for the interaction term, $Priv_{i,t}$ *$Bank_{i,t-1}$, equals 0.064 and is statistically significant at the 1 percent level. Consistent with the theoretical prediction, the relation between $Bank_{i,t-1}$ and $Tradpay_{i,t}$ for private firms is also significantly negative which supports Hypothesis 1 that trade credit is significantly negatively related to the bank loans acquired in the formal financial markets, and the substitution effect between bank loans and trade credit for private firms is much weaker than that for state-owned firms.

Based on the results from using different forms of $Tradpay_{i,t}$, such as $Accpay_{i,t}$, $Notpay_{i,t}$ and $Adrec_{i,t}$, we find that the estimated coefficients of $Priv_{i,t}$ continue to be significantly negative at the 1 percent level, whereas in column (3) where $Notpay_{i,t}$ is used as the dependent variable, the estimated coefficients of $Priv_{i,t}$ become significantly positive at the 1 percent level. These results suggest that compared to state-owned firms, private firms obtain fewer accounts payable and receipts in advance, but more notes payable. It is worth seeing that a similar effect is also reflected in $Bank_{i,t-1}$. In column (2) and (4), the coefficients of $Bank_{i,t-1}$ are still significantly negative at the 1 percent level, indicating that there is a substitution effect between bank borrowing and accounts payable (receipts in advance). We find that the coefficient of $Bank_{i,t-1}$ is positive and significant at the 1 percent level, suggesting that there is a complementary relationship between bank loans and notes payable. In addition, the estimated coefficients for the interaction term, $Priv_{i,t}$ *$Bank_{i,t-1}$, remain significantly positive at the 5 and 1 percent level, respectively, indicating that the substitution relation between bank borrowing and accounts payable or receipts in advance for private firms is much weaker than that for state-owned firms.

Turning to the independent variables, $Accrcc_{i,t-1}$, $Notrcc_{i,t-1}$ and $Adpay_{i,t-1}$ are statistically significant and positive at the 1 percent level in column (2), (3) and (4), respectively, indicating that the more accounts receivable (notes receivable and payments in advance),

Table 5b
Multivariate Results for Trade Credit, Bank Loan, and Firm Performance: (Dependent variable = $Roa_{i,t}$).

Variables	$Tradpay_{i,t}$ (1)	$Accpay_{i,t}$ (2)	$Notpay_{i,t}$ (3)	$Adrec_{i,t}$ (4)
Intercept	−0.111*** −2.690	−0.197*** −13.700	−0.110*** −2.970	−0.094*** −2.730
$Bank_{i,t-1}$	−0.065*** −2.700	−0.060*** −2.680	−0.060*** −2.740	−0.061*** −2.710
$Tradpay_{i,t-1}$	−0.027 −1.280			
$Tradpay_{i,t-1} \times Bank_{i,t-1}$	−0.0891 −1.090			
$Accpay_{i,t-1}$		−0.027 −0.910		
$Accpay_{i,t-1} \times Bank_{i,t-1}$		0.0073 0.050		
$Notpay_{i,t-1}$			−0.057* −1.660	
$Notpay_{i,t-1} \times Bank_{i,t-1}$			−0.1162 −0.720	
$Adrec_{i,t-1}$				−0.008 −0.310
$Adrec_{i,t-1} \times Bnak_{i,t-1}$				−0.1802 −1.190
$Roa_{i,t-1}$	0.409*** 3.030	0.412*** 3.120	0.409*** 3.080	0.415*** 3.160
$Growth_{i,t-1}$	0.035*** 4.130	0.035*** 4.200	0.035*** 4.240	0.034*** 4.150
$Larg_{i,t}$	0.009 1.160	0.009 1.260	0.008 1.120	0.009 1.180
$LnTA_{i,t-1}$	0.005*** 2.750	0.005*** 2.990	0.005*** 3.020	0.004*** 2.840
$LnAge_{i,t}$	−0.004** -2.450	−0.004** -2.460	−0.004** -2.490	−0.004** -2.530
Ind	Included	Included	Included	Included
Year	Included	Included	Included	Included
$PseudoR^2$	0.307	0.306	0.307	0.306
F	23.700***	23.040***	22.650***	22.450***
No. of obs	9894	9894	9894	9894
*F*difference(p)	5.380 (0.020)	1.710(0.190)	0.010(0.909)	4.550(0.033)

This table presents the regression results from the model below.
Notes : ***, **, and * denote statistical significance at the 1%, 5%, and 10 % level, respectively.

the more accounts payable (notes payable and receipts in advance) is required from external to meet their financing need. Similarly, the estimated coefficients for $Inv_{i,t-1}$ and $LnTA_{i,t-1}$ are both still statistically significant at the 1 percent level and in the expected direction in column (2), (3) and (4).

4.3.2. Trade credit, bank loans and firm performance

Table 5a tabulates the multivariate regression results from estimating Model (2) with a total of 2183 observations of private firms which employ the natural logarithm of Tobin's q, LnTobin's $q_{i,t}$, a widely used variable in measuring firm's performance. (Table 5b)

In column (1), the coefficient on $Bank_{i,t-1}$ equals -0.366 and is statistically significant at the 1 percent level, indicating that bank loan has a negative effect on the operating performance of private firms. The F-statistic for the difference in coefficients between $Bank_{i,t-1}$ and $Tradpay_{i,t-1}$ is 6.61 and statistically significant at the 5 percent level (p = 0.010), which suggests that, compared to $Tradpay_{i,t-1}$, $Bank_{i,t-1}$ has a more serious negative impact on the operating performance of private firms. The coefficient of the interaction item, $Tradpay_{i,t-1}$*$Bank_{i,t-1}$ is not significant. Therefore, we find very weak evidence to support hypothesis 3.

Now turn to hypothesis 4, we can see the coefficient of $Bank_{i,t-1}$ is still negative and statistically significant at the 1 percent level in column (2), (3) and (4), and the coefficients of $Accpay_{i,t-1}$, $Notpay_{i,t-1}$ and $Adrec_{i,t-1}$ are significant at different levels. More specifically, in column (2), the coefficients on $Accpay_{i,t-1}$ is -0.311 and statistically significant at the 5 percent level (t-statistic=-2.200), indicating that accounts payable has a negative impact on *LnTobin's* $q_{i,t}$. The F-statistic for the difference in coefficients between $Bank_{i,t-1}$ and $Accpay_{i,t-1}$ is 0.100 and statistically insignificant at the conventional level (p = 0.754). This result suggests that there is no significant difference between $Bank_{i,t-1}$ and $Accpay_{i,t-1}$ in terms of the negative effect on *LnTobin's* $q_{i,t}$. column (3) and (4), similar to $Accpay_{i,t-1}$, the estimated coefficients for $Notpay_{i,t-1}$ and $Adrec_{i,t}$ are insignificant at all, showing that neither $Notpay_{i,t}$ nor $Adrec_{i,t}$ has an effect on *LnTobin's* $q_{i,t}$ of private firms.

In terms of control variables, from column (1) to column (4), prior period's profitability ($Roa_{i,t-1}$, and), growth ratio of sales ($Growth_{i,t-1}$), enterprise size ($LnTA_{i,t-1}$) are all significantly positive to the $Roa_{i,t}$ at the 1 percent level. The coefficients of $LnAge_{i,t}$ are all significantly negative at the 5 percent level. These findings imply that private firms with a stronger prior period's profitability, higher growth opportunities have a better operating performance.

4.4. Robustness tests

To make our results more reliable, we also include several robustness tests. First, it is difficult to capture the dynamic characteristics of trade credit financing by using accounts payable, notes payable and receipts in advance. Hence, we use the changes in accounts payable, notes payable and receipts in advance from year t-1 to t to substitute for $Accpay_{i,t}$, $Notpay_{i,t}$, $Adrec_{i,t}$ and $Tradpay_{i,t}$, respectively, and re-estimate Model (1) and (2). Second, we explore whether the results of this paper are robust to an alternative measure of bank loans. Specifically, we use cash receipts from borrowings of an enterprise in year t-1 divided by the book value of total assets as of the end of year t-1. Third, besides *LnTobin's* $q_{i,t}$ and $Roa_{i,t}$, we use sales profit margin and return on equity to measure a firm's performance. The corresponding regression results from the robustness tests remain qualitatively the same as the original results. Due to space limitations, robustness results are not tabulated but available upon request.

4.5. Endogeneity

One would ask if there is any potential endogeneity issue in our tests, are our main results surviving from the estimation of instrument independent variables?

The relation between trade credit and bank loans can be well explained by the substitution theory (Meltzer, 1960; Schwartz, 1974; Petersen and Rajan, 1997; Burkart and Ellingsen, 2004, etc.). The substitution theory is built on a pecking order assumption that, because the cost of trade credit can be very high, firms first use relatively inexpensive bank loans and then expensive trade credit after bank loans become unavailable (Smith, 1987; Petersen and Rajan, 1994). And this is particularly the case in China. As we point out in the above response, and also in our revised manuscript, Allen et al. (2019), based on their survey among Chinese firms, show that when asked about which financing channels are least costly, while most of the surveyed firms point to short- and long-term bank loans, and 60 % of firms indicate trade credit among business partners. Hence, both theories and empirical evidence suggest that trade credit is used as a substitute financing when bank loans are not available, as trade credit is more costly. And it is less likely to see a reverse causality.

Though we are not very worried about the endogeneity issue caused by reverse causality, in responding to the reviewer's concern, we conduct further analysis to address the possible endogeneity concern in Appendix 2.

5. Conclusion

Even after many years' development and openness in China, the allocation of resources and funds in the formal financial markets is still subject to credit rationing and ownership discrimination, which could greatly impede the development of private firms that are in an inferior position in the financial markets. Hence, private firms have to seek alternative financing channels such as trade credit to alleviate their difficulties. Using a broad sample of firms listed on Shanghai and Shenzhen stock exchanges over the period of 2003−2015, this study empirically explores the relation between the use of bank loans and trade credit of Chinese private firms, and the impact of using different forms of trade credit, namely accounts payable, notes payable and receipts in advance, on the performance of the firms. Our results show that, due to credit rationing and ownership discrimination in the formal financial markets, private firms have significantly less access to bank borrowings from financial institutions than state-owned firms. Consistent with the theoretical expectation and the prediction from Allen, Qian and Qian (2005), there is little evidence showing that private firms would use more trade credit to make up for their lack of bank loans. Specifically, on average, there is a substitution effect between trade credit and bank loans for private firms, and this effect is much weaker compared to that of state-owned firms. Moreover, while univariate comparisons indicate that private firms obtain more notes payable than state-owned firms, multivariate regression analyses show that the relation between bank loan and notes payable is positive and indifferent between private and state-owned firms.

Private firms could resort to other alternative financings besides trade credit. Allen et al. (2019)'s survey on sources of financing among Chinese firms particularly private ones shows that there are a few other channels that are important sources of financing, such as investment from "ethnic Chinese" (investment from Hong Kong, Taiwan, and overseas Chinese), mostly in the form of private loans and equity. However, this financing source is highly dependent on the relationship between the investors and the entrepreneurs. Other alternative financing channels include state and local budgets and foreign direct investments (FDI). However, Allen et al. (2019) show that when asked about which financing channels are least costly, while most of the surveyed firms point to short- and long-term bank loans, almost 60 % of firms indicate trade credit among business partners. Such a fact indicates that the majority of firms prefer trade credit as the best alternative when they are not able to obtain sufficient bank loans. Hence, we focus on the trade credit as the main substitute for bank loans of our sample firms and leave the study on other alternative financing sources for future research.

CRediT authorship contribution statement

Dr. Min Bai: Conceptualization and Writing. **Professor Jipu Cai**: Original draft preparation. **Dr. Yafeng Qin**: Data and Methodology, Writing reviewing and Editing.

Appendix A

See Tables A1 and A2

Table A1
Analysis of Using Trade Credit across Sectors.

Trade Credit: Private vs. State-owned (2003−2015)									
Industry	Variables	Private-owned enterprise			State-owned enterprise			Diff. Mean	Diff. Median
		Mean	Median	Standard deviation	Mean	Median	Standard deviation	t-value	z-value
Transportation/Logistic/Distribution (1127)	Trade Credit	0.108	0.087	0.086	0.071	0.044	0.079	5.334***	6.612***
Hospitality/Restaurant/Food Services(144)	Trade Credit	0.105	0.048	0.104	0.076	0.074	0.044	1.682*	−0.627
Chemical Fiber Manufacturing(348)	Trade Credit	0.178	0.167	0.101	0.147	0.133	0.086	3.144***	3.001***
Printing and Recording(98)	Trade Credit	0.184	0.16	0.098	0.079	0.051	0.065	3.082***	2.190**
Furniture Manufacturing(124)	Trade Credit	0.165	0.145	0.083	0.077	0.046	0.050	5.954***	4.388***
Health and Social Security(58)	Trade Credit	0.088	0.087	0.054	0.027	0.027	0.030	1.009	1.225
Real estate(1617)	Trade Credit	0.208	0.177	0.143	0.181	0.167	0.115	4.060***	2.692***
Water conservancy, environment, and public facilities(366)	Trade Credit	0.156	0.137	0.111	0.083	0.054	0.082	6.998***	6.768***
Utility(1272)	Trade Credit	0.121	0.103	0.099	0.087	0.067	0.076	4.367***	4.656***
Leasing(399)	Trade Credit	0.131	0.092	0.131	0.113	0.076	0.103	1.524	1.174
Computers/Software/Network/ Information system(1765)	Trade Credit	0.134	0.107	0.108	0.222	0.205	0.125	−3.362***	−3.971***
Agriculture/Fishing/Forestry(605)	Trade Credit	0.094	0.078	0.066	0.114	0.088	0.102	−2.891***	−1.682*
Household Services(32)	Trade Credit	0.162	0.154	0.136	0.234	0.219	0.101	−1.690*	−2.020**
Wholesale(1974)	Trade Credit	0.224	0.200	0.146	0.262	0.267	0.146	−5.684***	−5.876***
Culture, sports, and entertainment (381)	Trade Credit	0.103	0.08	0.083	0.188	0.184	0.101	−8.914***	−8.477***
Research and supports(210)	Trade Credit	0.170	0.154	0.116	0.374	0.417	0.179	−7.725***	−6.703***
Mining(762)	Trade Credit	0.103	0.079	0.095	0.127	0.112	0.083	−3.139***	−5.32***
Construction(842)	Trade Credit	0.310	0.315	0.122	0.346	0.342	0.146	−3.933***	−3.644***
Others(786)	Trade Credit	0.147	0.107	0.139	0.164	0.137	0.123	−1.761*	−3.207***

This table shows the differences in using trade credits between private and state-owned firms across all major sectors/industries. In general, we can see that the trade credit financing channel has been used in both private and state-owned enterprises during our sample period from 2003 to 2015. Based on the *t*-test of means and medians, private firms among sectors of Transportation/logistic/distribution, Chemical fiber manufacturing, Printing and recording, Furniture manufacturing, Real estate, Water conservancy, environment, and public facilities and Utility using trade credit as a financing channel are significantly higher than state-owned firms. State-owned firms among sectors of Computers/software/network/information system, Agriculture/fishing/forestry, Household services, Wholesale, Culture, sports and entertainment, Research and supports, Mining and Construction using trade credit as a financing channel are significantly higher than private firms. Notes : ***, **, and * denote statistical significance at the 1%, 5%, and 10 % level, respectively.

Table A2
Results of the endogeneity test.

Variables	$Tradpay_{i,t}$ (1)	$Accpay_{i,t}$ (2)	$Notpay_{i,t}$ (3)	$Adrec_{i,t}$ (4)
Intercept	−0.384*** (-15.940)	−0.150*** (-10.657)	−0.152*** (-7.460)	−0.183*** (-13.966)
$Priv_{i,t}$	−0.048*** (-2.925)	−0.006 (-0.604)	−0.075*** (-5.616)	−0.000 (-0.025)
$Bank_{i,t-1}$	−0.006 (-0.137)	−0.020 (-0.725)	0.235*** (5.908)	−0.097*** (-3.738)
$Priv \times Bank_{i,t-1}$	0.138* (1.745)	−0.041 (-0.896)	0.333*** (5.156)	−0.011 (-0.252)
$Tradrec_{i,t-1}$	0.337*** (44.860)			
$Accrec_{i,t-1}$		0.284*** (53.156)		
$Notrec_{i,t-1}$			0.326*** (16.594)	
$Adpay_{i,t-1}$				0.210*** (21.809)

(*continued on next page*)

Table A2 (*continued*)

Variables	$Tradpay_{i,t}$ (1)	$Accpay_{i,t}$ (2)	$Notpay_{i,t}$ (3)	$Adrec_{i,t}$ (4)
$Roa_{i,t-1}$	−0.192*** (-6.300)	−0.136*** (-7.583)	0.186*** (7.293)	−0.098*** (-5.703)
$Growth_{i,t-1}$	0.011*** (7.864)	0.006*** (7.687)	0.003** (2.526)	0.002*** (2.851)
$Cash_{i,t-1}$	0.126*** (9.886)	−0.002 (-0.254)	0.118*** (10.802)	0.033*** (4.733)
$Inv_{i,t-1}$	0.255*** (39.791)	0.057*** (15.586)	0.047*** (8.481)	0.159*** (46.188)
$Larg_{i,t-1}$	0.008 (1.592)	0.005 (1.588)	−0.000 (-0.038)	0.006** (2.236)
$LnTA_{i,t-1}$	0.016*** (12.067)	0.007*** (9.094)	0.002* (1.959)	0.008*** (11.170)
$LnAge_{i,t}$	0.012*** (6.906)	0.007*** (7.320)	−0.010*** (-6.938)	0.007*** (7.956)
Prov	Included	Included	Included	Included
Ind	Included	Included	Included	Included
Year	Included	Included	Included	Included
Wald chi2	13971.71***	12099.18***	4140.01***	10123.98***
No. of obs	21,747	21,747	21,747	21,747

Controlling for the possible endogeneity of the dependent variables by using 1 lag of the dependent variables as instruments, we re-estimate our baseline model using the Maximum Likelihood Estimation (MLE). The table below shows the endogeneity test results are consistent with our baseline regression results. ***, **, and * denote statistical significance at the 1%, 5%, and 10 % level, respectively.

Notes: The number of observations is 21,747, 2 observations are missed from the baseline estimation results due to using lagged variables as our instrumental regressors.

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