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Abstract

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Trade Credit Use and Bank Loan Access:

An Agency Theory Perspective

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Abstract:

In this study we find that firms' use of trade credit significantly facilitates their access to bank loans in the future, suggesting a complementary relationship. Such a relationship is more profound for firms with higher perceived agency costs, i.e., firms with opaque corporate information, firm located in regions with less developed external institutions, and firm at their early stage of existence. Firms switch from trade credit to bank loans as the main source of debt financing as they age. However, the process is slower for firms with a greater level of corporate information opacity and firms located in regions with weak external institutions.

Keywords: Bank loans; Trade credit; Agency concerns; Information opacity; Institutions

JEL Codes: G14; G21; G31; G32

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1. Introduction

Why do firms use trade credit despite it being a relatively expensive form of short-term financing? According to Petersen and Rajan (1997) and Ng *et al.* (1999), a sizeable fraction of firms pay an implicit annual interest rate of over 40% when they fail to take advantage of early payment discounts. Yet, trade credit accounts for a significant proportion of total assets in both developed and developing markets (Petersen and Rajan, 1997; Ge and Qiu, 2007; Wu *et al.*, 2014).

To explain the prevalent yet puzzling use of trade credit, existing literature provides several theories. The first strand of theories argues that suppliers (i.e., providers of trade credit) can obtain information about clients' creditworthiness through transactions, and thus, they have a monitoring advantage over banks (Biais and Gollier, 1997; Jain, 2001); or that they have a stake in the survival of their clients which makes them willing to provide support to their clients through trade credit (Cunat, 2007). The second strand of theories focuses on real operations of firms and argues that suppliers use trade credit to price discriminate (Mian and Smith, 1992; Petersen and Rajan, 1994), signal or guarantee product quality (Lee and Stowe, 1993; Giannetti *et al.*, 2011), and reduce transaction costs (Nilsen, 2002). However, both of these strands of theories are not without shortcomings. For example, the monitoring advantage theories "do not explain why suppliers regularly lend inputs, but only very rarely lend cash" (Burkart and Ellingsen, 2004, p. 570). While many theories in the second strand may hold in specific circumstances, they "do not capture what seems to be central for explaining the wide spread use of trade credit" (Maksimovic and Frank, 2005). Therefore, there must be more reasons (than what existing theories have proposed) to explain the use of trade credit.

In this paper, we make some significant contributions to fill the void of existing literatures. Building on the work of Demircug-Kunt and Maksimovic (2001) and Burkart and Ellingsen (2004) we propose that trade credit and bank credit can be either complementary or substitutive and such a relationship depends on the perceived agency costs of the firm. The economic theory behind our argument is that when a borrowing firm's perceived agency costs are high, banks are reluctant to grant loans to the firm with the concern

that the firm may divert the cash for private benefits of the controlling shareholders or waste the cash on inefficient investments. In that case, the firm is forced to turn to the more expensive trade credit as the main source of debt financing. A firm's use of trade credit indicates the trustworthiness of the borrowing firm by its suppliers (Guiso *et al.*, 2004) and the quality of the firm's investments (Aktas *et al.*, 2012), which will in turn alleviate banks' concern about the firm's borrowing potential. Thus, the use of trade credit will increase the willingness of banks to extend loans to the firm. To this extent, trade credit and bank credit are complementary. Such a relationship is expected to be more profound for firms with higher perceived agency costs. As the borrowing firm becomes better known to the banks it is expected that the firm will gradually turn to banks as the main source of debt financing because bank credit is generally cheaper than trade credit. This argument suggests that the use of bank credit relative to trade credit is higher for older or more established firms. It also suggests that the complementary relationship between bank credit and trade credit is expected to become weaker as firms get older.

We test our hypotheses on privately (i.e., non-state) controlled but publicly listed firms in China. China provides an ideal setting to study trade credit from an agency perspective for the following reasons. Firstly, the public bond market in China (and more broadly many other emerging markets) is still rudimentary and banks remain the dominant providers of corporate debt. However, at the same time, almost all banks are tightly controlled and bank credit is highly regulated by the governments. For political and social purposes most bank credit is allocated to state-owned enterprises (SOEs), resulting in restricted or no access to bank credit for many privately controlled firms even though the private sector has been an important driver of the economic growth in China. For example, data from the National Bureau of Statistics of China (NBSC) show that in 2004 only 7% of all bank loans were allocated to non-state firms and this figure dropped to less than 5% in 2009. Such a systemic bias gives rise to the wide-spread use of trade credit among private firms (Ge and Qiu, 2007; Cull *et al.*, 2009; Wu *et al.*, 2014). Therefore, a better understanding of the determinants of trade credit use remains an important issue not only for firms but also for policy makers. Secondly, in China, there is a wide disparity across regions in terms of economic development and

institutional efficiency. This cross-region disparity in terms of institutional development allows us to examine whether the relationship between trade credit and bank credit is also influenced by institutional factors such as marketization, legal protection of property rights, and law enforcement at the province level, as these above-firm-level intuitions are believed to affect the outside investors' (including debtholders) perception of firm level agency problems (La Porta *et al.*, 2000). Moreover, business laws, culture and social norms are largely the same across China. Thus, our single-country design enables us to disentangle the influence of institutional efficiency from that of other country-level factors.

Using a sample of 13243 firm-year observations from 2004 to 2016, we find that: (1) a firm's use of trade credit improves its future access to bank credit; (2) the positive causal relationship between trade credit and bank credit is stronger for firms with higher perceived agency costs measured either by the information opacity of the firm or the level of institutional development of the province where the firm is headquartered; (3) the moderating role of perceived agency costs on the relationship between trade credit and bank credit is more profound for younger firms than for older or more established firms; (4) and finally, firms gradually turn to bank credit as the source of debt financing as they get older. However, such a move is slower for firms with higher perceived agency costs.

This paper builds on the theoretical framework developed by Burkart and Ellingsen (2004), in which the authors attribute a monitoring advantage to suppliers but argue that the suppliers' monitoring advantage applies exclusively to input transactions. At the center of their theory is the argument that, compared to cash, most inputs are less easily diverted for the private benefits of the managers of the receiving firms. This agency perspective of trade credit successfully explains why suppliers have an information advantage over banks that specialize in evaluating borrower's creditworthiness and why suppliers lend inputs but not cash. However, this theory does not explain what causes the substantial differences in the use of trade credit among credit constrained firms. For example, our data shows that the use of trade credit varies significantly among private firms in China, ranging from zero to 37.2% (measured by accounts payable to total assets) and from zero to 68.2% (measured by accounts payable to total debt), respectively. At the same time, a significant proportion of these firms are likely to be credit constrained due

to the systemic bias against privately controlled firms in the allocation of bank loans in China (Cull and Xu, 2000; Ge and Qiu, 2007; Cull *et al.*, 2009; Wu *et al.*, 2014). This paper complements their theory by providing evidence that a firm's perceived agency costs play an important role.

The contributions of this study to the existing literature are significant in the following ways. Firstly, the majority of existing literature investigates only the impact of a firm's access to bank credit for financing its trade credit. However, little is known whether and how a firm's use of trade credit affects its access to bank credit. Research on such a relationship is warranted because bank credit remains one of the most important sources of debt financing in both developed and developing countries, notwithstanding, the use of trade credit is widespread and forms an important source of debt financing. Thus, identifying the relationship between trade credit and bank credit will enable firms to compete better for scarce bank credit if they can secure trade credit from their suppliers. Secondly, although a large number of prior studies have examined the firms' access to bank credit from an agency or information asymmetry perspective (e.g., Petersen and Rajan, 1994; Nilsen, 2002; Bailey *et al.*, 2011; Lin *et al.*, 2012), this study shows an alternative channel through which banks allocate credit to firms in an environment where direct monitoring is highly costly and enforcement of formal financial contracts is weak. Thirdly, this study confirms the argument proposed by Demirguc-Kunt and Maksimovic (2001) that institutional development plays an important role in determining the relative use of trade credit and bank credit among firms. Furthermore, we provide evidence that external institutions also influence the speed at which firms move from the use of trade credit to the cheaper but scarce bank credit. Finally, this study makes a complementary contribution to the literature that examines the relationship between the firm's age and bank loan access (e.g., Petersen and Rajan, 1995; Sakai *et al.*, 2010) in that we demonstrate that as the firm age banks are less likely to rely on the firms' trade credit use to assess the potential moral hazard when making loan decisions.

The rest of this paper is organized as follows. Section 2 describes the research design. Section 3 presents and discusses the main empirical findings. Section 4 reports the results of robustness checks and some additional tests. Section 5 concludes.

2. Sample, data, and statistics

2.1 Sample selection and data sources

This study is conducted on all privately controlled (i.e., the ultimate largest shareholder is neither a state-owned enterprise nor a government agency) non-financial A-share issuing firms listed on either the Shanghai Stock Exchange or the Shenzhen Stock Exchange between 2004 and 2016. After we delete observations with missing data or with zero assets or sales, our final sample consists of 2043 firms and 13243 firm-year observations. The accounting and financial data of all the firms in this study are obtained from the China Securities Market and Accounting Research (CSMAR) database. All continuous variables are winsorized at the 1% and 99% levels. Data used to construct firm-level information opacity variables are also from CSMAR. Province-level institutional development data are from Fan, Wang, and Zhu (2011) for 2004-2008 while data from 2009-2014 are from Wang *et al.* (2016). The institutions' data are only updated to 2014; as a result, the tests involving institutions data use a sample of 1615 firms and 9686 firm-year observations.

2.2 Measures of key variables

2.2.1 Dependent variable

Our ultimate interest is whether the firm's use of trade credit helps to improve its access to bank credit. We use newly granted bank loans in the current year (scaled by total assets) as our main dependent variable. We also examine the firm's relative use of trade credit and bank loans, whether and how it is affected by certain firm characteristics and external institutions. We use three variables to measure the relative use of trade credit and bank loans: the proportion of bank loans in total debt, the proportion of trade credit in total debt, and the ratio of trade credit to the sum of trade credit and bank loans.

2.2.2 Key independent variables

Trade credit

We follow the convention in the trade credit literature and measure trade credit as the ratio of accounts payable to total assets. In addition, based on Ge and Yu (2007), we use the ratio of accounts payable to total sales as an alternative measure. Reflecting the concern about a strong

seasonal trend in the use of trade credit, we obtain the values of trade credit from both the half-yearly and the annual reports and then collect the average of these two values.

Perceived agency costs

We use two sets of variables to measure a firm's perceived agency costs by debtholders. The first set of variables measure the firm-level information opacity and are based on the notion that compared to transparent firms, firms with opaque information are more difficult and costly to monitor and therefore the incentive and the likelihood of large shareholders extracting private benefits of control are greater at opaque firms. Following Lin *et al.* (2011, 2013) and Hollie *et al.* (2017), these two factors measure the firm's information opacity: 1) whether the firm is included in a national major stock index, 2) the number of financial analysts following the firm. The intuitions of these measures are well-known. In addition, prior literature has also showed a negative association between the quality of a firm's external auditor and the opacity of the firm's financial information (Gul *et al.*, 2006; Dutilleux *et al.*, 2013). Following this literature, we use a dummy variable to denote high information opacity if the firm's annual report is not audited by a big auditor.

Our second set of variables focus on institutional development. It is commonly held in the literature that large shareholders' expropriation risk is higher in a weak institutional environment (La Porta *et al.*, 2000; Dyck and Zingales, 2004; Bae and Goyal, 2009). Ma *et al.* (2017) demonstrate that the strength of institutions can be used as a good proxy for perceived agency costs in the Chinese market. In this paper, we use three institution measures. They are: 1) the overall marketization, 2) the strength of legal protection of property rights, and 3) the number of lawyers per 10,000 people.

2.2.3 Control variables

Following prior studies, we include the following control variables in our regression models: firm age, firm size, the ratio of fixed assets to total assets, the ratio of total debt to total assets, return on assets, annual growth of sales, the ratio of operating cash flow to total assets, and the proportion of independent or outside directors. In addition, we control for foreign ownership and government ownership because foreign ownership may help firms to acquire financing through their foreign partners or international financial markets and government minority

ownership may help to access formal bank loans. Finally, we include the total amount of savings in financial institutions in each province as a proxy for potential bank loan supply. Detailed descriptions of all the variables used in this study are provided in Table 1.

<Insert Table 1 about here>

2.3 Descriptive statistics

Table 2 presents the descriptive statistics for the main variables. On average, accounts payable make up 8.8% of a firm's total assets (*APTA*). This figure is slightly lower than that reported in Wu *et al.* (2014), whose sample period covers from 2003-2008 and significantly lower than that reported in Ge and Qiu (2007) whose sample period covers from 1994-1999. These differences are reasonable. Demirguc-Kunt and Maksimovic (2001) demonstrate that the use of trade credit is negatively associated with the efficiency of formal institutions in a country where a firm is located. Thus, as formal institutions continue to develop in China it is expected that the use of trade credit would gradually decline. The mean ratio of accounts payable to total sales (*APTS*) is 18.2%, which is also lower than that reported in Ge and Qiu (2007), further confirming the trend in *APTA*.

<Insert Table 2 about here>

It can be seen from Table 2 that the mean ratio of bank loans to total assets (*BLTA*) is 17.4%, nearly double that of *APTA*. In terms of the relative use of trade credit and bank loans, we see that bank loans (*BLTD*) constitute 32.8% of total debt while trade credit (*APTD*) makes up 21.4% of all debt. When combined, bank loans and trade credit account for almost 55% of all debt. These figures clearly show it is warranted to examine the relationship between these two important sources of external debt financing for Chinese private firms.

3. Empirical results

3.1 The effect of trade credit use on bank loan access

In this section, we investigate whether the firms' use of trade credit facilitates its access to bank loans. We estimate the following baseline empirical model using ordinary least squares (OLS) regression:

(1)

The dependent variable in Equation (1) is the newly granted bank loans scaled by total assets in year t . All independent variables in the multivariate regression models (except for the institutions' variables in corresponding models) are lagged by one period to control for endogeneity. We include *Year*, *Industry*, and *Year*Industry* in all multivariate regressions to control for unobserved time-invariant heterogeneity at the firm level.

Table 3 presents the regression results of estimating Equation (1). In column 1, the coefficient of $APTA_{t-1}$ is positive and significant at the 1% level. The result shows that the use of trade credit facilitates the firms' access to new bank loans, indicating a complementary relationship between the use of trade credit and bank loans. In column 2, we replace $APTA_{t-1}$ with $APTS_{t-1}$ and the result is qualitatively similar, albeit at a higher significance level.

<Insert Table 3 about here>

In summary, the results in Table 3 confirm our expectation that the firms' use of trade credit can alleviate banks' concern about the firm's potential agency costs because the use of trade credit can be seen as a positive signal of the firm's trustworthiness as well as the quality of its investment. This in turn, facilitates the firm's access to new bank loans. Thus, trade credit has a complementary effect on bank loan access.

3.2 Factors influencing the link between trade credit and bank loans

In this section, we examine the factors that may influence the link between trade credit use and bank loan access. In particular, we investigate the roles played by firm-level information opacity and province-level external institutions, in the view that the effect of trade credit in alleviating agency concerns and thus the positive impact of trade credit use on bank loan access should be particularly strong when there is higher risk of potential expropriation and moral hazard behaviour by the controlling shareholders of the borrowing firm. We focus on the following two sets of factors that are widely regarded in the literature as good proxies for

potential agency costs: firm-level information opacity (Lin *et al.*, 2011; Benson *et al.*, 2014; Qi *et al.*, 2017), and external legal institutions (La Porta *et al.*, 2000; Dyck and Zingales, 2004; Bae and Goyal, 2009; Ma *et al.*, 2017).

3.2.1 Firm-level information opacity

It is expected that information opacity of a firm would strengthen its access to trade credit and bank loans. To test this conjecture, we add the information opacity measures and their interactions with trade credit to our baseline model. Following Lin *et al.* (2011, 2013), we use three measures as our proxies for information opacity: 1) whether the firm's external auditor is a small auditor^[1], 2) the number of analysts following the firm, and 3) Whether the firm is included in a national major stock index. In Equation (2) we extend our baseline model in Equation (1) by adding an interaction term between the trade credit and information opacity measure. The results of Equation (2) tests are reported in Table 4.

(2)

<Insert Table 4 about here>

As can be seen from Table 4, the positive impact of trade credit use (*APTA*) on the firm's bank loan access (*New bank loans*) is significantly stronger for firms with small external auditor as indicated by the positive and statistically significant coefficient of the interaction term. On the other hand, the impact of trade credit use is weaker for firms followed by more financial analysts and firms included in the national major stock index, as indicated by the significantly negative coefficients of the interaction terms between trade credit and the corresponding information opacity measures. For brevity purpose, we only report the regression results using *APTA_{it}* as the key independent variable. The results are qualitatively similar when we replace *APTA_{it}* with *APTS_{it}* and are available upon request. In summary, the results in Table 4 are consistent with our expectation that the positive relationship between trade credit use and bank loan access is stronger for firms with more opaque information.

3.2.2 External institutional development

Previous studies exhibit that institutional development is an important factor that mitigates agency conflicts and curbs private benefits of control (Shleifer and Vishny, 1997; La Porta *et al.*, 2000; Dyck and Zingales, 2004; Qi *et al.*, 2010). In this section, our tests are based on the significant variation in economic and legal development among China's diverse regions to test whether institutional development influences the relationship between a firm's trade credit use and bank loan access. When external institutions are weaker it is easier or less costly for large shareholders to engage in expropriating activities. Thus, for firms located in regions with less developed institutions the perceived agency costs are expected to be higher and as a result, banks are less willing to lend to these firms. This suggests that the role played by using trade credit in indicating a firm's trustworthiness should be more important, and consequently the positive relationship between trade credit use and bank loan access should be more significant.

To test this conjecture, we extend our baseline model in Equation (1) by adding an interaction term between trade credit and institutional development measure:

(3)

The province-level institutional development data are obtained from Fan *et al.* (2011) covering the period of 2004-2008 and from Wang *et al.* (2016) covering the period of 2009-2014. These authors have evaluated a wide range of economic and institutional factors in China and constructed a range of indices to measure these factors at the province level. In this study we focus on three indices as proxies for institutional development: these are 1) marketization as an indicator of the overall market development, 2) property rights as an indicator of the level of regulation and protection of property rights including contracts, and 3) the number of lawyers per 10,000 populations as an indicator of the easiness and efficiency of enforcement in the province in which a firm is headquartered. A potential issue arising from the data is that the indices for 2009-2014 are not directly comparable with those for 2004-2008 due to changes in how these factors are measured (Wang *et al.*, 2016). To overcome this issue, we do not directly use these indices; instead, we use the rankings of these three measures for all 31 provinces in mainland China. A ranking of 1 indicates the most advanced institutional

development and the lowest perceived agency costs. A ranking of 31 for each measure indicates the least developed institutions and therefore high perceived agency costs for firms located in that province. The results of estimating Equation (3) are reported in Table 5.

<Insert Table 5 about here>

As can be seen from Table 5, in all three columns the coefficients of the interaction terms between trade credit and institutional development ranking are positive and statistically significant. These results show that the positive effect of trade credit use on bank loan access is more profound for firms located in regions with relatively less developed legal and market institutions. These results are consistent with our expectation as well as implications by Demirguc-Kunt and Maksimovic (2001).

3.3 The effect of the firms' age

In this section, we examine the effect of the firms' age on the relationship between trade credit and bank loan access as well as its effect on the moderating role of corporate opacity and institutional development on such a relationship.

The firms' age is an important factor in explaining the availability and cost of external financing and its effect has been extensively studied in prior literature. Diamond (1989) argues that a bank cannot directly observe a borrowing firm's true quality but can observe the firm's repayment behaviour. Thus, because young firms lack a track record of repayment history their access to bank loans is rather limited. This constraint will be alleviated as the firm establishes a reputation of successful repayment and no default as the firm ages. Similarly, Boot and Thakor (1994) and Petersen and Rajan (1995) argue that information asymmetry between a bank and a firm is most severe at the early stage of the firm's life. As the firm ages, they will engage in more information exchanges and establish a mutual trust relationship between them. This in turn alleviates the problem of information asymmetry and relieves the bank loan constraint. Sakai *et al.* (2010) and Ylhainen (2017) provide empirical evidence to further support the positive relationship between the firms' age and availability of bank loans. In summary, the aforementioned studies suggest that banks' concern for the potential agency costs with the borrowing firm would be alleviated as the firm ages.^[2]

Diamond (1991) predicts that firms rely on bank monitoring in their early stage to accumulate reputation. Overtime, the acquired reputation can help to deal with moral hazard and the firms will switch to other sources of financing as they age. This would indicate that bank loans are the main source of debt for young firms. However, this argument is based on the implicit assumption that bank monitoring is effective and efficient or in other words is supported by an efficient legal and in particular enforcement system. As Demirguc-Kunt and Maksimovic (2001) demonstrate, in an environment with an inefficient legal system such as China and many other emerging markets, firms' access to bank loans would be significantly constrained, particularly in their early lives when moral hazard is relatively high.

To sum up, the aforementioned analysis indicates that younger firms are likely to have a higher probability of severe potential moral hazard problems compared to older firms. As a result, younger firms would have even more limited access to bank loans than older firms. Consequently, the function of trade credit in alleviating agency problem concerns and in facilitating firms' access to bank loans would be more profound for younger firms.

We test the effect of the firms' age in two ways. Firstly, we divide our sample into young firms and old firms based on the median sample age. We define firms' age as the number of years since the firm was founded.^[3] For each subsample, we re-estimate Equations (1) to (3) to compare the effects of trade credit use on bank loan access between young firms and older firms. Secondly, for the whole sample, we conduct the regressions with firms' relative use of trade credit and bank loans as the dependent variables and the firms' age as the key independent variable. The purpose of this estimate is to see if the firm's relative use of these two sources of debt changes with the age of the firms as predicted by prior research.

3.3.1 Different effects of trade credit use between young and old firms

In Panel A of Table 6 we report the results of estimating Equation (1) for young firms and old firms, respectively.

<Insert Table 6 about here>

As can be seen, for young firms (columns 1 and 2) the coefficients of $APTA_{t-1}$ and $APTS_{t-1}$ are both positive and significant at the 1% level, confirming the results in Table 3 that a firm's use of trade credit in year $t-1$ significantly facilitates its access to new bank loans in year t .

However, for older firms (columns 3 and 4) the coefficients of $APTA_{i,t}$ and $APTS_{i,t}$ are only marginally significant at the 10% level. The results in Panel A indicate that the complementary effect of trade credit use on bank loan access is more profound for younger firms than for older firms. Our results are consistent with prior research (e.g., Diamond, 1989; Petersen and Rajan, 1995) that banks' concerns about potential moral hazard risk at the borrowing firms are greater for younger firms than for older firms.

Again we separately re-estimate Equation (2) for young and old firms respectively. The results are reported in Panel B of Table 6.^[4]

In the young firm subsample (columns 1 to 3), the coefficient of the stand-alone $APTA_{i,t}$ remains positive and significant at the 1% level, indicating that when the firms are young the use of trade credit can significantly improve their access to new bank loans, even when the firms are informationally transparent. The statistically significant coefficients of the interaction term between $APTA_{i,t}$ and the information opacity measure suggest that for young firms the complementary effect of trade credit use on bank loan access is particularly strong when the corporate's information is opaque and the perceived agency problems are likely to be more severe.

Furthermore, we examine the results for older firms (columns 4 to 6). The coefficient of the stand-alone $APTA_{i,t}$ is only marginally significant in specification 4, indicating that the use of trade credit does not significantly affect firms' access to new bank loans when firms are well established. In other words, banks' lending to older firms does not readily rely on the firms' use of trade credit to assess their riskiness and/or creditworthiness. In addition, none of the coefficient of the interaction terms is statistically significant. The results suggest that for old firms, the use of trade credit does not influence firms' access to bank loans even when information is opaque and potential moral hazard is high.

Moreover, we compare the interactive effect of trade credit and institutional development between young and old firms. To do so we separately re-estimate Equation (3) for young and old firms respectively. The results are reported in Panel C of Table 6.

The results show that for young firms (columns 1 to 3), the coefficients of the stand-alone $APTA_{i,t}$ are all significant at the 1% level, indicating that for young firms, the use of trade

credit significantly improves the firms' access to new bank loans even in regions with high level of institutional development. The coefficients of the interaction term between $APTA_{i,t}$ and institutions ranking are positive and significant at either the 1% or 5% level, indicating that the complementary effect of trade credit is stronger for firms located in regions with relatively weak institutions. For older firms on the other hand (columns 4 to 6), except for the interaction between $APTA_{i,t}$ and *Property rights* which is marginally significant at the 10% level, neither of the coefficient of the other two interaction term is statistically significant, indicating that institutional development no longer plays a moderating role in the relationship between the use of trade credit and bank loan access among older firms.

Collectively the results in Table 6 confirm our expectation that the role of trade credit use in facilitating firms' access to bank loans is stronger for young firms than for older firms. The complementary effect of trade credit is especially strong for young firms with relatively opaque information and for young firms located in regions with a relatively weak institution, where the potential moral hazard of large shareholders engaging in expropriating activities is considered the highest.

3.3.2 Firms' relative use of trade credit and bank credit over time

In section 3.3.1 we find that the complementary effect of trade credit use on bank loan access is stronger for young firms than for older firms. In this section, we will examine the effect of the firms' age from a different approach. We'll run regressions for the whole sample with the relative use of trade credit and bank loans as dependent variables and the firms' age as a key independent variable. We apply three firm-level proxies for the relative use of trade credit and bank loans. Our first proxy is the ratio of bank loans to total debt ($BLTD$). Based on our analysis at the beginning of section 3.3, the firm's age should have a positive effect on $BLTD$, that is, as firms age, they gradually switch from trade credit to bank loans as the main source of debt financing. Our second proxy is the ratio of trade credit to total debt ($APTD$). We expect that firm age will have a negative effect on $APTD$. Our third proxy is the ratio of trade credit to the sum of trade credit and bank loans ($AP/(AP+BL)$). Based on our analysis, we expect that this ratio should decrease with the firms' age. We report the regression results in Panel A of Table 7.

<Insert Table 7 about here>

The dependent variable in column 1 is *BLTD*. As can be seen, the coefficient of the firms' age in column 1 is positive and statistically significant at the 1% level. The result is consistent with our expectation that as the firms age, they rely more on bank loans as the main source of debt financing than at the earlier stages of their existence. This finding is also consistent with prior research (Petersen and Rajan, 1995; Sakai *et al.*, 2010; Ylhainen, 2017). The dependent variables in columns 2 and 3 are *APTD* and $AP/(AP+BL)$, respectively. The coefficient of the firms' age is negative and significant in both columns. The results indicate that as the firms' age, they rely less on trade credit to finance their debt. In summary, the results in Panel A demonstrate that firms rely more on trade credit in their early phase when there is information asymmetry between the banks and the borrowing firms coupled with the banks' concern about potentially high moral hazard. However, as information asymmetry is

Again we examine the role of information opacity and external institutional development on the evolution of the firms' relative use of trade credit and bank loans over time. In this paper, we exhibit that, all things being equal, firms with opaque information and firms located in regions with weak institutions are perceived to have higher risk of moral hazard. As a result, it would take longer for these firms to alleviate their information asymmetry with the banks, as well as to build their reputation to convince banks to extend loans to them. Hence, the process of switching from trade credit to bank loans would be slower, compared to those firms with more transparent information and firms located in regions with more developed institutions.

To test this conjecture, we added the interaction terms between the firms' age and information opacity measures to the models used in Panel A. The results are reported in Panel B of Table 7.

The dependent variable in models 1 to 3 is *BLTD*. The coefficient of the stand-alone firms' age is positive and significant in all models, and consistent with the result in column 1 of Panel A of Table 7. Our main interest here is the coefficients of the interaction terms between the firms' age and information opacity measures. The coefficients of the interaction term are statistically significant in all three models, confirming our expectation that the switch from

trade credit to bank loans is slower when corporate information is opaque, but is accelerated when information is transparent. The results in models 4 to 9 further confirm the results in models 1 to 3.

Furthermore, we add to the models used in Panel A with an interaction term between firm age and the institutional development measure and report the results in Panel C of Table 7.

The dependent variable is *BLTD* in columns 1 to 3. The positive and significant coefficients of the stand-alone firm age and the negative and significant coefficients of the interaction term between the firms' age and institutions rankings in columns 1 to 3 indicate that weak external institutions significantly slow the process of firms switching from trade credit to bank loans. The results are also consistent with our expectation. In columns 4 to 6 and columns 7 to 9, the dependent variables are *APTD* and $AP/(P+BL)$, respectively. Again, the results suggest that firms are less likely to rely on trade credit to finance their debt as they age because they switch to bank loans which are cheaper. However, this process is slower for firms located in regions with weak institutions.

In summary, the results in section 3.3 provide convincing evidence that as the firms get older they build up a reputation with a track record of loan repayment history, and the information asymmetry between firms and their banks is alleviated. Thus, they gradually switch from trade credit to bank loans as the main source of debt financing. However, this process is significantly slower for firms with opaque information and for firms located in regions with weak institutions, where firms are perceived to have a higher risk of moral hazard.

4. Robustness checks and additional tests

4.1 Supply of trade credit

Throughout this paper, we have focused on the impact of using trade credit to (i.e., accounts payable) access new bank loan. However, the supply of trade credit (accounts receivable) may also provide information on the firms' financing and therefore will affect their future bank loan access. For example, Cull *et al.* (2009) find that, compared to unprofitable

private firms, profitable firms are more likely to extend trade credit to their customers that are shut out of formal credit. Such a supply of trade credit will help to improve the financial performance of their customers, which will in turn enhance the performance of the extending firms and consequently their access to future bank loans.

In this section, we examine the impact of firms' trade credit supply, controlling for the use of trade credit, on their access to new bank loans and the moderating roles of information opacity and external institutions on such a relationship. The results are not reported for brevity purpose but are available on request.

The results show that trade credit supply has a positive impact on bank loan access, which is consistent with the finding in Cull *et al.* (2009). However, unlike trade credit use, the positive impact of trade credit supply on new bank loans is more profound for firms with more transparent information and firms located in regions with more developed external institutions. One possible explanation is that for firms with low perceived agency costs, trade credit is less likely to be extended to related parties.

In addition, we use net trade credit as the key independent variable. We calculate the net trade credit by subtracting accounts receivable from accounts payable, with both scaled by total assets. Thus, net trade credit takes into account both the use and supply of trade credit. Unreported results show a positive impact of net trade credit on bank loan access and such an impact is also stronger for firms with higher perceived agency costs.

4.2 Alternative information opacity measure

So far in this paper, we have used three information opacity measures to explore the moderating role of firms' information opacity in the relationship between trade credit use and access to new bank loans. These three measures are a dummy variable indicating whether a firm's annual report is audited by a small auditor, the number of analysts following the firm, and a dummy variable indicating whether the firm is included in the CSI300 index. There is, however, a concern that these proxies are not exogenous but related to the firms' characteristics. The fixed effects used in our multivariate models can help to deal with unobserved time-invariant firm characteristics. Formal pairwise correlation tests also show that these three proxies are not significantly correlated to most firm characteristics included in our models.^[5]

To further alleviate the endogeneity concern, we use an alternative proxy for information opacity. Following Ma *et al.* (2017), we construct an opacity index that consists of three components, namely, trading volume, the proportion of zero-return trading days, and stock return volatilities. The intuitions drawn from these information opacity proxies are well known. To construct the corporate opacity index, we first calculate these three individual components of opacity. We next rank each of these three components into deciles, with a value of 9 representing the most opaque firms and a value of zero representing the most transparent firms. We then sum up these three rankings and divide the sum by a factor of 27, which is the maximum possible value. This process yields an opacity index (*Opacity*) that ranges from 0 to 0.9, with higher values indicating greater information opacity. We do not believe such a market-based index will be significantly correlated to firms' opacity and formal correlation tests (unreported but available on request) confirm this.

Again, we replace our original three information opacity proxies with this opacity index and examine the impact of information opacity on the relationship between trade credit use and bank loan access. The results are reported in Table 8.

<Insert Table 8 about here>

The results in Table 8 confirm those reported in Table 4 and Panel B of Table 6. That is, the positive impact of trade credit use on bank loan access is significantly stronger for firms with more opaque information. However, such impact is insignificant for old firms.

4.3 The impact of the global financial crisis and economic stimulus plan

The global financial crisis (GFC) hit the Chinese economy hard during the fourth quarter of 2008, during that time the supply of, and consequently, the use of trade credit drastically reduced, and at the same time, firms' access to bank loans were further restricted. In response to the financial crisis, the Chinese central government officially announced an economic stimulus plan on 5th November 2008. Under the stimulus plan, the central government would spend a total of 4 trillion RMB from the fourth quarter of 2008 till the end of 2010. Of the total 4 trillion, the central government directly funded 1.6 trillion, with the rest funded by local governments and a loosened monetary policy to encourage banks to make loans to enterprises.

Thus, the ultimate impact on a firm's financing is a combination of the initial GFC and the following economic stimulus plan.

To capture such an impact, we create three dummy variables. *Year08* is a dummy variable that equals 1 for all observations in year 2008 and zero for all other observations. Dummy variables *Year09* and *Year10* are similarly defined. The dummy variables and their interaction with trade credit use are added to our baseline model (Equation 1). The results are reported in Table 9.

<Insert Table 9 about here>

The coefficients of the stand-alone $APTA_{i,t}$ are positive and significant at the 1% level in all three models. The insignificant coefficients of the stand-alone dummy *Year08* and the interaction term $APTA_{i,t} * Year08$ may be because the GFC had no negative impact on Chinese firms until the second half of 2008, and banks didn't tighten their lending practice. The insignificant coefficients of the stand-alone dummy *Year10* may be because the negative impact of GFC had eased toward the end of 2010. Interestingly, the coefficient of the stand-alone dummy *Year09* is negative and statistically significant at the 10% level, indicating that firms with low trade credit use had more difficulty obtaining new bank loans despite the economic stimulus plan. The coefficient of the interaction term $APTA_{i,t} * Year09$ is positive and significant, indicating that trade credit use plays an even more important role in helping firms to get new bank loans. Our results are consistent with those of Liu, Pan, and Tian (2016), who find that the majority of new bank loans from the stimulus plan were extended to state owned enterprises (SOEs), and that most banks didn't loosen their criteria when making loans to private firms.

5. Conclusion

Existing literature does not provide sufficient evidence on how the firms' use of trade credit could impact on their access to bank loans. This question is, however, important given that

bank loans remain a very important source of debt financing and the use of trade credit is widespread in many emerging markets.

Building on the work of prior studies, we apply an agency approach to investigate the effect of firms' use of trade credit on their access to bank loans. We argue that a firm's use of trade credit sends a signal to outside investors (banks in this case) about the trustworthiness of the firm and the quality of its investments. This would help to ease the banks' concern about potential agency costs at the firm, and as a result, banks would be more willing to lend to the firms. Using a sample of privately controlled but publicly listed Chinese firms we find that the use of trade credit can significantly facilitate firms' future access to bank loans. This finding is consistent with our expectation and indicates a complementary relationship between trade credit and bank loans.

We also discover that the complementary effect of trade credit on bank loans is more profound for firms with relatively opaque firm-level information and for firms located in regions with less developed external institutions. These findings further demonstrate the role of trade credit in extenuating banks' concern about large shareholders' opportunistic behaviour at borrowing firms.

Finally, we find that firms switch from more expensive trade credit to less costly bank loans as the main source of debt financing as they age, which is consistent with findings in many prior studies. However, we provide further evidence that such a process is moderated by information opacity as well as institutional development. Specifically, the process is slowed down by opaque corporate information and weak presence of external institutions.

In summary, our study provides consistent and convincing evidence that a firm's use of trade credit has a complementary effect on its access to bank loans and such an effect is particularly strong for firms with high perceived agency costs. This study deepens our understanding about the relationship between trade credit and bank loans, and makes a complementary contribution to the literature in this field.

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Table 1**Variable definitions**

This table provides detailed descriptions of main variables used in the analyses.

Variable	Definition
<i>New bank loans</i>	Newly granted bank loans in year t / total assets in year $t-1$
<i>BLTA</i>	Bank loans / total assets
<i>BLTD</i>	Bank loans / total debt
<i>APTA</i>	Accounts payable / total assets
<i>APTD</i>	Accounts payable / total debt
<i>APTS</i>	Accounts payable / total sales
$\ln(\text{assets})$	Natural log of total assets
$\ln(\text{age}+1)$	Natural log of (firm age +1)
<i>Tangibility</i>	Fixed assets / total assets
<i>Leverage</i>	Total debt / total assets
<i>ROA</i>	Net income / total assets
<i>Growth</i>	(This year's sales – last year's sales) / last year's sales
<i>Cash flow</i>	Operating cash flow / total assets
<i>Outside directors</i>	Number of outside directors / total number of board directors
<i>Foreign</i>	Percentage of shares owned by foreign entities
<i>Government</i>	Percentage of shares owned by government agencies
<i>Total savings</i>	The total amount of savings deposit in financial institutions in the province in which a firm is headquartered
<i>Small auditor</i>	A dummy variable that equals one if a firm's annual report is audited by a small auditor and zero otherwise
$\ln(\text{analyst}+1)$	Natural log of (number of stock analysts following a firm + 1)
<i>CSI300</i>	A dummy variable that equals one if a firm is included in the CSI300 index and zero otherwise
<i>Marketization</i>	Ranking (from 1 to 31) of the overall level of marketization in the province in which a firm is headquartered. A ranking of 1 indicates the highest level of marketization and a ranking of 31 indicates the lowest
<i>Property rights</i>	Ranking (from 1 to 31) of the level of legal protection of property rights in the province in which a firm is headquartered. A ranking of 1 indicates the highest level of protection and a ranking of 31 indicates the lowest
<i>Lawyers</i>	Ranking (from 1 to 31) of the number of lawyers per 10,000 people in the province in which a firm is headquartered. A ranking of 1 indicates the highest number of lawyers and a ranking of 31 indicates the lowest

Table 2**Summary statistics**

This table provides summary statistics for the main variables. Descriptions of all variables are reported in Table 1.

	obs.	Mean	Std. dev.	Min	Median	Max
<i>APTA</i>	13243	0.088	0.068	0	0.071	0.354
<i>APTD</i>	13243	0.214	0.166	0	0.172	0.754
<i>APTS</i>	13243	0.182	0.178	0.002	0.132	1.465
<i>BLTA</i>	13243	0.174	0.158	0	0.148	0.666
<i>BLTD</i>	13243	0.328	0.248	0	0.330	0.844
<i>Total assets (100 million yuan)</i>	13243	377	591	1.25	21.7	2,210
<i>Age (in years)</i>	13243	6.626	5.916	0	5	22
<i>Tangibility</i>	13243	0.389	0.200	0.023	0.377	0.873
<i>Leverage</i>	13243	0.653	0.591	0.045	0.440	2.002
<i>ROA</i>	13243	0.069	0.174	-0.946	0.073	0.744
<i>Growth</i>	13243	0.052	0.043	-2.458	0.091	0.853
<i>Cash flow</i>	13243	0.038	0.081	-0.234	0.039	0.267
<i>Outside directors</i>	13243	0.371	0.054	0	0.333	0.571
<i>Foreign</i>	13243	0.017	0.016	0	0	0.716
<i>Government</i>	13243	0.063	0.081	0	0.033	0.394
<i>Total savings (100 million yuan)</i>	13243	65,980	42,763	2,576	62,078	179,829

Table 3**Effect of trade credit use on new bank loans granted**

This table presents the regression results for the effect of trade credit use on new bank loans granted to firms. The dependent variable is newly granted bank loans scaled by total assets. Trade credit is measured by accounts payable scaled by total assets (Column 1) or scaled by total sales (Column 2). All other variables are defined in Table 1. *P*-values adjusted for firm-level clustering are reported in parentheses. *, **, and *** indicates significance at the 10%, 5%, and 1% level, respectively.

	Dependent variable: <i>New bank loans</i>	
	(1)	(2)
<i>APTA</i> _{<i>t-1</i>}	1.280*** (0.000)	
<i>APTS</i> _{<i>t-1</i>}		0.007** (0.013)
<i>Ln (age+1)</i> _{<i>t-1</i>}	-0.053** (0.017)	-0.055** (0.015)
<i>Ln (assets)</i> _{<i>t-1</i>}	-0.047*** (0.003)	-0.042*** (0.009)
<i>Tangibility</i> _{<i>t-1</i>}	-0.144 (0.115)	-0.210** (0.020)
<i>Leverage</i> _{<i>t-1</i>}	-0.681*** (0.000)	-0.578*** (0.000)
<i>ROA</i> _{<i>t-1</i>}	0.124 (0.195)	0.153 (0.117)
<i>Growth</i> _{<i>t-1</i>}	0.054** (0.031)	0.059** (0.019)
<i>Cash flow</i> _{<i>t-1</i>}	-0.197*** (0.007)	-0.182*** (0.008)
<i>Outside directors</i> _{<i>t-1</i>}	-0.190 (0.492)	-0.228 (0.441)
<i>Foreign</i> _{<i>t-1</i>}	0.022 (0.288)	0.908 (0.178)
<i>Government</i> _{<i>t-1</i>}	0.012 (0.333)	0.301* (0.060)
<i>Total savings</i> _{<i>t-1</i>}	0.146 (0.142)	0.245 (0.109)
<i>Year</i>	Included	Included
<i>Industry</i>	Included	Included
<i>Year*Industry</i>	Included	Included
No. of obs.	13243	13243
Adjusted R ²	0.106	0.105

Table 4**Information opacity and the effect of trade credit use on new bank loans granted**

This table presents the regression results for the effect of information opacity on the relation between trade credit use and new bank loans granted to firms. The dependent variable is newly granted bank loans scaled by total assets. Corporate information opacity is measured by three proxies, namely, a dummy indicating annual report being audited by a small auditor, natural log of the number of analysts following the firm, and a dummy indicating inclusion in the CSI300 index. *P*-values adjusted for firm-level clustering are reported in parentheses. *, **, and *** indicates significance at the 10%, 5%, and 1% level, respectively.

	Dependent variable: <i>New bank loans</i>		
	(1)	(2)	(3)
$APTA_{t-1}$	2.325*** (0.000)	1.299*** (0.000)	1.210*** (0.000)
$APTA_{t-1} * Small\ auditor_{t-1}$	1.544*** (0.003)		
$APTA_{t-1} * Ln(analysts+1)_{t-1}$		-0.177** (0.024)	
$APTA_{t-1} * CSI300_{t-1}$			-0.766** (0.019)
$Small\ auditor_{t-1}$	0.076 (0.258)		
$Ln(analysts+1)_{t-1}$		0.023 (0.224)	
$CSI300_{t-1}$			-0.099 (0.281)
<i>Control variables</i>	Included	Included	Included
<i>Year</i>	Included	Included	Included
<i>Industry</i>	Included	Included	Included
<i>Year*Industry</i>	Included	Included	Included
No. of obs.	13243	13243	13243
Adjusted R ²	0.109	0.109	0.109

Table 5**External institutions and the effect of trade credit use on new bank loans granted**

This table presents the regression results for the effect of external institutions on the relation between trade credit use and new bank loans granted to firms. The dependent variable is newly granted bank loans scaled by total assets. External institutions are measured by three variables. *Marketization* is the ranking of the overall level of marketization in the province in which a firm is headquartered. *Property rights* is the ranking of the level of legal protection of property rights in the province in which a firm is headquartered. *Lawyers* is the ranking of the number of lawyers per 10,000 people in the province in which a firm is headquartered. *P*-values adjusted for firm-level clustering are reported in parentheses. *, **, and *** indicates significance at the 10%, 5%, and 1% level, respectively.

	Dependent variable: <i>New bank loans</i>		
	(1)	(2)	(3)
$APTA_{t-1}$	2.017*** (0.000)	2.035*** (0.000)	1.786*** (0.000)
$APTA_{t-1} * Marketization$	0.107*** (0.004)		
$APTA_{t-1} * Property\ rights$		0.105*** (0.003)	
$APTA_{t-1} * Lawyers$			0.058** (0.011)
<i>Marketization</i>	0.011*** (0.004)		
<i>Property rights</i>		0.011*** (0.002)	
<i>Lawyers</i>			0.006 (0.126)
<i>Control variables</i>	Included	Included	Included
<i>Year</i>	Included	Included	Included
<i>Industry</i>	Included	Included	Included
<i>Year*Industry</i>	Included	Included	Included
No. of obs.	9686	9686	9686
Adjusted R ²	0.105	0.106	0.106

Table 6 Subsample analysis of the effects of trade credit use on new bank loans granted**Panel A:**

This panel presents the regression results for the effect of trade credit use on new bank loans granted for young firms and old firms, respectively. The dependent variable is newly granted bank loans scaled by total assets. Column 1 and Column 2 report the results for young firms (i.e., firm age below sample median). Column 3 and Column 4 report the results for old firms (i.e., firm age above sample median). *P*-values adjusted for firm-level clustering are reported in parentheses. *, **, and *** indicates significance at the 10%, 5%, and 1% level, respectively.

	Dependent variable: <i>New bank loans</i>			
	Young firms		Old firms	
	(1)	(2)	(3)	(4)
$APTA_{t-1}$	2.926*** (0.000)		0.616* (0.051)	
$APTS_{t-1}$		0.410*** (0.007)		0.005* (0.074)
<i>Control variables</i>	Included	Included	Included	Included
<i>Year</i>	Included	Included	Included	Included
<i>Industry</i>	Included	Included	Included	Included
<i>Year*Industry</i>	Included	Included	Included	Included
No. of obs.	7137	7137	6106	6106
Adjusted R ²	0.132	0.133	0.097	0.088

Panel B:

This panel presents the regression results for the effect of information opacity on the relationship between trade credit use and new bank loans granted for young firms and old firms, respectively. The dependent variable is newly granted bank loans scaled by total assets. Corporate information opacity is measured by three proxies, namely, a dummy indicating annual report being audited by a small auditor, natural log of stock analysts following the firm, and a dummy indicating inclusion in the CSI300 index. Columns 1 to 3 report the results for young firms (i.e., firm age below sample median). Columns 4 to 6 report the results for old firms (i.e., firm age above sample median). *P*-values adjusted for firm-level clustering are reported in parentheses. *, **, and *** indicates significance at the 10%, 5%, and 1% level, respectively.

	Dependent variable: <i>New bank loans</i>					
	Young firms			Old firms		
	(1)	(2)	(3)	(4)	(5)	(6)
$APTA_{t-1}$	6.423*** (0.000)	4.760*** (0.000)	3.934*** (0.000)	1.036* (0.052)	0.390 (0.332)	0.575 (0.124)
$APTA_{t-1} * Small\ auditor_{t-1}$	3.520*** (0.005)			0.806 (0.137)		
$APTA_{t-1} * Ln(analysts+1)_{t-1}$		-0.614*** (0.008)			-0.139 (0.587)	
$APTA_{t-1} * CSI300_{t-1}$			-4.924*** (0.002)			-0.559 (0.471)
$Small\ auditor_{t-1}$	-0.037 (0.226)			0.083 (0.247)		
$Ln(analysts+1)_{t-1}$		0.112* (0.100)			0.016 (0.591)	
$CSI300_{t-1}$			0.433* (0.084)			0.018 (0.849)
<i>Control variables</i>	Included	Included	Included	Included	Included	Included
<i>Year</i>	Included	Included	Included	Included	Included	Included
<i>Industry</i>	Included	Included	Included	Included	Included	Included
<i>Year*Industry</i>	Included	Included	Included	Included	Included	Included
No. of obs.	7137	7137	7137	6106	6106	6106
Adjusted R ²	0.133	0.117	0.116	0.031	0.032	0.031

Panel C:

This panel presents the regression results for the effect of external institutions on the relationship between trade credit use and new bank loans granted for young firms and old firms, respectively. The dependent variable is newly granted bank loans scaled by total assets. External institutions are measured by three variables. *Marketization* is the ranking of the overall level of marketization in the province in which a firm is headquartered. *Property rights* is the ranking of the level of legal protection of property rights in the province in which a firm is headquartered. *Lawyers* is the ranking of the number of lawyers per 10,000 people in the province in which a firm is headquartered. Columns 1 to 3 report the results for young firms (i.e., firm age below sample median). Columns 4 to 6 report the results for old firms (i.e., firm age above sample median). *P*-values adjusted for firm-level clustering are reported in parentheses. *, **, and *** indicates significance at the 10%, 5%, and 1% level, respectively.

	Dependent variable: <i>New bank loans</i>					
	Young firms			Old firms		
	(1)	(2)	(3)	(4)	(5)	(6)
$APTA_{t-1}$	4.549*** (0.000)	4.543*** (0.000)	4.604*** (0.000)	0.844** (0.027)	0.889** (0.018)	0.604 (0.153)
$APTA_{t-1} * Marketization$	0.206*** (0.009)			0.055 (0.104)		
$APTA_{t-1} * Property\ rights$		0.185** (0.018)			0.059* (0.096)	
$APTA_{t-1} * Lawyers$			0.139** (0.019)			0.021 (0.523)
<i>Marketization</i>	0.021*** (0.007)			0.004 (0.201)		
<i>Property rights</i>		0.020*** (0.007)			0.005 (0.106)	
<i>Lawyers</i>			0.016** (0.034)			0.001 (0.783)
<i>Control variables</i>	Included	Included	Included	Included	Included	Included
<i>Year</i>	Included	Included	Included	Included	Included	Included
<i>Industry</i>	Included	Included	Included	Included	Included	Included
<i>Year*Industry</i>	Included	Included	Included	Included	Included	Included
No. of obs.	5145	5145	5145	4541	4541	4541
Adjusted R ²	0.127	0.127	0.127	0.079	0.079	0.079

Table 7**Relative use of trade credit and bank loans over time****Panel A:**

This panel reports regression results for the effect of firm age on the relative use of trade credit and bank loans. The dependent variable in Column 1 is the ratio of bank loans to total debt (*BLTD*). The dependent variable in Column 2 is the ratio of accounts payable to total debt (*APTD*). The dependent variable in Column 3 is the ratio of accounts payable to the sum of accounts payable and bank loans ($AP/(AP+BL)$). *P*-values adjusted for firm-level clustering are reported in parentheses. *, **, and *** indicates significance at the 10%, 5%, and 1% level, respectively.

	<i>BLTD</i>	<i>APTD</i>	$AP/(AP+BL)$
	(1)	(2)	(3)
$\ln(age+1)_{t-1}$	0.028*** (0.000)	-0.019*** (0.000)	-0.016*** (0.000)
$\ln(assets)_{t-1}$	0.044*** (0.000)	-0.015*** (0.000)	-0.071*** (0.000)
<i>Tangibility</i> _{t-1}	0.333*** (0.000)	-0.176*** (0.000)	-0.047 (0.194)
<i>Leverage</i> _{t-1}	0.149*** (0.000)	-0.126*** (0.000)	-0.005** (0.020)
<i>ROA</i> _{t-1}	-0.016 (0.321)	0.015 (0.182)	0.000 (0.626)
<i>Growth</i> _{t-1}	0.007* (0.081)	-0.004 (0.167)	0.000 (0.900)
<i>Cash flow</i> _{t-1}	-0.574*** (0.000)	0.217*** (0.000)	0.073*** (0.000)
<i>Outside directors</i> _{t-1}	0.080* (0.070)	-0.042 (0.164)	-0.026 (0.953)
<i>Foreign</i> _{t-1}	0.022 (0.445)	0.018 (0.516)	0.026 (0.405)
<i>Government</i> _{t-1}	0.018* (0.078)	0.011 (0.225)	0.012 (0.211)
<i>Total bank deposits</i> _{t-1}	0.187* (0.083)	-0.126 (0.114)	-0.117 (0.156)
<i>Year</i>	Included	Included	Included
<i>Industry</i>	Included	Included	Included
<i>Year*Industry</i>	Included	Included	Included
No. of obs.	13243	13243	13243
Adjusted R ²	0.230	0.277	0.316

Panel B:

This panel reports the regression results for the effect of information opacity on firms' relative use of trade credit and bank loans over time. The dependent variable in Columns 1 to 3 is the ratio of bank loans to total debt (*BLTD*). The dependent variable in Columns 4 to 6 is the ratio of accounts payable to total debt (*APTD*). The dependent variable in Columns 7 to 9 is the ratio of accounts payable to the sum of accounts payable and bank loans ($AP/(AP+BL)$). Corporate information opacity is measured by three proxies, namely, a dummy indicating annual report being audited by a small auditor, natural log of stock analysts following the firm, and a dummy indicating inclusion in the CSI300 index. *P*-values adjusted for firm-level clustering are reported in parentheses. *, **, and *** indicates significance at the 10%, 5%, and 1% level, respectively.

	Dep. Var. = <i>BLTD</i>			Dep. Var. = <i>APTD</i>			Dep. Var. = $AP/(AP+BL)$		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\ln(age+1)_{t-1}$	0.051*** (0.003)	0.055*** (0.000)	0.049*** (0.000)	-0.010** (0.036)	-0.018*** (0.005)	-0.025*** (0.000)	-0.056*** (0.009)	-0.040*** (0.002)	-0.026** (0.018)
$\ln(age+1)_{t-1} * \text{Small auditor}_{t-1}$	-0.016** (0.027)			0.026** (0.043)			0.016** (0.029)		
$\ln(age+1)_{t-1} * \ln(analysts+1)_{t-1}$		0.013** (0.013)			0.010** (0.036)			0.022** (0.031)	
$\ln(age+1)_{t-1} * \text{CSI300}_{t-1}$			0.032** (0.043)			-0.019** (0.048)			-0.028** (0.044)
$\text{Small auditor}_{t-1}$	-0.031 (0.512)			-0.065 (0.117)			-0.022 (0.661)		
$\ln(analysts+1)_{t-1}$		0.030* (0.082)			0.026** (0.011)			0.048** (0.024)	
CSI300_{t-1}			0.031 (0.603)			0.036 (0.305)			0.028 (0.704)
Control variables	Included	Included	Included	Included	Included	Included	Included	Included	Included
Year	Included	Included	Included	Included	Included	Included	Included	Included	Included
Industry	Included	Included	Included	Included	Included	Included	Included	Included	Included
Year*Industry	Included	Included	Included	Included	Included	Included	Included	Included	Included
No. of obs.	13243	13243	13243	13243	13243	13243	13243	13243	13243
Adjusted R ²	0.203	0.205	0.206	0.278	0.278	0.275	0.202	0.243	0.242

Panel C:

This panel reports the regression results for the effect of external institutions on firms' relative use of trade credit and bank loans over time. The dependent variable in Columns 1 to 3 is the ratio of bank loans to total debt (*BLTD*). The dependent variable in Columns 4 to 6 is the ratio of accounts payable to total debt (*APTD*). The dependent variable in Columns 7 to 9 is the ratio of accounts payable to the sum of accounts payable and bank loans ($AP/(AP+BL)$). *Marketization* is the ranking of the overall level of marketization in the province in which a firm is headquartered. *Property rights* is the ranking of the level of legal protection of property rights in the province in which a firm is headquartered. *Lawyers* is the ranking of the number of lawyers per 10,000 people in the province in which a firm is headquartered. *P*-values adjusted for firm-level clustering are reported in parentheses. *, **, and *** indicates significance at the 10%, 5%, and 1% level, respectively.

	Dep. Var. = <i>BLTD</i>			Dep. Var. = <i>APTD</i>			Dep. Var. = $AP/(AP+BL)$		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\ln(age+1)_{t-1}$	0.021*** (0.000)	0.018*** (0.003)	0.027*** (0.000)	-0.032*** (0.000)	-0.031*** (0.000)	-0.029*** (0.000)	-0.014* (0.060)	-0.010** (0.018)	-0.024*** (0.006)
$\ln(age+1)_{t-1} * \text{Marketization}$	-0.076** (0.017)			0.014*** (0.000)			0.009** (0.049)		
$\ln(age+1)_{t-1} * \text{Property rights}$		-0.011** (0.039)			0.011*** (0.002)			0.005** (0.046)	
$\ln(age+1)_{t-1} * \text{Lawyers}$			-0.014** (0.018)			0.007** (0.046)			0.007** (0.027)
<i>Marketization</i>	0.021 (0.135)			-0.055*** (0.000)			-0.023 (0.141)		

<i>Property rights</i>		0.033** (0.026)			-.047*** (0.000)			-0.028 (0.138)	
<i>Lawyers</i>			0.020 (0.121)			- 0.036*** (0.000)			-0.025 (0.193)
<i>Control variables</i>	Included	Included	Included	Included	Included	Included	Included	Included	Included
<i>Year</i>	Included	Included	Included	Included	Included	Included	Included	Included	Included
<i>Industry</i>	Included	Included	Included	Included	Included	Included	Included	Included	Included
<i>Year*Industry</i>	Included	Included	Included	Included	Included	Included	Included	Included	Included
No. of obs.	9686	9686	9686	9686	9686	9686	9686	9686	9686
Adjusted R ²	0.236	0.237	0.238	0.315	0.313	0.313	0.334	0.333	0.337

Table 8

Alternative information opacity proxy

This table presents the regression results for the effect of information opacity on the relationship between trade credit use and new bank loans granted. The dependent variable is newly granted bank loans scaled by total assets. Information opacity is measured by an opacity index (*Opacity*) that consists of three components: trading volume, proportion of zero-return trading days, and stock return volatilities. Control variables are included but their coefficients are not reported. *P*-values adjusted for firm-level clustering are reported in parentheses. *, **, and *** indicates significance at the 10%, 5%, and 1% level, respectively.

	Dependent variable: <i>New bank loans</i>		
	Full sample	Young firms	Old firms
	(1)	(2)	(3)
<i>APTA_{t-1}</i>	4.469*** (0.004)	6.288*** (0.000)	0.596 (0.325)
<i>APTA_{t-1}*Opacity_{t-1}</i>	1.011*** (0.005)	2.332*** (0.006)	0.047 (0.322)
<i>Opacity_{t-1}</i>	-0.257 (0.102)	-0.359* (0.082)	0.066 (0.445)
<i>Control variables</i>	Included	Included	Included
<i>Year</i>	Included	Included	Included
<i>Industry</i>	Included	Included	Included
<i>Year*Industry</i>	Included	Included	Included
No. of obs.	13243	13243	13243
Adjusted R ²	0.116	0.121	0.072

Table 9**Effect of global financial crisis**

This table reports regression results for the effect of global financial crisis (GFC) on the relationship between use of trade credit and new bank loans granted. The dependent variable is newly granted bank loans scaled by total assets. *Year08* is a dummy variable that equals 1 for all observations in year 2008 and zero for all other observations. *Year09* and *Year10* are similarly defined. Control variables are included in all regressions but their coefficients are not reported. *P*-values adjusted for firm-level clustering are reported in parentheses. *, **, and *** indicates significance at the 10%, 5%, and 1% level, respectively.

	Dependent variable: <i>New bank loans</i>		
	(1)	(2)	(3)
<i>APTA_{t-1}</i>	2.322*** (0.000)	2.417*** (0.000)	2.296*** (0.000)
<i>APTA_{t-1}*Year08</i>	0.044 (0.485)		
<i>Year08</i>	0.031 (0.727)		
<i>APTA_{t-1}*Year09</i>		0.522*** (0.000)	
<i>Year09</i>		-0.235* (0.069)	
<i>APTA_{t-1}*Year10</i>			0.188* (0.075)
<i>Year10</i>			-0.087 (0.415)
<i>Control variables</i>	Included	Included	Included
<i>Year</i>	Included	Included	Included
<i>Industry</i>	Included	Included	Included
<i>Year*Industry</i>	Included	Included	Included
No. of obs.	13243	13243	13243
R ²	0.106	0.107	0.106

^[1] In our main tests, an auditor is regarded as a big auditor if it is one of the international Big Four (Deloitte, E&Y, KPMG, & PwC) or the largest six domestic auditors by revenue (Shanghai Lixin, XinyongZhonghe, Yuehua, Daxin, Dahua, & Zhongshen). Inevitably, it is a subjective judgement as to how many domestic auditors are deemed to be big auditors. As a robustness check, we alternatively classify the largest eight (Chen *et al.*, 2011) or the largest fifteen auditors (Firth *et al.*, 2011) as big auditors. Our main empirical results are robust to these alternative definitions.

^[2] There are other studies that examine the effect of firm age on bank loan access from different approach. For example, Barclay *et al.* (2003) argue that old firms are likely to have more assets available as collateral and they are also inclined to have more stable cash flows. This is not the focus of our study as we investigate the age effect from an agency cost perspective. We control fixed assets, firm size, and cash flows in all our regressions.

^[3] As a robustness test, we define the firm's age as the number of years since the firm is publicly listed. Our main results are qualitatively similar when we use this alternative definition.

^[4] As in section 3.2, we only report regression results using *APTA* as the key independent variable in Panel B and Panel C. The results are qualitatively similar when we use *APTS* and are available upon request.

^[5] The test results are available from the authors upon request.