

Which Type of Debt Financing Matters to Whom? Firm-Level Evidence during the Financial Crisis

Ye Jin Heo *

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Abstract

This paper investigates how different forms of debt financing were related to firms' sales performance during the Global Financial Crisis using Korean firm-level data. I show that a negative relationship between sales growth and leverage ratio during the crisis is predominantly driven by "trade credit" (credit extended by firm's suppliers), with short-term bank credit also playing a role. Firms more dependent on bond performed better than others. By comparing firms with different degree of financial access, I show that short-term bank credit was negatively associated with the sales growth only of firms with limited financial access. By contrast, trade credit was associated with the sales performance of a wider range of firms, including those with better financial access. Furthermore, I find that the negative effect of trade credit tends to be pronounced for firms with better financial access in more concentrated markets, suggesting the role of a firm's market power in inter-firm financing. The results can be interpreted such that during a financial crisis, these firms may no longer be able to benefit from favorable funding contract terms from their suppliers, and a reduction in trade credit cannot be easily offset by drawing on other sources of financing.

Keywords: Financial crisis; bank credit; trade credit; financial constraints

JEL Classification Codes: F42, G01, G20, G32

*The Graduate Institute of International and Development Studies, Geneva, Switzerland, *email:yejin.heo@graduateinstitute.ch*. I am grateful to Cédric Tille for invaluable support and advice. I also thank Ugo Panizza, Yun Jung Kim, Rahul Mukherjee, Julia Cajal, Kalinda Manova, Cyril Monnet, and participants at the Gerzensee Alumni conference for their helpful comments and suggestions. All errors are mine.

1 Introduction

The transmission of monetary policy to the real economy through the bank lending channel has been much discussed in the literature (Bernanke and Blinder (1988); Bernanke and Gertler (1995)). Some studies empirically show firm's increased use of trade credit, credit extended by a firm's suppliers, as a substitute for the reduced supply of bank loans as indirect evidence of the bank lending channel (Nilsen (2002); Mateut and Mizen (2003)). However, the role of trade credit in the transmission of financial shocks remain understudied even though trade credit accounts for a considerable share in firm's balance sheet as one of the major sources of financing.¹

Using Korean firm-level data, this paper investigates the effects of three primary types of debt financing – bank credit, trade credit, and bonds – on firm sales performance during the Global Financial Crisis (GFC). It aims to understand the role of firm characteristics in the transmission of liquidity shock to the real economy through the firm's balance sheet. I start by examining the responsiveness of each type of debt financing to the financial crisis in terms of its relationship with sales growth, considering the maturity and currency composition of debt. Subsequently, I compare how the effect of debt financing varies across different groups of firms and investigate heterogeneous effects of trade credit by firm characteristics. I provide suggestive evidence on the potential mechanism through which the heterogeneous effects are generated.

This study is motivated by the fact that the GFC was an exogenous shock to Korea, unlike the Asian Financial Crisis of 1997. Since the Asian Financial Crisis, which was one of the most traumatic events experienced by the Korean economy, the country had introduced a number of new regulations to improve its economic fundamentals. Only a decade after experiencing this large-scale crisis, Korea was able to recover relatively quickly from the GFC compared to other economies, mostly because the crisis was not associated with a severe contraction of domestic demand. Nonetheless, Korea did experience significant spillover effects during the crisis. The real GDP growth rate shrank from 5.5% in 2007 to 0.7% in 2009, and the Korean won lost almost 50% of its value vis-a-vis the US dollar between 2007 and the end of 2008, experiencing sharp capital outflows after the collapse of Lehman Brothers.² Therefore, it provides a suitable setting in which to study the transmission channels of financial shocks to the real economy. In this study, I focus on the firm balance sheet.

¹Trade credit is internationally reported to be the second largest source of financing after bank loans for small firms (see, for example, Berger and Udell (1998); Demircuc-Kunt and Maksimovic (2001)).

²In 2006, the balance of total financial account (inflows minus outflows) was 21 billion dollars in surplus, but it turned to 50.8 billion dollars in deficit in 2008. Among them, loans from abroad especially fell sharply from 44 billion dollars in surplus to 19.5 billion dollars in deficit during the same period.

During a financial crisis, the balance sheet can affect firm performance primarily through two mechanisms. First, under capital market imperfections in which asymmetric information between lenders and borrowers exists, credit plays an important role in the real effects of a financial shock by raising the cost of external financing for firms.³ Internal and external finance being imperfect substitutes, financially constrained firms face a higher “external finance premium,” and therefore the impact of a liquidity shock on firm performance depends on the firm’s financing structure, which in turn is tied to firm’s degree of financial access.

Secondly, if a financial crisis is accompanied by a sharp exchange rate depreciation, which often is the case and was for Korea during the GFC, holdings of foreign currency denominated debt can negatively affect firm performance as the value of foreign debt inflates (Krugman (1999); Feldstein (1999)).⁴ Firms that rely more on cross-border finance become more vulnerable to a liquidity shock given a sudden stop or a retrenchment in capital flows by foreign investors, especially when the shock is coming from abroad. Therefore, the impact of financial crisis on firm performance also depends on the currency composition of the balance sheet.

In the first part of this paper, I estimate the effects of bank credit, trade credit, and bonds on sales growth during the GFC. I find that the negative relationship between a firm’s leverage and sales growth during the crisis is prominent through trade credit, followed by bank credit; in a cross-sectional setting, ten percentage points increase in the pre-crisis trade credit is associated with a decrease in sales growth of 3.5 percentage points between 2007 and 2009, whereas that of bank credit is associated with a decrease in sales growth of one percentage point. Meanwhile, firms that relied more on bonds performed better than other firms, suggesting that a bond is the most resilient type of debt to a financial crisis. Subsequently, I show that higher exposure to short-term credit is more risky than that to long-term credit during the crisis; firms that used more short-term bank credit experienced lower sales growth, but the effect of long-term bank credit is not statistically significant in a variety of model specifications. While trade credit mostly consists of short-term credit, a few firms also had a larger decline in sales growth associated with their use of long-term trade credit. Having decomposed debt by currency denomination, I find that the balance sheet effect of the exchange rate is pronounced through trade credit rather than bank credit, reflecting the collapse of international trade during the GFC.

In the second part of the paper, I examine the role of firm characteristics in the effect

³Such transmission channel of monetary tightening to the real economy is often discussed as “the broad credit channel” in the literature (see, for example, Oliner and Rudebusch (1996); Kohler et al. (2000)).

⁴Exchange rate depreciation may also have a positive effect on firm performance through holdings of foreign assets or improved terms of trade, so called “the competitiveness channel”.

of debt financing by distinguishing firms on the basis of four measures of access to finance: a listed status on the stock exchange, size of asset, foreign ownership, and credit ratings. Consistently with previous studies, I show that dependence on short-term bank credit is only negatively related to the sales performance of firms with limited financial access. By contrast, I find that a higher share of trade credit in the balance sheet is associated with slower sales growth for all firms except for those with high creditworthiness. I further provide evidence that unlike bank credit and bond, the negative effect of trade credit tends to be stronger for firms with better financial access.

Based on the literature on trade credit contracts, I hypothesize that the heterogeneous effect of trade credit is due to heterogeneous credit contract terms with suppliers, which is associated with a firm's bargaining power.⁵ Financially better connected firms are likely to hold higher bargaining power than suppliers under the right circumstances, which enables them to enjoy favorable contract terms during normal times.⁶ However, when liquidity dries up during the crisis, these firms may no longer be able to benefit from the same funding contract terms, and a reduction in trade credit may not be easily offset by drawing on other sources of financing. I test this hypothesis by separating the sample into firms in a more concentrated market and those in an unconcentrated market based on the Herfindahl-Hirschman Index (HHI). I find that the heterogeneous effect of trade credit is significant mostly for firms with better financial access in a more concentrated market, suggesting that a firm's market power plays a role in the manner in which inter-firm financing is associated with sales performance during the crisis.

Finally, to better understand the findings concerning trade credit, I exploit the special feature of trade credit, namely, that most firms are borrowers and lenders at the same time in inter-firm financing. Thus, I compare the net trade credit, the difference between received credit and extended credit, and the gross trade credit of firms with different degrees of financial access. For firms with better financial access, I find that net trade credit increased during the crisis, making them net recipients of trade credit. However, I show that this is not because they received more credit from suppliers in gross but because they reduced credit provision to their customers to a larger extent, which emphasizes the importance of gross trade credit to sales performance rather than that of net trade credit.

The rest of the paper is organized as follows. Section 2 discusses relevant literature and the contributions of this study. Section 3 describes the data and presents stylized facts.

⁵For example, Fabbri and Klapper (2016) and Ellingsen et al. (2016) show that trade credit contracts are related to firm's bargaining power such that firms with lower bargaining power provide more trade credit or better contract terms to their customers with higher bargaining power.

⁶I do not argue that firms with better financial access always have high bargaining power. Firms with high credit ratings in this study are an example; they are financially unconstrained firms, yet do not show any evidence of a strong negative effect of trade credit on their sales growth.

Section 4 describes the main empirical strategy. Section 5 presents the results, and Section 6 conducts robustness checks. Section 7 further discusses firm’s use of trade credit, and Section 8 concludes.

2 Related literature

The real effects of the GFC through the channel of external financing have been extensively discussed in the literature, often focusing on the “standard” source of financing. Considering the maturity composition of corporate debt, Almeida et al. (2009) and Kalemli-Ozcan et al. (2018) find that short maturity debt negatively affects firm investment following the crisis. Studies also paid a special attention to the effect of contracted trade finance on firm’s trade performance, providing inconsistent empirical evidence (see, for example, Chor and Manova (2012); Levchenko et al. (2010); Bricongne et al. (2012)).⁷ Studies that are most similar to this one in terms of their focus are Coulibaly et al. (2013) and Xia (2016). They examine the effect of trade credit along with other external and/or internal sources of finance on sales growth and find a positive effect for firms in six emerging economies and a negative effect for Chinese firms, respectively.⁸ In the context of Korean firms, Song (2014) overall finds no significant relationship between firm’s financial vulnerability and export performance,⁹ while Kim (2016) and Bae et al. (2016) focus on foreign currency denominated debt and show a negative balance sheet effect on investment and firm value, respectively.

On the other hand, a number of studies on trade credit have explored the role of trade credit as an alternative source of funding for financially constrained firms. Since the seminal work of Petersen and Rajan (1997) documented empirical evidence on the use of trade credit by small firms, many studies have investigated trade credit under tight supply of bank lending. Kohler et al. (2000), Nilsen (2002), and Mateut et al. (2006) show that firms increase the use of trade credit as a substitute for bank credit during monetary contractions. While Love et al. (2007), Garcia-Appendini and Montoriol-Garriga (2013), and Carbó-Valverde et al. (2016) find the similar results for periods of financial crisis, Love

⁷Trade finance generally refers to *bank products*, such as letters of credit, supply chain finance, trade insurance, and invoice discounting, that are designed specifically to support international trade transactions. Therefore, they are distinguished from trade credit which is *inter-firm financing* firms receive from their upstream suppliers in the form of delayed payments for the purchase of goods (see, BIS (2014) and Coulibaly et al. (2013)).

⁸Coulibaly et al. (2013) find that firms relied more on trade credit in the pre-crisis period performed better, once the substitution across different sources of fund during the crisis is controlled in the regression. Without including the substitution variables, the effect of trade credit on sales growth is not statistically significant.

⁹However, the author finds that cross-border trade credit is negatively related to export of small firms.

et al. (2007) show that aggregate trade credit provision decreases following a bank credit crunch, suggesting that even large and financially stronger firms find it difficult to extend credit when liquidity dries up.

Several other papers look at firm's bargaining power in trade credit contracts to explain heterogeneity in inter-firm credit provisions. Ng et al. (1999) shows that buyers with high reputation receive more credit terms than cash terms, while Giannetti et al. (2011) and Klapper et al. (2012) show that the largest and most creditworthy buyers receive more credit with the longest maturities. Similarly, Fabbri and Klapper (2016) and Ellingsen et al. (2016) find that buyers with higher bargaining power have favorable credit contract terms from suppliers with weak bargaining power.

My paper contributes to the literature by using extensive balance sheet information for both large and small firms. Many studies examine the transmission of financial shocks based on the responses of large firms or exporters due to data limitations. In this paper, I distinguish firms with better financial access and those not by using four indirect measures of financial access gathered from various firm characteristics; these reflect different aspects of a firm's financial ability. Similarly, while previous studies often focus on a certain type of debt such as the standard bank credit, bond, short-term debt, or foreign debt, I use comprehensive information on a firm's liabilities, which disaggregates debt not only by sources but also by maturity and currency denomination. Therefore, the data allows a close investigation of how firm heterogeneity affects the relationship between sales performance and different types of debt financing.

This paper also contributes to the literature by combining two existing literatures, namely the literature on the transmission of the GFC through firms' balance sheet and the literature on inter-firm credit contracts. While trade credit is the main alternative source of financing to bank credit, its effect on firm performance has been much understudied compared to that of bank credit or bonds. Rather, many studies in the literature try to understand the motivation of firms to use trade credit though it is considered an inferior source of financing. In this paper, on the one hand, I investigate how liquidity contraction is transmitted to the real economy through trade credit along with bank credit and bonds, and on the other hand, I address the factors that make the effect of inter-firm financing heterogeneous across firms by considering the firm's bargaining power, which is often discussed in the literature on trade credit contracts. Empirical findings on trade credit during a financial crisis are somewhat mixed, and one possible reason for this could be that trade credit not only depends on the firm's degree of financial access but also on its bargaining power, which greatly varies depending on the choice of data. I attempt to fill this gap in the literature by providing evidence of the effect of trade credit used by different types of

firms. Recent papers by Coricelli and Frigerio (2016) and Gonçalves et al. (2018) have a similar focus to this paper in the sense that they both consider market power as one of determinants of the inter-firm credit relationship. However, the former focuses on its impact on investments by small-to-medium enterprises (SMEs), while the latter focuses on trade credit decisions rather than the impact of trade credit on firm performance.

3 Data and stylized facts

3.1 Data source and definitions

The sample is drawn from annual firm-level data KISVALUE by the NICE Information Service. It provides extensive corporate data for both publicly-listed and non-listed firms in Korea whose assets are over 7 billion won, approximately 6.5 million US dollar in 2017. I use general firm information (company name, established year, industry code, a listed status on the stock exchange, foreign ownership, etc), detailed balance sheet information and other financial information (export, income statement, cash flow statement, cost of goods, etc). Although the original panel is unbalanced, I focus on firms that have observations in all years between 2001 and 2010 for panel regressions in Section 4 to track down the relationship between the pre-crisis debt structure and sales growth during the crisis. I exclude firms in the financial industry and those with sales growth and leverage ratio in the top and bottom 1% level.

As the analysis heavily relies on information on firm liabilities, I carefully clean up balance sheet data. I drop observations with negative values of total assets, total liabilities, and subcategories of liabilities. As long as observations on sales, total assets and total liabilities are valid, missing values on any subcategory of liability are considered as zero. If the sum of subcategories of liability is larger than total liabilities, I use adjusted total liabilities so that the sum of bank credit, trade credit, bond, and the rest of liabilities are equal to total liabilities.

Following the literature, borrowings and trade account payable on the liabilities side of balance sheet are defined as bank credit and trade credit, respectively. Trade account payable is unpaid expenses for transactions not only with international suppliers but also with domestic suppliers.¹⁰ Table 1 summarizes the composition of the right side of firm's balance sheet. I focus on liabilities and rearrange the subcategories of liabilities by primary

¹⁰The data does not distinguish between trade account payable for international transactions and domestic transactions. I can only presume whether transactions are international or domestic, based on currency of trade account payable.

Table 1: The right side of firm's balance sheet

Liabilities and Equity
Liabilities
Bank credit (borrowings)
Short-term bank credit
Long-term bank credit
Trade credit (trade account payable)
Short-term trade credit
Long-term trade credit
Bond
Short-term bond
Long-term bond
Rest
Equity

types that are used in this analysis.¹¹ The sum of liabilities and equity would be total assets, which will be used later to normalize the size of liabilities. Short-term debt is debt due within twelve months. Liabilities in Korean won is defined as the difference between total liabilities and foreign currency denominated liabilities, which are given in the data.

All values are transformed to real 2001 Korean won using the Producer Price Index for financial goods. The final balanced sample consists of 8,683 firms and a total of 73,323 observations. Appendix A provides more details on the construction of the variables used in the main analysis as well as in robustness checks.

3.2 Stylized facts

One of the variables of interest in this study is real sales growth. Figure 1 (a) compares how real GDP growth of Korea and the median level of real sales growth of firms in the balanced sample had evolved between 2002 and 2010. The high correlation between the two variables suggests that the analysis on sales growth in firm-level data would be consistent with that on aggregate macroeconomic dynamics. Real GDP growth and real sales growth consistently increased between 2005 and 2007, then they dropped about 4.7% and 4.5%, respectively, between 2007 and 2009. Accordingly, the period between 2007 and 2009 is

¹¹In Table 1, account payable that is unrelated to transactions with suppliers is categorized under the rest.

defined as the crisis period in this study.

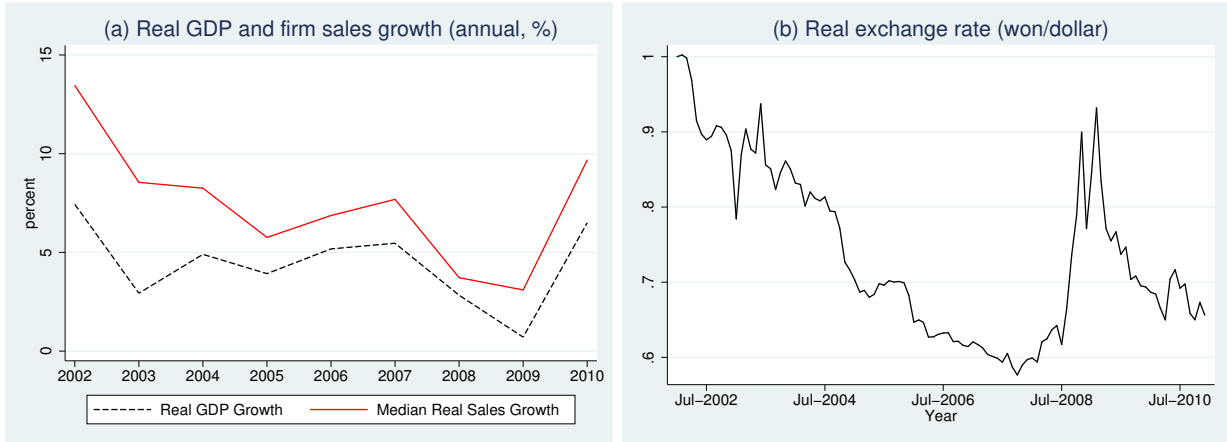


Figure 1: GDP growth, firm sales growth and exchange rate by year

During the same period, Korea experienced considerable real exchange rate depreciation as shown in Figure 1 (b). Real exchange rate is calculated as monthly nominal exchange rate (won/dollar) deflated by the consumer price index, and then normalized to its 2002 value. Korea's real exchange rate started to depreciate in summer 2007 when the news related to the US subprime mortgage problem spread and then the value of Korean won fell dramatically in the second half of 2008, following the collapse of Lehman brothers.

Figure 2 compares the median real sales growth across different quartiles of leverage, bank credit, trade credit and bond in the balanced sample in which leverage is defined as total liabilities over total assets. Four quartiles of debt finance are calculated based on the mean of each firm between 2001 and 2010. The 1st quartile refers to firms with the least share of debt, while the 4th quartile refers to firms with the highest share of debt.

Figure 2 (a) shows that in general firms who depend more on debt grew faster in the pre-crisis period, but experienced a larger decline in sales growth during the crisis. Figure 2 (b) and (c) further indicate that sales growth position of firms with the highest share of bank credit and trade credit (in the 4th quartile) and that of firms with the least share (in the 1st quartile) is switched in 2009, compared to the positions in the pre-crisis period. Sales performance of firms with and without bonds, however, shows little difference from each other in 2009, suggesting that the negative impact of crisis on bond was not as severe as that on bank credit or trade credit.

Liability variables are another important variables in this study. Figure 3 shows the average debt structure by industry for the pre-crisis period between 2001 and 2006. The balanced panel largely consists of manufacturing firms; 61.7% of firms are in the manufacturing industry, 14.8% in wholesale, retail trade and transportation, 9.8% in construction

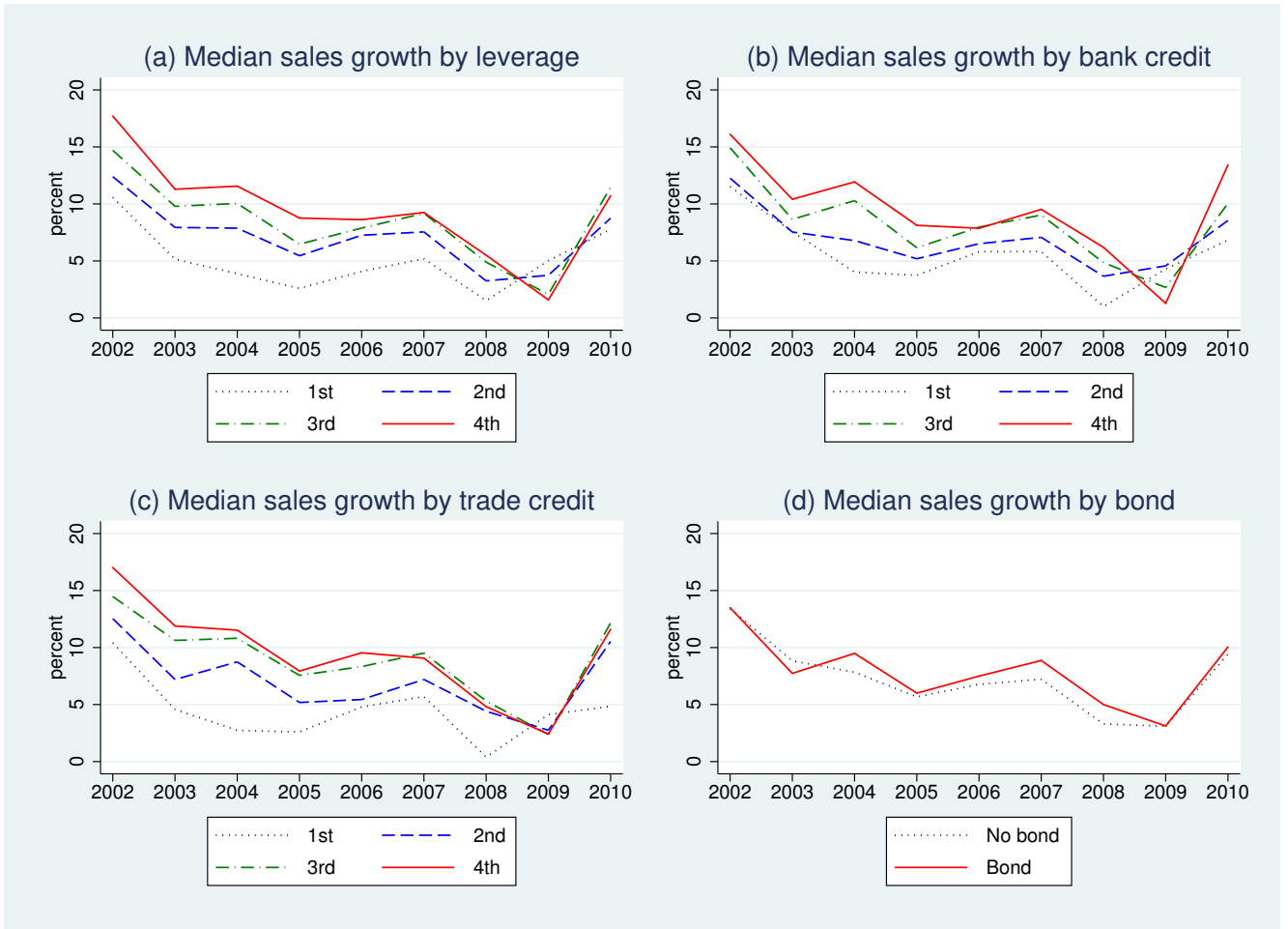


Figure 2: Median sales growth of firms with different quartiles of debt holdings

and utility, and the remaining 13.5% of firms provide other services.¹²

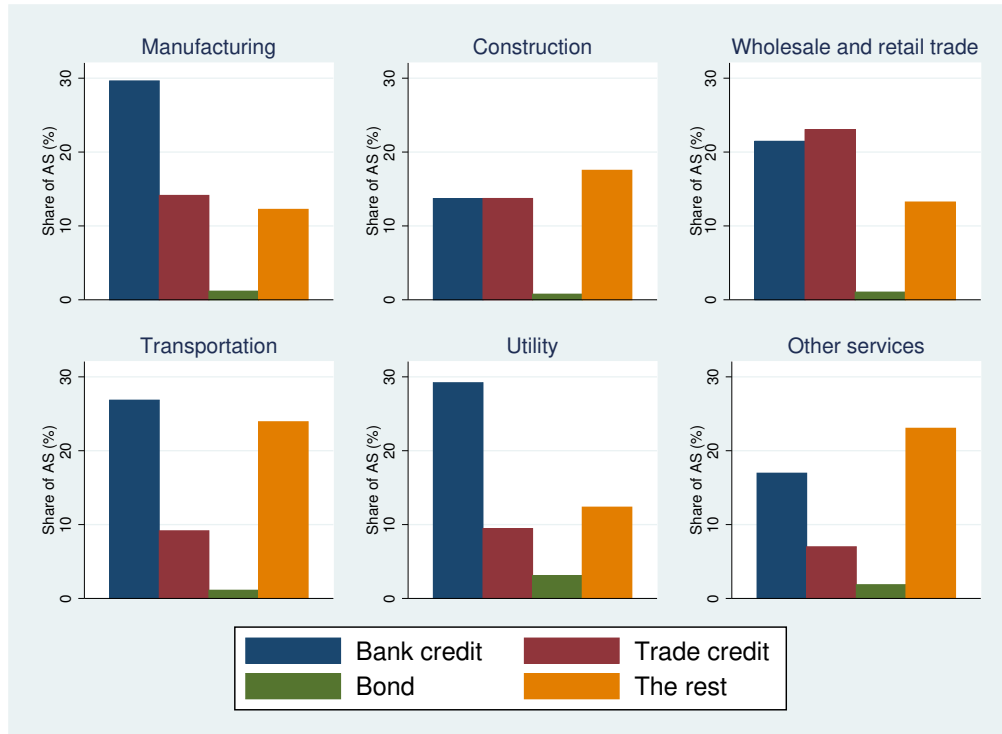


Figure 3: Debt financing structure by industry

Bank credit is often the single largest source of debt finance; it takes 29.6% of total assets in manufacturing, 26.8% in transportation, 29.2% in utility, and 16.9% in other service industries. The second largest form of debt finance is trade credit in most industries, ranging from 6.9% (other services) to 14.1% (manufacturing). For construction and whole sale and retail trade sectors, the share of trade credit in balance sheet is almost the same as or higher than bank credit, consisting 13.7% and 23%, respectively. Meanwhile, since the data includes a lot of small non-listed firms that are unable to issue bonds, on average the share of bond is small, ranging between 0.7% (construction) to 3.1% (utility) of total assets.

Next, I compare the average debt financing structure by firm characteristics. I use a status on stock exchange, size, foreign ownership, and credit ratings, which are often used as a criteria to proxy the financial access of firms in the literature. Firms are defined large if their real assets are in the upper 20%. The data distinguishes firms into ten groups on the basis of credit score, which has equivalent rating standards to that of S&P credit ratings. Firms whose average credit score in the pre-crisis period (between 2001 and 2006) is in the upper 20%, which is equivalent to A and above in S&P credit ratings, are defined

¹²Industry classification and the list of industry are described in Appendix A.



Figure 4: Debt financing structure by firm characteristics

as high credit score firms. For foreign ownership classification, I follow Kim (2016), which uses the same data. Since foreign ownership information is available only until 2003, firms that are ever foreign owned until 2003 are defined as foreign-owned firms.

Figure 4 confirms that bank credit is the largest source of debt financing for the vast majority of firms. Non-listed firms, SMEs, domestic-owned, and low credit score firms rely much on bank credit, around 25-30% of total assets, indicating that firms with limited access to financial markets are more bank-dependent. They also generally use more trade credit than their counterparts, but the gap in trade credit between the two groups of firms is much smaller than in bank credit; large firms use slightly more trade credit than SMEs do, whereas high credit score firms on average use more trade credit than bank credit. In other words, firms with better access to financial markets still use trade credit to a considerable extent, despite the view that trade credit is only preferred by firms left with little alternative options of funding. As expected, the share of bond is much higher for publicly-listed, large, and foreign-owned firms.

Table 2 presents the summary statistics of the main variables based on a balanced panel. For comparison, in the left panel I first present statistics for the full sample, and then split the sample into large firms and SMEs, representing firms with better financial access and those not, respectively. The number of observations indicates that the full sample consists of a lot of small firms. Debt variables are normalized by firm's total assets. Information on

Table 2: Summary statistics of the main variables

Variable	Full sample			Large firms			SMEs		
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
<i>A. Dependent variable</i>									
Real sales growth (%)	13.43	7.27	36.36	9.85	5.61	31.18	14.71	8.06	37.96
<i>B. Debt variables</i>									
Bank credit (%)	25.33	23.15	20.61	19.18	15.45	18.09	27.53	26.61	21.01
ST bank credit (%)	16.46	12.19	16.39	13.79	9.55	14.54	17.42	13.33	16.90
LT bank credit (%)	8.87	2.66	12.93	5.38	1.01	9.38	10.12	3.84	13.77
KR bank credit (%)	23.11	19.96	19.96	16.07	11.35	16.67	25.63	23.90	20.43
FX bank credit (%)	2.22	0.00	6.56	3.11	0.00	7.09	1.90	0.00	6.32
Trade credit (%)	13.20	9.38	13.38	12.02	8.19	12.69	13.63	9.85	13.59
ST trade credit (%)	13.19	9.36	13.37	12.00	8.17	12.68	13.61	9.84	13.58
LT trade credit (%)	0.02	0.00	0.51	0.02	0.00	0.43	0.01	0.00	0.53
KR trade credit (%)	4.91	0.00	10.23	3.41	0.21	8.04	5.44	0.00	10.85
FX trade credit (%)	8.29	3.29	11.91	8.59	4.53	11.50	8.18	2.68	12.05
Bond(%)	1.24	0.00	4.71	2.94	0.00	6.99	0.63	0.00	3.35
ST bond (%)	0.41	0.00	2.37	1.05	0.00	3.38	0.18	0.00	1.83
LT bond (%)	0.83	0.00	3.64	1.89	0.00	5.23	0.45	0.00	2.76
<i>C. Other covariates</i>									
Age	17.34	14.00	11.62	24.50	22.00	13.96	14.77	12.00	9.42
Real assets	23.65	23.45	1.40	25.44	25.12	1.12	23.01	23.09	0.81
Return on sales (%)	5.71	5.02	21.94	6.97	5.66	16.29	5.25	4.85	23.61
Export/sales (%)	4.04	0.00	15.21	7.41	0.00	20.50	2.84	0.00	12.58
Observations	73323			19311			54012		

Notes: The statistics are based on a balanced panel used for panel regressions in Section 5. All variables are in real term. All debt variables are presented as a share of total assets. Real assets are in billion 2001 Korean won. Return on sales is the ratio of operating income to net sales. Export ratio is sales from export divided by total gross sales. All debt variables are presented as a share of total assets. ST refers to short-term debt due within the next twelve months, and FX refers to debt denominated in foreign currency.

the maturity composition is available for bank credit, trade credit, and bond, while that of currency composition is available for bank credit and trade credit. On average, bank credit is often with short-term maturity and denominated in local currency. Almost all trade credit is used as a mean of short-term financing, while the share of foreign currency denominated trade credit is larger than that in Korean won. For the full sample, the share of bond is considerably small, indicating that only a small share of firms have access to bond markets. About two-thirds of bond has long-term maturity.

Moving on to the comparison between large firms and SMEs, SMEs depend more on bank credit (27.53%) than large firms do (19.18%). Nonetheless, the share of foreign currency denominated bank credit is higher for large firms, suggesting that the degree of financial access matters to the use of foreign debt. In contrast to bank credit, the share of trade credit in large firms' balance sheet (12.02%) is much closer to that of SMEs (13.63%). Similar to bank credit, large firms also have a higher share of foreign currency denominated trade credit than SMEs. Meanwhile, the size of bond financing by large firms (2.94%) is almost five times as high as that by SMEs (0.63%).

4 Empirical strategy

To examine the relationship between debt financing and sales growth during the GFC, I use two empirical approaches; cross-sectional regressions and panel regressions. The former allows to study the cross-sectional variation during the crisis associated with informative time-invariant firm characteristics, whereas the latter focuses on the within-firm variation over time, controlling for unobserved factors across firms and years that are related to sales performance. Results can be considered robust if both approaches indicate the same direction.

In cross-sectional regressions, I express sales growth between 2007 and 2009 as a function of debt financing and other firm characteristics in the pre-crisis period. The general regression model has the following form:

$$\Delta S_{i,07-09} = \alpha + \beta_1 \Delta S_{i,06-07} + \beta_2 BC_{i,06} + \beta_3 TC_{i,06} + \beta_4 B_{i,06} + \beta_5 R_{i,06} + X_{i,06}'\gamma + \psi_j + \varepsilon_i \quad (1)$$

in which $\Delta S_{i,07-09}$ represents the percent change in real sales of firm i between 2007 and 2009. $\Delta S_{i,06-07}$ is sales growth between 2006 and 2007, which accounts for a serial correlation in sales growth. $BC_{i,06}$, $TC_{i,06}$, $B_{i,06}$, $R_{i,06}$ are bank credit, trade credit, bond

and the rest of liabilities, respectively, as a share of total assets in 2006.¹³ $X_{i,06}$ is the vector of firm characteristics, and it includes chaebol dummy, age, size, return on sales, and export ratio in 2006. ψ_j is two-digit KSIC-9 level industry dummies and ε_i is an idiosyncratic error.

As lending standards tighten and the supply of liquidity reduces, firms more dependent on debt are expected to be more negatively affected during the crisis. The analysis focuses on the coefficients on bank credit, trade credit, and bond to identify which of three primary types of debt financing is most vulnerable or resilient to the crisis. Breakdown of the financial system in developed economies and the collapse of international trade during the GFC suggest that the dependence on bank credit and trade credit would be more negatively associated with firm's performance than that on bonds.

Firm characteristics in $X_{i,06}$ are standard determinants of firm's sales growth identified in the literature. Chaebol is a dummy which takes value one if a firm is a member of Korea's top 30 business conglomerates. Age is the number of years since establishment, and size is measured by the logarithm of real assets. Return on sales, which proxies for firm's profitability, is the ratio of operating income to net sales. Export ratio is the share of export sales to total sales, and aims to account for the reduction in global demand during the crisis.

Chaebol dummy is expected to be positively correlated with sales growth since conglomerates are financially well developed, have a better relationship with financial institutions, and can support financially distressed members within their network. Previous studies suggest that firm age is expected to be inversely related to sales growth,¹⁴ but evidence on the relationship between firm size and sales growth is mixed. Return on sales is included to account for firm's ability to issue bonds, as not all firms are able to raise finance through bonds. The sign of coefficient on export ratio can be either positive or negative. If exporters are more productive firms, as predicted by the Melitz model, the expected sign is positive. On the other hand, if the crisis hit exporters particularly hard, then higher export ratio can be negatively linked to sales growth.

Meanwhile, a panel fixed effect regression model has the following general form:

$$\begin{aligned} \Delta S_{i,t} = & \alpha + \beta_1 BC_{i,t-1} + \beta_2 TC_{i,t-1} + \beta_3 B_{i,t-1} + \beta_4 R_{i,t-1} \\ & + \beta_5 BC_{i,t-1} \cdot C_t + \beta_6 TC_{i,t-1} \cdot C_t + \beta_7 B_{i,t-1} \cdot C_t + \beta_8 R_{i,t-1} \cdot C_t + X_{i,t-1}'\gamma + \delta_i + \eta_t + \varepsilon_{i,t} \end{aligned} \quad (2)$$

in which $BC_{i,t-1}$, $TC_{i,t-1}$, $B_{i,t-1}$, $R_{i,t-1}$ represent bank credit, trade credit, bonds, and

¹³As Table 1 demonstrates, total assets are the sum of total liabilities and equity.

¹⁴See, for example, Variyam and Kraybill (1992).

the rest of liabilities as a share of total assets, respectively. To account for the contemporaneous endogeneity concerns, all explanatory variables are one-year lagged. C_t is crisis dummy which takes value one if year is 2008 or 2009. Interaction terms between debt variables and crisis dummy would reveal the responsiveness of each type of debt financing to the crisis in terms of its impact on sales growth. Firm fixed effects (δ_i) and year fixed effects (η_t) are expected to capture unobserved time-invariant firm specific effects and year specific effects. Standard errors are clustered at the firm level to allow for correlation in sales growth of a firm.

5 Regression results

5.1 The effect of debt finance during the crisis

I begin with a cross-sectional regression model (1) in which the dependent variable is sales growth between 2007 and 2009. Column (1) of Table 3 starts with leverage ratio as a measure of dependence on debt financing, then column (2) distinguishes debt into four types, and columns (3) and (4) further decompose debt by maturity and currency denomination, respectively.

In all columns, firm age, size, and return on sales show negative and statistically significant coefficients, suggesting that older, bigger, and more profitable firms had slower sales growth during the crisis. The positive coefficient on chaebol status indicate that firms who are a member of Korean business conglomerates nonetheless performed better than others. These relationships are similarly documented in previous studies on Korean firms.¹⁵

Firms with higher export ratio also had faster sales growth than others during the crisis. There are two potential explanations on this result. On the one hand, the positive effect of export may suggest that the impact of trade collapse is not effectively captured in this regression since export of Korean firms drastically declined only in the second half of 2008, and it soon started to recover in 2009.¹⁶ When I separate the demand shock by focusing on sales growth between 2008 and 2009 in Table A2, the sign of the coefficient for export ratio becomes negative, although it is not statistically significant. On the other hand, given the small share of exporters in the full sample, it may also indicate that in a cross-sectional setting exporters are more productive firms and hence show better performance.

Now I turn to debt variables, which are the main variables of interest. The coefficient

¹⁵For example, Kim et al. (2015) find that the change in net worth of Korean listed firms during the Asian crisis is negatively related to firm's age and size, while it is positively related to a chaebol status.

¹⁶Bricongne et al. (2012) also point out that annual data would miss the dynamics of the trade collapse between the third quarter of 2008 and the first quarter of 2009.

Table 3: Effects of debt financing: cross-sectional estimation

	(1)	(2)	(3)	(4)
Leverage		Baseline	Maturity	Currency
Sales growth (06-07)	0.057** (0.023)	0.052** (0.023)	0.052** (0.024)	0.052** (0.023)
Chaebol	0.205*** (0.035)	0.196*** (0.035)	0.195*** (0.035)	0.196*** (0.035)
Age	-0.004*** (0.001)	-0.004*** (0.001)	-0.004*** (0.001)	-0.004*** (0.001)
Size	-0.112*** (0.010)	-0.121*** (0.011)	-0.121*** (0.011)	-0.121*** (0.011)
Return on sales	-0.178* (0.091)	-0.177* (0.091)	-0.177* (0.091)	-0.177* (0.091)
Export/sales	0.082** (0.041)	0.084** (0.041)	0.085** (0.041)	0.085** (0.041)
Leverage	-0.118*** (0.042)	Bank credit -0.108** (0.047)	ST bank credit -0.111** (0.053) LT bank credit -0.104 (0.067)	KR bank credit -0.108** (0.048) FX bank credit -0.113 (0.103)
		Trade credit -0.355*** (0.066)	ST trade credit -0.352*** (0.067) LT trade credit -1.949** (0.906)	KR trade credit -0.387*** (0.127) FX trade credit -0.350*** (0.068)
		Bond 0.789*** (0.265)	ST bond 0.826 (0.689) LT bond 0.773** (0.324)	Bond 0.789*** (0.265)
		Rest 0.040 (0.098)	0.040 (0.098)	0.040 (0.098)
Observations	12030	12030	12030	12030
R^2	0.075	0.079	0.079	0.079

Notes: The dependent variable is sales growth between 2007 and 2009. The explanatory variables are for year 2006. All debt variables are presented as a share of total assets. Leverage is defined as a share of total liabilities to total assets. KR refers to credit denominated in Korean won, and FX refers to credit denominated in foreign currency. All regressions include industry dummies at the two-digit level. Robust standard errors are in parentheses. *, **, and *** denote a p-value less than 10%, 5%, and 1%, respectively.

for leverage ratio in column (1) is negative and statistically significant at the 1% level, suggesting that firms who used more debt to finance their assets in 2006 had slower sales growth between 2007 and 2009. Column (2) then shows which type of debt finance plays a dominant role in the negative relationship between leverage and sales performance. Both bank credit and trade credit show negative coefficients that are statistically significant. All else equal, firms who were more dependent on bank borrowings and trade credit in 2006 were more negatively affected during the crisis in terms of their sales performance. The magnitude of the negative coefficient on trade credit (-0.355) is more than a triple of that on bank credit (-0.108), which also suggests that among three types of debt financing trade credit played a critical role for sales drop between 2007 and 2009. The significant and positive coefficient on bond confirms the view that bond is the most resilient form of debt finance to a financial crisis; a one percentage point increase in the share of bond in the balance sheet is associated with an increase in sales growth of 0.78 percentage point during the crisis.

In column (3), I distinguish debt variables by maturity. For bank credit, only short-term maturity debt shows a negative and statistically significant coefficient, implying that banks refused to rollover short-term loans during the crisis, and thus firms who relied more on short-term bank credit had a larger sales decline, compared to those who used more long-term loans. Trade credit, however, shows a negative coefficient irrespective of maturity. Note that the vast majority of trade credit is short-term credit by nature, and only a very few firms hold long-term trade credit.¹⁷ Nonetheless, higher use of long-term trade credit is also associated with larger decline in sales growth. Meanwhile, the positive correlation between bonds and sales performance prominently comes from the use of long-term bonds.

When I decompose bank credit and trade credit by currency denomination in column (4), there is a clear difference between the two types of debt financing; while foreign trade credit shows a negative coefficient that is statistically significant at the 1% level, there is no evidence that foreign currency denominated bank credit is related to sales growth during the crisis. Therefore, the estimation suggests that foreign debt is associated with sales growth mainly through trade credit rather than bank credit.

Next, I run a panel regression model (2) to investigate whether these findings hold when I control time-invariant firm characteristics as well as year-specific shocks in the specification. To compare with the estimates in Table 3, I focus on the interaction terms between firm liabilities and crisis dummy to interpret the result. Column (1) of Table 4 starts with leverage ratio. There is a negative effect of leverage during the crisis, which reduces the usual positive correlation between leverage and sales performance. Column

¹⁷In 2006, 11 firms had a positive share in long-term trade credit. In a panel setting, the average share of long-term trade credit out of total trade credit is 29% among those who hold long-term trade credit.

Table 4: Effects of debt financing: within-firm estimation

	(1)	(2)	(3)	(4)
	Leverage	Baseline	Maturity	Currency
Size	-0.208*** (0.007)	-0.218*** (0.007)	-0.219*** (0.007)	-0.217*** (0.007)
Age	0.013*** (0.001)	0.013*** (0.001)	0.014*** (0.001)	0.013*** (0.001)
Return on sales	-0.319*** (0.048)	-0.310*** (0.047)	-0.310*** (0.047)	-0.309*** (0.047)
Export/sales	-0.011 (0.014)	-0.006 (0.014)	-0.005 (0.014)	-0.006 (0.014)
Leverage	0.341*** (0.020)	Bank credit 0.429*** (0.022)	ST bank credit 0.386*** (0.024)	KR bank credit 0.440*** (0.022)
Lev. \times Crisis	-0.051*** (0.014)	BC \times Crisis -0.055*** (0.016)	ST BC \times Crisis -0.060*** (0.019)	KR BC \times Crisis -0.053*** (0.017)
			LT bank credit 0.495*** (0.027)	FX bank credit 0.327*** (0.036)
			LT BC \times Crisis -0.033 (0.027)	FX BC \times Crisis -0.042 (0.046)
		Trade credit 0.187*** (0.029)	ST trade credit 0.190*** (0.029)	KR trade credit 0.182*** (0.030)
		TC \times Crisis -0.074*** (0.022)	ST TC \times Crisis -0.072*** (0.022)	KR TC \times Crisis 0.006 (0.061)
			LT trade credit -0.092 (0.323)	FX trade credit 0.190*** (0.030)
			LT TC \times Crisis -0.768 (0.548)	FX TC \times Crisis -0.086*** (0.023)
		Bond 0.445*** (0.056)	ST bond 0.521*** (0.095)	Bond 0.446*** (0.056)
		B \times Crisis -0.106 (0.073)	ST B \times Crisis -0.293** (0.141)	B \times Crisis -0.107 (0.073)
			LT bond 0.414*** (0.066)	
			LT B \times Crisis -0.001 (0.102)	
		Rest 0.193*** (0.031)		
		Rest \times Crisis -0.011 (0.027)		
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	73323	73323	73323	73323
Number of firms	8683	8683	8683	8683
R^2	0.091	0.094	0.095	0.095

Notes: The dependent variable is annual sales growth. The explanatory variables are one-year lagged. Crisis is a dummy for years 2008 and 2009. All regressions include firm and year fixed effects. Robust standard errors, clustered at firm-level, are in parentheses. *, **, and *** denote a p-value less than 10%, 5%, and 1%, respectively.

(2) then shows that all types of debt variables are positively associated with sales growth in normal times. During the crisis, however, only bank credit and trade credit show a significant negative coefficient. Furthermore, the negative effect associated with the use of trade credit (-0.074) is larger than that of bank credit (-0.055), confirming that trade credit is the most vulnerable type of debt financing to the crisis. Bonds and the rest of liabilities, however, do not affect sales growth in a significantly different manner during the crisis from what they do in normal times.

Moving to column (3), the estimation shows that higher share of short-term bank credit, trade credit and bond are associated with slower sales growth during the crisis. Therefore, the result supports the vulnerability of short-term maturity debt found in Table 3. Lastly, column (4) shows that in normal times both debt in Korean won and foreign currency are positively associated with sales growth, but the positive correlation significantly decreases for bank credit in Korean won and for trade credit in foreign currency during the crisis.

To summarize, two different regression approaches provide the following consistent results on the role of different types of debt financing during the crisis; 1) trade credit, especially foreign currency denominated, is most negatively related to sales growth, 2) the negative relationship between bank credit and sales performance is prominent from short-term bank credit, mostly in Korean won, and 3) bond generally remains to be positively related to sales performance, although the marginal effect of short-term bond decreases during the crisis.

Regarding the relationship between bank credit and trade credit, the literature on the bank lending channel has shown that trade credit serves as a substitute for reduced bank lending during periods of monetary tightening (Meltzer (1960); Nilsen (2002); Mateut and Mizen (2003)). However, my findings suggest that first, this may not necessarily be the case during a financial crisis since trade credit, mostly consists of short-term credit, is more responsive to the crisis than bank credit is, and secondly, the positive role of trade credit may depend on firm's ability to replace bank credit with trade credit during the crisis rather than firm's pre-crisis use of trade credit itself. The similar argument is made in Coulibaly et al. (2013) who show that during the crisis firms that were able to substitute away from external finance to trade credit had better performance, while the reverse did not hold. Therefore, trade credit may serve as an important substitute of bank credit if a firm has ability to do so, but reduced availability of trade credit seems hard to be offset by drawing on other sources of financing, suggesting the vulnerability of trade credit as a form of financing lower down in the pecking order.

5.2 The role of firm characteristics

5.2.1 Firm's degree of financial access

As substitutability between funds depends on the access to financial markets, a natural follow-up question is whether the relationship between debt financing and sales growth during the crisis varies with firm's degree of financial access. If firms can alternate the mean of funding, a negative supply shock to a certain form of debt financing may not severely affect funding of those firms. On the other hand, even though firms have better access to financing, if they are more exposed to a vulnerable type of debt or debt which is hard to substituted, the performance of those firms may still be influenced during the crisis.

Table 5: Role of firm characteristics: cross-sectional estimation

	(1)	(2)	(3)	(4)	(5)
	Full sample	Listed	Large	Foreign	High
Sales growth (06-07)	0.052** (0.023)	-0.177** (0.088)	-0.027 (0.043)	-0.111 (0.082)	0.008 (0.059)
Chaebol	0.195*** (0.035)	0.295*** (0.091)	0.009 (0.039)	0.199*** (0.061)	0.297*** (0.079)
Age	-0.004*** (0.001)	-0.004** (0.001)	-0.005*** (0.001)	-0.002 (0.001)	-0.003* (0.002)
Size	-0.121*** (0.011)	-0.098** (0.046)	0.026 (0.022)	-0.084* (0.045)	-0.092*** (0.030)
Return on sales	-0.177* (0.091)	-0.676** (0.278)	-0.380* (0.201)	-0.273 (0.216)	-0.022*** (0.004)
Export/sales	0.088** (0.041)	0.117 (0.081)	0.036 (0.042)	0.202*** (0.074)	0.063 (0.069)
Bank credit	-0.108** (0.047)	0.022 (0.173)	0.137 (0.122)	-0.027 (0.152)	0.220 (0.365)
Trade credit	-0.355*** (0.066)	-1.083*** (0.335)	-0.332*** (0.107)	-1.214*** (0.347)	0.254 (0.270)
Bond	0.789*** (0.265)	-0.005 (0.345)	0.089 (0.336)	-0.306 (0.196)	0.306 (0.407)
Observations	12030	1056	2541	979	2332
R^2	0.079	0.161	0.064	0.149	0.063

Notes: The dependent variable is sales growth between 2007 and 2009. The explanatory variables are for year 2006. Firms are defined listed firms if it is publicly-listed at a given year. Firms with real asset in 2006 is in the upper 20% are defined as large firms. Firms that ever had foreign ownership until 2003 are defined as foreign owned firms. Firms with average credit score between 2001 and 2006 is in the upper 20%, which is equivalent to having A or above in S&P credit ratings, are defined as high credit score firms. All regressions include industry dummies at the two-digit level. Robust standard errors are in parentheses. *, **, and *** denote a p-value less than 10%, 5%, and 1%, respectively.

To test this, I compare the effect of debt financing on firms with different characteristics. Following the literature, I use market listing, firm size, foreign ownership, and credit score

as a proxy for financial access.¹⁸ In Table 5, I run separate cross-sectional regressions for firms that are considered to have better financial access – publicly-listed, large, foreign-owned, and high credit score firms – in columns (2)-(5), and compare the estimations to that of the full sample in column (1), which serves as a benchmark. If the results are significantly different from each other, it would suggest that firm’s degree of financial access plays an important role in the effect of debt financing on sales during the crisis.

The estimated coefficients on bank credit in columns (2)-(5) are not statistically significant, indicating that sales growth between 2007 and 2009 is not related to the use of bank credit in 2006 if a firm has better access to external financing. Therefore, it is mostly firms with limited financial access who are negatively affected by risk averse banks during the crisis. This finding is consistent with those in previous studies on credit constraints and a financial crisis (Campello et al. (2010); Judge and Korzhenskaya (2012); Claessens and Kose (2013)).

The pre-crisis share of trade credit, however, continues to show a negative and statistically significant coefficient in all columns except for firms with high credit score. In fact, trade credit is the only form of debt finance that is negatively associated with sales growth of firms with better financial access. This suggests that the mechanism through which trade credit affects firm’s sales is different from that of bank credit and bond. While better access to financial markets may help firms deal with contracted bank lending, a negative shock in inter-firm financing seems more universally affects firms’ sales performance, irrespective of the degree of financial access faced by firms.

I repeat the analysis using the panel data in Table 6. The interpretation focuses on the interaction terms between debt financing variables and crisis dummy. In normal times, sales growth of most firms in the data benefits from the use of bank credit and bonds, whereas only sales performance of firms with limited financial access is positively related to trade credit. During the crisis, the effect seems to be reversed. Consistent with the results in Table 5, firms that relied more on bank credit had slower sales growth only when they had limited financial access (columns (2), (4), (6), and (8)). The effect of trade credit on sales performance looks different from that of bank credit. Trade credit shows a negative and statistically significant coefficient for all firms, except for those with high creditworthiness in column (7). Therefore, it indicates that neither bank credit nor trade credit is negatively associated with sales performance during the crisis, if firms have high credit score. This result also suggests that listed, large, and foreign-owned firms may not necessarily be financially stable firms, and firm’s degree of financial access may not be the only factor that explains the negative effect of inter-firm financing in times of financial

¹⁸The definitions of the measures are described in Section 3.2.

Table 6: Role of firm characteristics: within-firm estimation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Stock exchange		Size		Ownership		Credit score	
	Listed	Non-listed	Large	SMEs	Foreign	Domestic	High	Low
Bank credit	0.186*** (0.061)	0.449*** (0.024)	0.312*** (0.041)	0.472*** (0.026)	0.183*** (0.060)	0.454*** (0.023)	0.420*** (0.061)	0.436*** (0.024)
BC × Crisis	-0.040 (0.057)	-0.060*** (0.017)	-0.034 (0.032)	-0.069*** (0.019)	-0.075 (0.060)	-0.051*** (0.017)	-0.038 (0.052)	-0.075*** (0.023)
Trade credit	0.060 (0.101)	0.198*** (0.030)	0.118** (0.059)	0.208*** (0.033)	0.104 (0.114)	0.204*** (0.030)	0.259*** (0.065)	0.180*** (0.033)
TC × Crisis	-0.270*** (0.085)	-0.068*** (0.023)	-0.174*** (0.037)	-0.056** (0.026)	-0.369*** (0.082)	-0.057** (0.023)	0.050 (0.064)	-0.107*** (0.027)
Bond	0.402*** (0.116)	0.440*** (0.062)	0.308*** (0.062)	0.566*** (0.090)	0.367*** (0.109)	0.459*** (0.065)	0.252* (0.143)	0.471*** (0.061)
Bond × Crisis	0.061 (0.127)	-0.199** (0.084)	-0.042 (0.069)	-0.187 (0.165)	-0.113 (0.105)	-0.115 (0.104)	-0.330* (0.186)	-0.086 (0.081)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8614	64709	19311	54012	7986	65337	17068	56255
Number of firms	1190	7906	3002	7000	942	7741	1994	6689
R^2	0.068	0.092	0.074	0.101	0.078	0.097	0.129	0.089

Notes: The dependent variable is firm's annual sales growth. The explanatory variables are one-year lagged. Firms with real asset is in the upper 20% are defined as large firms. Firms that ever had foreign ownership until 2003 are defined as foreign owned firms. Firms are defined high credit score firms if their average credit score between 2001 and 2006 is in the upper 20%. Robust standard errors, clustered at firm-level, are in parentheses. *, **, and *** denote a p-value less than 10%, 5%, and 1%, respectively.

distress.

Table 7: Role of firm characteristics: decomposition by maturity and currency

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Stock exchange		Size		Ownership		Credit score	
<i>Panel A. Maturity</i>	Listed	Non-listed	Large	SMEs	Foreign	Domestic	High	Low
ST BC \times Crisis	0.028 (0.064)	-0.070*** (0.021)	-0.070* (0.038)	-0.077*** (0.023)	0.009 (0.067)	-0.062*** (0.020)	-0.041 (0.073)	-0.079*** (0.025)
LT BC \times Crisis	-0.183 (0.150)	-0.034 (0.028)	0.055 (0.076)	-0.042 (0.029)	-0.294* (0.154)	-0.021 (0.028)	-0.032 (0.090)	-0.055* (0.032)
ST TC \times Crisis	-0.270*** (0.084)	-0.066*** (0.023)	-0.168*** (0.037)	-0.055** (0.026)	-0.370*** (0.082)	-0.055** (0.023)	0.048 (0.064)	-0.105*** (0.026)
LT TC \times Crisis	-12.936*** (2.942)	-0.739 (0.551)	-1.496 (1.126)	-0.802 (1.111)	-1.038 (0.844)	-0.745 (0.572)	0.647 (1.383)	-0.928* (0.547)
R^2	0.070	0.093	0.075	0.101	0.080	0.097	0.130	0.089
<i>Panel B. Currency</i>								
KR BC \times Crisis	-0.088 (0.068)	-0.057*** (0.018)	-0.048 (0.035)	-0.062*** (0.019)	-0.108 (0.072)	-0.048*** (0.018)	-0.002 (0.058)	-0.075*** (0.023)
FX BC \times Crisis	0.156 (0.121)	-0.074 (0.050)	0.065 (0.071)	-0.133** (0.055)	0.082 (0.123)	-0.055 (0.050)	-0.244** (0.124)	-0.042 (0.052)
KR TC \times Crisis	0.037 (0.267)	0.006 (0.062)	-0.037 (0.116)	-0.012 (0.069)	-0.171 (0.287)	0.015 (0.062)	0.271* (0.164)	-0.082 (0.065)
FX TC \times Crisis	-0.285*** (0.088)	-0.079*** (0.024)	-0.183*** (0.040)	-0.058** (0.028)	-0.388*** (0.083)	-0.068*** (0.024)	-0.024 (0.064)	-0.107*** (0.028)
R^2	0.070	0.092	0.074	0.101	0.080	0.097	0.130	0.089
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8614	64709	19311	54012	7986	65337	17068	56255
Number of firms	1190	7906	3002	7000	942	7741	1994	6689

Notes: The dependent variable is firm's annual sales growth. The explanatory variables are one-year lagged. Robust standard errors, clustered at firm-level, are in parentheses. *, **, and *** denote a p-value less than 10%, 5%, and 1%, respectively.

The magnitude of the negative coefficient on trade credit interaction is larger than that of bank credit in most columns, showing that trade credit was more responsive to the crisis than bank credit. Meanwhile, neither the coefficient on bond nor the coefficient on the bond interaction term shows a significant difference between the two groups of firms.

Then in Table 7, I decompose bank credit and trade credit by maturity (panel A) and currency denomination (panel B). I only report the crisis interaction terms in Table 7. The estimations generally confirm the findings so far. The negative effect of bank credit is mostly driven by short-term credit, and firms with limited financial access experience higher rollover risk, compared to their counterparts. Short-term trade credit, on the other hand, is negatively associated with sales growth of all types of firms, except for high credit score firms. A new finding regarding trade credit in Table 7 is that not only short-term but

also long-term trade credit is negatively related to firms' sales growth during the crisis, as shown in columns (1) and (3) of panel A.

In panel B, the negative coefficient on interaction between crisis dummy and foreign currency denominated trade credit confirms that balance sheet effect presents primarily through trade credit. Additionally, columns (2), (4), and (6) provide some evidence that higher exposure to foreign currency denominated bank credit is also related to slower sales growth during the crisis, if firms are non-listed, small, and with high credit ratings.

5.2.2 Heterogeneous effect of trade credit

Since trade credit shows a robust and consistent negative coefficient in a number of different specifications, I further examine whether there is a heterogeneous effect of trade credit which depends on firm characteristics. In Table 8, I interact debt variables with four different financial access dummy variables in cross-sectional regressions. Dummy variable takes value one if firms are listed, large, foreign-owned, or have high credit ratings. Since trade credit is the credit extended by suppliers, firms' use of trade credit can be more industry-sensitive than other types of debt financing, therefore I consider the manufacturing industry separately. Columns (1)-(4) use the full sample, and columns (5)-(8) use manufacturing firms.

Table 8: Heterogeneous effect of trade credit: cross-sectional estimation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Full sample				Manufacturing industry			
	Listed	Large	Foreign	Score	Listed	Large	Foreign	Score
Bank credit	-0.088*	-0.111**	-0.082*	-0.172***	-0.261***	-0.235***	-0.270***	-0.367***
	(0.048)	(0.050)	(0.048)	(0.058)	(0.060)	(0.064)	(0.060)	(0.076)
BC × FA	0.127	0.190	-0.006	0.000	0.272	-0.067	0.135	0.049
	(0.167)	(0.129)	(0.153)	(0.216)	(0.189)	(0.094)	(0.150)	(0.312)
Trade credit	-0.313***	-0.346***	-0.308***	-0.403***	-0.587***	-0.586***	-0.595***	-0.714***
	(0.069)	(0.077)	(0.068)	(0.074)	(0.118)	(0.131)	(0.117)	(0.127)
TC × FA	-0.379*	-0.092	-0.586***	-0.113	-0.342	-0.333**	-0.578***	-0.040
	(0.199)	(0.109)	(0.208)	(0.214)	(0.224)	(0.165)	(0.210)	(0.397)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12030	12030	12030	12030	6951	6951	6951	6951
R ²	0.082	0.088	0.082	0.080	0.103	0.110	0.102	0.099

Notes: The dependent variable is sales growth between 2007 and 2009. The explanatory variables are for year 2006. FA refers to financial access dummy, which is specified in each column. All regressions using the full sample include industry dummies at the two-digit level. Robust standard errors are in parentheses. *, **, and *** denote a p-value less than 10%, 5%, and 1%, respectively.

In both samples, there is evidence of the heterogeneous effect of trade credit. Columns (1) and (3) show that the negative relationship between trade credit and sales growth is

larger for listed and foreign-owned firms in the full sample. For bank credit, I do not find a consistent heterogeneous effect across different types of firms. The heterogeneous effect is more pronounced for manufacturing firms; trade credit interaction with large and foreign-owned dummy in columns (6) and (7) shows a negative coefficient that is statistically significant at the 5% and 1% level, respectively. The coefficient on the interaction with listed firm dummy shows a negative sign in both samples, although it is weakly significant or not significant.

The exception is high credit score firms in columns (4) and (8). The positive coefficient on the trade credit interaction term means that sales performance of firms with high credit score in fact is less negatively correlated with their pre-crisis use of trade credit, which is consistent with the results in Table 5 and 6. This indicates that there are unobserved firm characteristics that further distinguish listed, large, foreign-owned firms from high credit score firms in terms of their use of trade credit.

Table 9: Heterogeneous effect of trade credit: within-firm estimation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Listed	Large	Foreign	Score	Listed	Large	Foreign	Score
Bank credit	0.442*** (0.023)	0.437*** (0.024)	0.450*** (0.023)	0.413*** (0.023)	0.435*** (0.023)	0.430*** (0.024)	0.442*** (0.023)	0.409*** (0.024)
BC × Crisis	-0.059*** (0.017)	-0.065*** (0.019)	-0.051*** (0.017)	-0.072*** (0.022)	-0.041** (0.018)	-0.047** (0.019)	-0.034* (0.018)	-0.055** (0.022)
BC × FA	-0.157*** (0.060)	-0.035 (0.036)	-0.249*** (0.064)	-0.026 (0.045)	-0.008 (0.024)	-0.041 (0.035)	-0.237*** (0.063)	-0.048 (0.044)
BC × Crisis × FA	0.017 (0.062)	0.039 (0.038)	-0.030 (0.063)	0.010 (0.070)	-0.008 (0.061)	0.027 (0.037)	-0.064 (0.063)	-0.009 (0.070)
Trade credit	0.196*** (0.030)	0.195*** (0.031)	0.201*** (0.030)	0.170*** (0.030)	0.184*** (0.030)	0.186*** (0.031)	0.187*** (0.030)	0.160*** (0.030)
TC × Crisis	-0.067*** (0.023)	-0.051* (0.026)	-0.058** (0.023)	-0.091*** (0.026)	-0.043* (0.024)	-0.026 (0.028)	-0.034 (0.025)	-0.062** (0.028)
TC × FA	-0.066 (0.094)	-0.052 (0.044)	-0.103 (0.117)	0.101** (0.051)	-0.124 (0.092)	-0.082* (0.044)	-0.132 (0.115)	0.069 (0.051)
TC × Crisis × FA	-0.210** (0.089)	-0.098** (0.045)	-0.303*** (0.085)	0.014 (0.078)	-0.122 (0.087)	-0.090** (0.044)	-0.237*** (0.085)	0.017 (0.080)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	No	No	No	No
Industry × year FE	No	No	No	No	Yes	Yes	Yes	Yes
Observations	73323	73323	73323	73323	73323	73323	73323	73323
Number of firms	8683	8683	8683	8683	8683	8683	8683	8683
R ²	0.095	0.095	0.095	0.095	0.122	0.123	0.123	0.122

Notes: The dependent variable is firm's annual sales growth. The explanatory variables are one-year lagged. FA refers to financial access dummy, which is specified in each column. Foreign ownership dummy is time-invariant, therefore subsumed by firm fixed effect. Robust standard errors, clustered at firm-level, are in parentheses. *, **, and *** denote a p-value less than 10%, 5%, and 1%, respectively.

Within-firm estimation in Table 9 shows the consistent results. In the first four columns I use firm and year fixed effects, and in the last four columns I use firm and industry-year fixed effects to account for industry-specific demand changes during the crisis. The triple interaction of crisis dummy, trade credit, and financial access dummy shows a negative and statistically significant coefficient only for large and foreign-owned firms. The results remain qualitatively the same when I replace year fixed effects with industry-year fixed effects in columns (5)-(8). Since firm size and credit score can be presented as a continuous variable by year, I further interact debt variables with firm size and credit score in Table A3, and find consistent results; the negative effect of trade credit during the crisis increases for larger firms, but it is not the case for firms with high credit score.¹⁹

5.2.3 Explanation on the effect of trade credit

The previous section shows that the negative correlation between trade credit and sales growth during the crisis tends to be larger for firms with better financial access, specifically for large and foreign-owned firms. This finding initially seems counterintuitive since it means that firms that face reduced availability of trade credit during the crisis experience slower sales growth even if they have better access to other sources of financing. This is not the case with bank credit. There can be several potential explanations on why inter-firm financing is more negatively associated with sales performance of firms with better financial access during a crisis. The main difference between bank credit and trade credit is that trade credit involves other firms as financial intermediaries, therefore in this section I investigate a potential explanation on the heterogeneous effect of trade credit based on the literature on trade credit contracts between firms.

By empirically studying firms' choice of trade credit, Klapper et al. (2012), Gonçalves et al. (2018), and Ellingsen et al. (2016) argue that in normal times small firms with low bargaining power tend to supply more trade credit as well as longer credit periods to their large customers who enjoy monopolistic rents. Therefore, the larger negative effect of trade credit during the crisis for seemingly bigger and financially better connected firms could be associated with bargaining power these firms may have, in relation to their suppliers.

To investigate whether firm's bargaining power indeed provides any explanation on the relationship between trade credit and sales performance, I split the sample into two subgroups on the basis of market concentration. The idea is that financially better connected firms in more concentrated market could have higher bargaining power compared to their suppliers.²⁰ I define firms in more concentrated markets and firms in unconcen-

¹⁹For the sake of interpretation, I convert KIS credit score to 1-10 scale in which 10 represents the highest credit score. In the original data, 1 is the highest credit score.

²⁰Although bargaining power and market power are not the same, given information provided in my

Table 10: Potential role of firm's market power: cross-sectional estimation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	HHI \geq median				HHI $<$ median			
<i>Panel A. Full sample</i>	Listed	Large	Foreign	Sales	Listed	Large	Foreign	Sales
Bank credit	-0.212*** (0.057)	-0.228*** (0.067)	-0.206*** (0.057)	-0.232*** (0.061)	0.003 (0.074)	-0.031 (0.074)	0.010 (0.074)	-0.002 (0.074)
BC \times FA	-0.061 (0.218)	0.050 (0.093)	-0.108 (0.215)	-0.047 (0.098)	0.350 (0.260)	0.424 (0.282)	0.092 (0.204)	0.097 (0.244)
Trade credit	-0.371*** (0.131)	-0.428*** (0.156)	-0.369*** (0.130)	-0.472*** (0.149)	-0.296*** (0.076)	-0.309*** (0.081)	-0.289*** (0.076)	-0.340*** (0.086)
TC \times FA	-0.501* (0.281)	-0.099 (0.166)	-0.640** (0.301)	-0.200 (0.169)	-0.234 (0.305)	-0.126 (0.163)	-0.642** (0.299)	-0.024 (0.125)
Observations	5737	5737	5737	5737	6293	6293	6293	6293
R^2	0.112	0.115	0.112	0.111	0.063	0.071	0.062	0.063
<i>Panel B. Manufacturing</i>								
Bank credit	-0.339*** (0.086)	-0.329*** (0.092)	-0.348*** (0.086)	-0.369*** (0.088)	-0.186** (0.087)	-0.150 (0.092)	-0.192** (0.088)	-0.141 (0.091)
BC \times FA	0.192 (0.207)	-0.047 (0.116)	0.108 (0.195)	-0.007 (0.125)	0.439 (0.350)	0.008 (0.165)	0.193 (0.216)	-0.304** (0.151)
Trade credit	-0.595*** (0.197)	-0.576** (0.225)	-0.607*** (0.194)	-0.671*** (0.215)	-0.575*** (0.132)	-0.591*** (0.140)	-0.579*** (0.132)	-0.646*** (0.147)
TC \times FA	-0.365 (0.292)	-0.464* (0.257)	-0.535* (0.287)	-0.577** (0.253)	-0.322 (0.440)	-0.080 (0.247)	-0.810** (0.336)	-0.301 (0.220)
Observations	3466	3466	3466	3466	3485	3485	3485	3485
R^2	0.103	0.108	0.103	0.106	0.113	0.122	0.110	0.116
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable is sales growth between 2007 and 2009. The explanatory variables are for year 2006. FA refers to financial access dummy, which is specified in each column. An industry is defined more concentrated if its HHI in 2006 is equal or above the median. Sales refers to dummy which takes value one if firm's sales share is in the upper 20% in 2006. All regressions using the full sample include industry dummies at the two-digit level. Robust standard errors are in parentheses. *, **, and *** denote a p-value less than 10%, 5%, and 1%, respectively.

trated markets using the HHI calculated based on the two-digit level industry. Specifically, more concentrated markets are defined as markets whose HHI is above the median of all industries during the sample period.²¹

After separating the sample into two types of market, in Table 10 I interact bank credit and trade credit with financial access dummy in cross-sectional regressions. I exclude dummy for high credit score since Table 8 and 9 show that, unlike listed, large, and foreign owned firms, sales growth of high credit score firms is not negatively related to the share of trade credit in their balance sheet. Instead, I include a dummy variable for sales share, which takes value one if firm's sales share in its industry is in the upper 20% in a given year. It aims to measure firm's market power more directly than other financial access dummies. In panel A and B, I use the full sample and manufacturing firms, respectively. The first four columns focus on firms in more concentrated markets and the last four columns on those in unconcentrated markets in 2006. The number of observations for both groups is similar to each other. Columns (1)-(4) in both panels show evidence that listed, large, foreign-owned, and high sales share firms that relied more on trade credit experienced a larger decline in sales growth during the crisis than their counterparts, if they were in more concentrated industries. In columns (5)-(8), however, the coefficient for trade credit interaction becomes statistically not significant, except for foreign-owned firms in column (7).

In Table 11, I use a panel interaction model. The triple interaction term with trade credit shows a negative and statistically significant coefficient for large, foreign-owned, and high sales share firms in more concentrated markets, whereas the same interaction term shows no significant effect at all for firms in unconcentrated markets. Therefore, the results consistently provide suggestive evidence that firm's market power does play a role in the heterogeneous effect of inter-firm financing on sales performance, which is a clear difference from how bank credit and bond are related to firms' sales.

Firms' market power can influence trade credit contract terms with suppliers. The assumption here is that, financially better connected firms are likely to hold higher market power if they are in relatively more concentrated markets. These firms, however, may lose their monopoly rents in trade credit contracts during a crisis when liquidity becomes scarce. If their suppliers are more credit-constrained and have lower market power compared to them, the suppliers are likely to have limited access to bank credit during the crisis, which makes it hard for them to extend credit to customers as they did in a non-crisis period.

On the other hand, it can be interpreted the other way round. Using the US data,

data, I use firm's market power to proxy firm's bargaining power.

²¹According to the US Department of Justice, markets with the HHI of more than 2500, between 1500 to 2500, and under 1500 are considered to be highly concentrated, moderately concentrated, and unconcentrated, respectively. During the sample period, the median of HHI of my data is 420 and the maximum is 10000.

Table 11: Potential role of market power: within-firm estimation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	HHI \geq median				HHI $<$ median			
	Listed	Large	Foreign	Sales	Listed	Large	Foreign	Sales
BC	0.416*** (0.032)	0.417*** (0.035)	0.430*** (0.032)	0.424*** (0.033)	0.472*** (0.033)	0.460*** (0.034)	0.473*** (0.033)	0.457*** (0.034)
BC \times Crisis	-0.085*** (0.021)	-0.120*** (0.024)	-0.079*** (0.021)	-0.098*** (0.023)	-0.024 (0.026)	-0.007 (0.029)	-0.013 (0.026)	-0.017 (0.029)
BC \times FA	-0.079 (0.088)	-0.018 (0.052)	-0.194* (0.100)	-0.130*** (0.048)	-0.232** (0.090)	-0.034 (0.053)	-0.269*** (0.095)	-0.125** (0.056)
BC \times Crisis \times FA	-0.076 (0.081)	0.094** (0.045)	-0.081 (0.084)	0.056 (0.052)	0.132 (0.099)	-0.041 (0.067)	0.020 (0.102)	0.041 (0.062)
TC	0.171*** (0.043)	0.185*** (0.046)	0.192*** (0.044)	0.195*** (0.045)	0.208*** (0.041)	0.195*** (0.042)	0.204*** (0.041)	0.214*** (0.043)
TC \times Crisis	-0.066* (0.038)	0.005 (0.044)	-0.054 (0.038)	-0.009 (0.042)	-0.079*** (0.030)	-0.073** (0.035)	-0.070** (0.030)	-0.086** (0.035)
TC \times FA	0.094 (0.128)	-0.075 (0.069)	-0.112 (0.142)	-0.005 (0.071)	-0.316* (0.162)	-0.021 (0.061)	-0.166 (0.240)	-0.007 (0.056)
TC \times Crisis \times FA	-0.196* (0.117)	-0.285*** (0.071)	-0.266*** (0.103)	-0.227*** (0.077)	-0.167 (0.149)	-0.034 (0.059)	-0.261 (0.161)	0.023 (0.060)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35258	35258	35258	35258	38065	38065	38065	38065
Number of firms	5758	5758	5758	5758	5731	5731	5731	5731
R^2	0.115	0.116	0.115	0.121	0.083	0.083	0.083	0.091

Notes: The dependent variable is firm's annual sales growth. The explanatory variables are one-year lagged. FA refers to financial access dummy, which is specified in each column. Foreign ownership dummy is time-invariant, therefore subsumed by firm fixed effect. Robust standard errors, clustered at firm-level, are in parentheses. *, **, and *** denote a p-value less than 10%, 5%, and 1%, respectively.

Gonçalves et al. (2018) find that firms with higher market power decrease payable days of trade credit in comparison to low market power firms during a financial crisis, and they interpret the findings such that large firms provide liquidity to their suppliers in hard times to maintain their monopoly rents. In either case, the larger negative effect of trade credit for firms with better financial access can be a result of favorable inter-firm credit contract terms enjoyed by these firms in normal times due to their bargaining power.

The heterogeneous effect of trade credit can also be understood in the context of information-sensitivity in investment (Holmstrom (2015)). In inter-firm financing, credit extension to financially constrained customers is always risky and therefore information-sensitive investment by suppliers whether in normal times or in times of crisis. However, extending credit to unconstrained firms is information-insensitive, therefore is considered safe, in normal times as there is much less probability that customers with better financial access do not pay back within the trade credit agreed terms. During a time of heightened uncertainty such a financial crisis, however, inter-firm credit provision becomes information-sensitive even if customers are considered as financially unconstrained. Such a transition in information-sensitivity towards trade credit may explain why listed, large, foreign owned, and high credit rating firms are still negatively affected, and often more negatively affected, by the use of trade credit during the crisis.

6 Robustness checks

6.1 Endogeneity of debt variables

Although one-year lagged explanatory variables are used in the baseline panel regressions, one could still be concerned about endogeneity of debt financing variables. To deal with reverse causality, I interact crisis dummy with further lagged debt financing variables based on the assumption that years earlier debt financing positions are not correlated with unobserved within firm changes in sales growth during the crisis. To further account for possible omitted variable bias, instead of year fixed effects, I include industry-year fixed effects, which will capture any shocks to a firm in the same industry in a given year:

$$\begin{aligned} \Delta S_{i,j,t} = & \alpha + \beta_1 \overline{BC}_{i,j,t-1} + \beta_2 \overline{TC}_{i,j,t-1} + \beta_3 \overline{B}_{i,j,t-1} + \beta_4 \overline{R}_{i,j,t-1} \\ & + \beta_5 \overline{BC}_{i,j,t-1} \cdot C_t + \beta_6 \overline{TC}_{i,j,t-1} \cdot C_t + \beta_7 \overline{B}_{i,j,t-1} \cdot C_t + \beta_8 \overline{R}_{i,j,t-1} \cdot C_t + X_{i,j,t-1}' \gamma + \delta_i + \omega_{j,t} + \varepsilon_{i,j,t} \end{aligned} \quad (3)$$

in which $\overline{BC}_{i,t-1}$ in the first specification (equation (3)) is the average of bank credit between $(t - 1)$ and $(t - 3)$. It is based on the idea that firms are required to submit the

three-year average of financial statement to apply for bank loans.²²

In the second specification (equation (4)) to tackle the endogeneity issue, I use the median value of debt variables across firms in two-digit level industry to measure firm's reliance on debt financing. It follows the idea that technologically-determined financing characteristics of industry is not endogenous to individual firm's performance (Chor and Manova (2012)). Thus, I run the following regression with industry-specific debt variables:

$$\begin{aligned} \Delta S_{i,j,t} = & \alpha + \beta_1 BC_{j,t-1} + \beta_2 TC_{j,t-1} + \beta_3 B_{j,t-1} + \beta_4 R_{j,t-1} \\ & + \beta_5 BC_{j,t-1} \cdot C_t + \beta_6 TC_{j,t-1} \cdot C_t + \beta_7 B_{j,t-1} \cdot C_t + \beta_8 R_{j,t-1} \cdot C_t + X_{i,j,t-1}'\gamma + \delta_i + \eta_t + \varepsilon_{i,j,t} \end{aligned} \quad (4)$$

in which $BC_{j,t-1}$ is the one-year lagged median value of bank credit across firms in industry j . Therefore, the estimation would be interpreted such that firms in the industry which is more dependent on certain type of debt financing performed better or worse during the crisis.

Table 12 reports the corresponding estimations. Panel A uses three-year average of debt variables, and panel B uses industry-specific median of debt financing. In both panels, the negative coefficient on the interaction between crisis dummy and bank credit becomes statistically insignificant for most firms with better financial access. Meanwhile, the interaction effect with trade credit remains the same to the baseline result, confirming that higher dependence on trade credit is associated with larger decline in sales growth during the crisis.

6.2 Transaction motive of trade credit

In the literature, firms are known to use trade credit for two motives; the transaction motive and the financing motive (Elliehausen and Wolken (1993); Kohler et al. (2000)). The transaction motive says that, by paying their suppliers monthly or quarterly rather than immediately upon purchase of inputs, firms are able to reduce the transaction costs associated with cash management. Meanwhile, firms also use trade credit due to credit market imperfections, which make firms with higher risk have limited access to credit from specialized financial institutions. Since this study is interested in trade credit used out of the financing motive, I examine whether the estimates are robust to the inclusion of additional variable that accounts for the transaction motive of using trade credit.

Following Elliehausen and Wolken (1993), who discuss nonlabor costs as one of the main

²²I follow Song (2014) which uses the three-year average of firm's external finance as an explanatory variable of firm's export growth.

Table 12: Robustness check: endogeneity of debt variables

	(1)	(2)	(3)	(4)	(5)
<i>Panel A. 3-yr average</i>					
	All	Listed	Large	Foreign	High
Bank credit	0.145*** (0.021)	0.035 (0.068)	0.121*** (0.043)	0.043 (0.063)	0.163*** (0.044)
BC \times Crisis	-0.034** (0.016)	-0.015 (0.069)	-0.029 (0.035)	-0.074 (0.069)	-0.012 (0.059)
Trade credit	-0.312*** (0.030)	-0.510*** (0.132)	-0.537*** (0.070)	-0.608*** (0.127)	-0.283*** (0.063)
TC \times Crisis	-0.131*** (0.023)	-0.333*** (0.081)	-0.209*** (0.041)	-0.391*** (0.079)	-0.054 (0.068)
Observations	66445	8213	18129	7572	15860
Number of firms	8587	1175	2912	936	1982
R^2	0.075	0.093	0.088	0.110	0.095
<i>Panel B. Industry-specific</i>					
Bank credit	0.405*** (0.067)	0.462** (0.189)	0.362*** (0.099)	0.027 (0.201)	0.068 (0.127)
BC \times Crisis	-0.141*** (0.033)	-0.099 (0.086)	-0.098* (0.051)	-0.103 (0.087)	-0.077 (0.061)
Trade credit	0.165 (0.139)	0.239 (0.399)	0.382* (0.207)	0.033 (0.424)	0.058 (0.222)
TC \times Crisis	-0.395*** (0.070)	-0.698*** (0.194)	-0.367*** (0.103)	-0.561*** (0.190)	-0.000 (0.128)
Observations	73323	8614	19311	7986	17068
Number of firms	8683	1190	3002	942	1994
R^2	0.084	0.063	0.067	0.074	0.119
Covariates	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable is firm's annual sales growth. In panel A and B, debt variables are value of the past three year average and the median across firms in two-digit category of industry, respectively. The explanatory variables are one-year lagged. Firms with real asset in the previous year is in the upper 20% are defined as large firms. Firms that ever had foreign ownership until 2003 are defined as foreign owned firms. Firms are defined high credit score firms if their average credit score between 2001 and 2006 is in the upper 20%. Robust standard errors, clustered at firm-level, are in parentheses. *, **, and *** denote a p-value less than 10%, 5%, and 1%, respectively.

Table 13: Robustness check: disentangling transaction motive

	(1)	(2)	(3)	(4)	(5)
	All	Listed	Large	Foreign	High
Rcost	-0.120*** (0.006)	-0.087*** (0.017)	-0.088*** (0.011)	-0.081*** (0.018)	-0.117*** (0.012)
Rcost \times Crisis	-0.003 (0.006)	-0.032* (0.019)	-0.035*** (0.011)	-0.002 (0.018)	0.016 (0.013)
Bank credit	0.399*** (0.022)	0.186*** (0.061)	0.307*** (0.040)	0.184*** (0.060)	0.400*** (0.060)
BC \times Crisis	-0.047*** (0.016)	-0.026 (0.058)	-0.014 (0.033)	-0.073 (0.061)	-0.035 (0.052)
Trade credit	0.222*** (0.029)	0.129 (0.104)	0.156*** (0.060)	0.168 (0.117)	0.300*** (0.066)
TC \times Crisis	-0.068*** (0.022)	-0.226*** (0.087)	-0.150*** (0.037)	-0.363*** (0.085)	0.037 (0.064)
Covariates	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	73323	8614	19311	7986	17068
Number of firms	8683	1190	3002	942	1994
R^2	0.106	0.074	0.081	0.082	0.139

Notes: The dependent variable is firm's annual sales growth. The explanatory variables are one-year lagged. Rcost is raw material cost as a share of total assets. Robust standard errors, clustered at firm-level, are in parentheses. *, **, and *** denote a p-value less than 10%, 5%, and 1%, respectively.

transaction variables for demand for trade credit, I additionally include raw material cost as a share of total sales to proxy the transaction motive. If the negative effect of trade credit during the crisis is due to reduced transactions between firms, the transaction variable should capture a significant effect. Column (1) of Table 13 shows that firms that spent more on raw material cost (Rcost) had lower sales growth during the crisis. Nonetheless, the coefficient on crisis and trade credit interaction (-0.068) continues to be negative and statistically significant at the 1% level. Compared to the baseline result (-0.074) in column (2) of Table 4, the magnitude of the negative effect decreased but not much. In other words, although the inclusion of input purchases seems to account for the transaction motive of trade credit, it only partially explain the negative association between the use of trade credit and sales performance, indicating a diminished role of trade credit as a mean of financing during the crisis.

6.3 Alternative crisis period

Finally, I conduct a placebo test in which I assume a crisis in other time period. In Table 14, crisis dummy takes value one for year 2006. None of the crisis interaction terms with bank credit and trade credit shows a statistically significant and negative coefficient. Rather, firms using more trade credit in 2006 experienced faster sales growth than others.

Once I allow year heterogeneity in the effect of debt financing by interacting debt variables with year dummies, the estimates further indicate that GFC indeed was a special event throughout the sample period in terms of the effect of debt financing on sales growth. Figure 5 plots the marginal effects of leverage, bank credit, trade credit, and bonds on sales growth with 95% confidence interval by year. I use the period between 2001 and 2014 to compare the pre-crisis and the post-crisis periods. The marginal effects of leverage, bank credit, and trade credit started to decrease between 2007 and 2008 and then further sharply dropped in 2009, suggesting that my results are unlikely to be driven by factors other than the GFC. Although the marginal effects increased back in 2010, they do not fully return to the pre-crisis level. Figure 6-9 in appendix compare the marginal effects of bank credit and trade credit between firms with better financial access and those not.

7 Discussion on trade credit

One of the characteristics that distinguishes trade credit from other forms of debt financing is that firms act not only as borrowers by receiving credit from suppliers but also as lenders by extending credit to customers simultaneously. Therefore, to better understand the

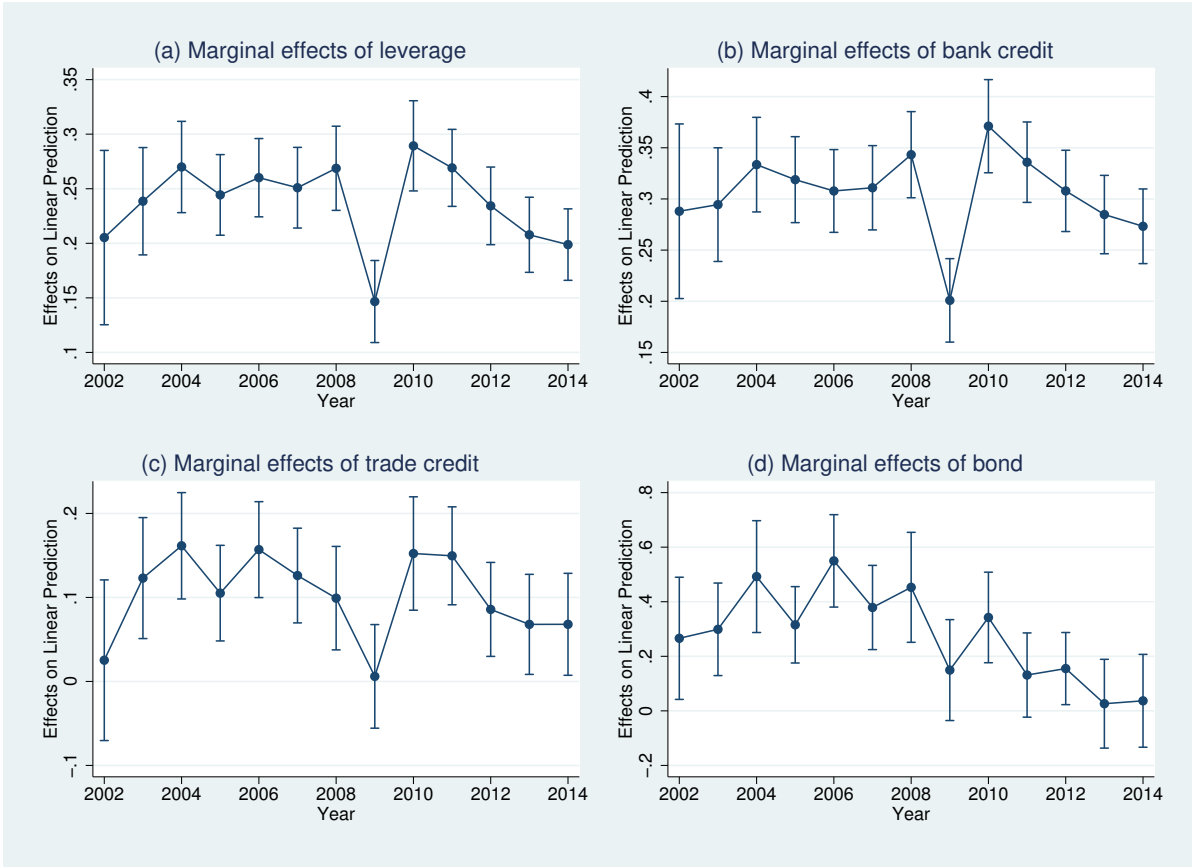


Figure 5: Marginal effects of debt financing by year

Table 14: Robustness check: crisis in 2006

	(1)	(2)	(3)	(4)	(5)
	All	Listed	Large	Foreign	High
Bank credit	0.416*** (0.021)	0.181*** (0.057)	0.303*** (0.040)	0.172*** (0.056)	0.404*** (0.058)
BC × Crisis	-0.002 (0.018)	-0.067 (0.081)	-0.013 (0.037)	-0.098 (0.071)	0.081 (0.057)
Trade credit	0.169*** (0.028)	-0.024 (0.100)	0.086 (0.060)	0.008 (0.111)	0.269*** (0.063)
TC × Crisis	0.059** (0.025)	0.188* (0.096)	0.053 (0.039)	0.226** (0.089)	-0.009 (0.063)
Covariates	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	73323	8614	19311	7986	17068
Number of firms	8683	1190	3002	942	1994
R^2	0.094	0.068	0.073	0.078	0.129

Notes: The dependent variable is firm’s annual sales growth. The explanatory variables are one-year lagged. Robust standard errors, clustered at firm-level, are in parentheses. *, **, and *** denote a p-value less than 10%, 5%, and 1%, respectively.

findings on trade credit, I check whether firms with different characteristics are net lenders or net borrowers during the crisis, by comparing net trade credit and gross trade credit.

Empirical studies on trade credit in the literature often investigate how firm’s use of inter-firm financing responds to the decreased supply of bank credit during a financial crisis or periods of monetary tightening (Mateut and Mizen (2003); Love et al. (2007); Coricelli and Frigerio (2016); Gonçalves et al. (2018)). To be consistent with previous studies, I examine how the crisis impacted firm’s credit extensions as well as credit takings by running panel regressions with the following general form:

$$T_{i,t} = \alpha + \beta_1 C_t + \beta_2 FA_{i,t-1} + \beta_3 C_t \cdot FA_{i,t-1} + X_{i,t-1}' \gamma + \delta_i + \varepsilon_{i,t} \quad (5)$$

in which the dependent variables are net trade credit and gross trade credit as a share of total liabilities. Trade account payable is gross credit received from suppliers (“trade credit” in the main analysis) and account receivable is gross credit extended to customers. Net trade credit is defined as the difference between trade account payable and account receivable, therefore, firms with positive (negative) values of net trade credit are net borrowers (lenders). C_t is dummy for the crisis years, $FA_{i,t-1}$ takes value one for firms with bet-

ter financial access in the previous year. Following the literature, $X_{i,t-1}$ includes one-year lagged cash flow, cash, tangible assets, short-term debt, sales, and firm age as determinants of trade credit.²³

7.1 Net trade credit

Table 15 reports the results in which the dependent variable is net trade credit. Each column indicates which financial access dummy is interacted with crisis dummy in the regression.

Table 15: Net trade credit: within-firm estimation

	(1)	(2)	(3)	(4)
	Net TC			
	Listed	Large	Foreign	Score
Crisis	-0.003 (0.004)	-0.002 (0.004)	-0.003 (0.004)	-0.003 (0.004)
FA	0.058*** (0.018)	0.009 (0.008)		-0.067*** (0.009)
FA × Crisis	0.040*** (0.008)	0.016** (0.007)	0.049*** (0.009)	0.025** (0.011)
Cash flow	0.108*** (0.022)	0.105*** (0.022)	0.103*** (0.022)	0.118*** (0.022)
Cash	0.104** (0.048)	0.103** (0.048)	0.103** (0.048)	0.127*** (0.048)
Tangible asset	0.313*** (0.019)	0.312*** (0.019)	0.313*** (0.019)	0.302*** (0.019)
ST debt	0.288*** (0.017)	0.289*** (0.017)	0.288*** (0.017)	0.265*** (0.017)
Sales	-0.016*** (0.006)	-0.017*** (0.006)	-0.015*** (0.006)	-0.013** (0.006)
Age	0.004*** (0.001)	0.005*** (0.001)	0.005*** (0.001)	0.005*** (0.001)
Firm FE	Yes	Yes	Yes	Yes
Observations	73323	73323	73323	73323
Number of firms	8683	8683	8683	8683
R^2	0.013	0.012	0.012	0.014

Notes: The dependent variable is net trade credit (trade account payable minus account receivable) as a share of total liabilities. Crisis dummy takes value one for years 2008 and 2009. The explanatory variables are one-year lagged. Robust standard errors, clustered at firm-level, are in parentheses. *, **, and *** denote a p-value less than 10%, 5%, and 1%, respectively.

Given other explanatory variables, the crisis interaction term shows a positive and significant coefficient in all columns, meaning that during the crisis these firms received more net trade credit than others. The separate regressions by each group of firms in Table

²³Operating cash flow, cash, tangible assets and short-term debt are divided by total assets.

A6 also provide the similar results. Although it does not provide supporting evidence on the argument that financially weaker firms increase the use of trade credit as a substitute for bank credit in times of tight liquidity, the result is in line with that of Coricelli and Frigerio (2016), who show that European SMEs were net lenders transferring credit to larger firms during the GFC due to their weaker bargaining power.

7.2 Gross trade credit

Then, I investigate whether changes in net trade credit during the crisis are driven by changes in received trade credit or extended trade credit. In Table 16, the dependent variable in columns (1)-(4) is received trade credit and in columns (5)-(8) is extended trade credit.

Table 16: Gross trade credit: within-firm estimation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Received TC				Extended TC			
	Listed	Large	Foreign	Score	Listed	Large	Foreign	Score
Crisis	-0.012*** (0.001)	-0.013*** (0.001)	-0.012*** (0.001)	-0.016*** (0.001)	-0.009** (0.004)	-0.011** (0.005)	-0.009** (0.004)	-0.013*** (0.004)
FA	-0.015** (0.007)	-0.021*** (0.003)		0.023*** (0.002)	-0.073*** (0.019)	-0.030*** (0.009)		0.090*** (0.009)
FA × Crisis	-0.011*** (0.003)	-0.001 (0.002)	-0.011*** (0.004)	0.016*** (0.003)	-0.051*** (0.009)	-0.017** (0.007)	-0.060*** (0.010)	-0.010 (0.011)
Cash flow	0.064*** (0.007)	0.062*** (0.007)	0.065*** (0.007)	0.058*** (0.007)	-0.044* (0.023)	-0.043* (0.023)	-0.038* (0.023)	-0.060*** (0.022)
Cash	0.017* (0.010)	0.016* (0.010)	0.017* (0.010)	0.007 (0.010)	-0.087* (0.048)	-0.087* (0.048)	-0.086* (0.048)	-0.120** (0.048)
Tangible asset	-0.136*** (0.007)	-0.135*** (0.007)	-0.136*** (0.007)	-0.131*** (0.007)	-0.449*** (0.020)	-0.448*** (0.020)	-0.449*** (0.020)	-0.433*** (0.020)
ST debt	0.037*** (0.006)	0.037*** (0.006)	0.037*** (0.006)	0.048*** (0.006)	-0.252*** (0.017)	-0.253*** (0.017)	-0.251*** (0.017)	-0.217*** (0.017)
Sales	0.010*** (0.002)	0.012*** (0.002)	0.009*** (0.002)	0.009*** (0.002)	0.026*** (0.006)	0.028*** (0.006)	0.024*** (0.006)	0.022*** (0.006)
Age	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.005*** (0.001)	-0.006*** (0.001)	-0.006*** (0.001)	-0.006*** (0.001)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	73323	73323	73323	73323	73323	73323	73323	73323
Number of firms	8683	8683	8683	8683	8683	8683	8683	8683
R^2	0.026	0.027	0.026	0.030	0.018	0.017	0.018	0.020

Notes: The dependent variable in columns (1)-(4) and columns (5)-(8) is received trade credit (trade account payable) and extended trade credit (account receivable), respectively, both as a share of total liabilities. Crisis dummy takes value one for years 2008 and 2009. The explanatory variables are one-year lagged. Robust standard errors, clustered at firm-level, are in parentheses. *, **, and *** denote a p-value less than 10%, 5%, and 1%, respectively.

The coefficient on crisis dummy is negative and statistically significant at the 1% level

in all columns, indicating that the overall transactions in trade credit decreased during the crisis. The estimates of separate regressions by each group of firms in Table A7 also suggest that, given a shortage of liquidity, all types of firms received and extended less credit than in normal times, which is consistent with the findings in the literature (Love et al. (2007)).

Especially, the negative impact of crisis on credit takings is larger for listed and foreign-owned firms as presented in column (1) and (3) of Table 16. At the same time, the estimates in columns (5), (7), and (8) show that listed, large, and foreign-owned firms also reduced credit extensions significantly larger than their counterparts. Therefore, the increased net trade credit for financially better connected firms during the crisis in Table 15 is not likely because they received more credit from suppliers. In fact, these firms received less credit from suppliers as expected in the main analysis of this study, but they cut credit extension to customers to a larger extent, which consequently results in increased net credit takings during the crisis. This finding supports the idea in the literature that firms with strong bargaining power are able to be stricter to their customers by cutting credit extension in bad times, whereas weaker firms are more reluctant to do so.

The estimates in this section suggest that in times of financial distress large firms seem to maintain their monopoly rents to a certain extent in the sense that they obtain more net trade credit by reducing credit provisions. Nonetheless, as the main findings of the study show, more net trade credit during the crisis did not seem to significantly help these firms perform better during the crisis, emphasizing the importance of gross credit than net credit to sales growth. However, to conclude trade credit dynamics among firms during the crisis, one needs to conduct a more careful examination using a detailed supplier-customer matched data on trade credit and a well-defined distinct measure for bargaining power.

8 Conclusion

This paper shows that the structure of debt financing has important implications for firms' sales performance during a financial crisis, and that while the effect of debt financing depends on the firms' degree of financial access, that of inter-firm financing also depends on their bargaining power. Using Korean firm-level data for the 2001–2010 period, I first examine how three main forms of debt financing – bank credit, trade credit, and bonds – are associated with sales growth during the GFC, and I show that the negative effect of leverage is prominent through trade credit, with short-term bank credit also playing a role. I find that the balance sheet effect presents mainly through foreign currency denominated trade credit and that long-term bank credit and bond are resilient to the crisis.

The paper then examines the role of a firm's degree of financial access. For firms

with better financial access, I find no effect for bank credit but a significant and often larger negative effect for trade credit. I investigate a potential mechanism through which trade credit can have the heterogeneous effect on sales growth. The effects are pronounced for firms with better financial access and with a high market share in relatively more concentrated industries, implying the role of market power in inter-firm credit provisions. During a financial crisis, they may not be able to receive credit from suppliers under the same contract terms as in normal times. I show that these firms, nonetheless, tend to be net recipients of trade credit during the crisis not because they received more credit but because they reduced credit extension to a larger extent.

The findings presented in this paper have policy implications. First, the results suggest that more attention should be paid on inter-firm financing because it is widely used not only by SMEs but also by large firms and its negative relationship with sales performance during the crisis tends to be universal whether firms have better financial access or not. Secondly, the findings also urge policy initiatives that ease financing constraints for small and young firms who have limited access to financial markets and have lower bargaining power. Finally, as the financing structure does matter to firm performance in times of financial distress, efforts that encourage firms to use more a resilient type of debt such as a long-term bond or equity financing could be considered.

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A Data

General information

KIS value provides general information and financial information. Time-invariant information used for the analysis includes two-digit level industry code, SME identification, established year, and listed date. SME identification distinguishes firms into three types - large firms, SMEs, and others. Others include government-owned utility providers and are assigned a missing value for firm size dummy so that it is identified neither as large firms nor as SMEs. Financial variables have annual observations.

Balance sheet

I drop observations with a missing value either for total assets or for total liabilities, and with a negative value for each subcategory of liabilities. Since there is some inconsistency in the original accounting information (the sum of subcategories is larger than total), I start at the very bottom and sum each subcategory to generate debt variables. I calculate debt in Korean won by subtracting the amount of foreign debt from each subtotal.²⁴ Then I define debt variables by maturity. Short-term bank credit is defined as the sum of short-term borrowings and current portion of long-term borrowings. Short-term bond is defined as the sum of bond and current portion of bonds. Short-term trade credit is trade account payable. Long-term debt is defined in the same way without current portion. Finally, the three main debt variables are defined as the sum of their subcategories by maturity.²⁵ The rest of liabilities is defined as the residual between total liabilities and the sum of three main debt variables. If the residual has a negative value, I replace it with the sum of debt variables.²⁶

Industries

Industries are classified based on the two-digit Korea Standard Industrial Classification (KSIC-9). The final balanced panel includes 2 agricultural industries, 3 mining industries, 24 manufacturing industries, 4 utility supply industries, 2 construction industries, 3 wholesale and retail trade industries, 4 transportation industries, and 21 service industries. The industry list is reported in Table A1.

²⁴For example, long-term borrowings in Korean won is the difference between long-term borrowings and long-term borrowings in foreign currency.

²⁵For example, bank credit is the sum of short-term bank credit and long-term bank credit.

²⁶Such change was made for 178 observations, which is not many, given the size of the original data.

Table A1: List of industry

Industry name	KSIC-9
Agriculture	01
Fishing	03
Mining of Coal, Crude Petroleum and Natural Gas	05
Mining of Metal Ores	06
Mining of Non-metallic Minerals, Except Fuel	07
Manufacture of Food Products	10
Manufacture of Beverages	11
Manufacture of Tobacco Products	12
Manufacture of Textiles, Except Apparel	13
Manufacture of wearing apparel, Clothing Accessories and Fur Articles	14
Tanning and Dressing of Leather , Manufacture of Luggage and Footwear	15
Manufacture of Wood and of Products of Wood and Cork ; Except Furniture	16
Manufacture of Pulp, Paper and Paper Products	17
Printing and Reproduction of Recorded Media	18
Manufacture of Coke, hard-coal and lignite fuel briquettes and Refined Petroleum Products	19
Manufacture of Chemicals and chemical products (except pharmaceuticals, medicinal chemicals)	20
Manufacture of Pharmaceuticals, Medicinal Chemicals and Botanical Products	21
Manufacture of Rubber and Plastic Products	22
Manufacture of Other Non-metallic Mineral Products	23
Manufacture of Basic Metal Products	24
Manufacture of Fabricated Metal Products, Except Machinery and Furniture	25
Manufacture of Electronic Components, Computer, Radio, Television and Communication Equipment and Apparatuses	26
Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks	27
Manufacture of Electrical equipment	28
Manufacture of Other Machinery and Equipment	29
Manufacture of Motor Vehicles, Trailers and Semitrailers	30
Manufacture of Other Transport Equipment	31
Manufacture of Furniture	32
Other manufacturing	33
Electricity, gas, steam and air conditioning supply	35
Sewage, Wastewater and Human Waste Treatment Services	37
Waste Collection, Disposal and Materials Recovery	38
Remediation activities and other waste management services	39
General Construction	41
Special Trade Construction	42
Sale of Motor Vehicles and Parts	45
Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles	46
Retail Trade, Except Motor Vehicles and Motorcycles	47
Land Transport ; Transport Via Pipelines	49
Water Transport	50
Air Transport	51
Storage and support activities for transportation	52
Accommodation	55
Food and beverage service activities	56
Publishing activities	58
Motion picture, video and television programme production, sound recording and music publishing activities	59
Broadcasting	60
Telecommunications	61
Computer programming, System Integration and Management Services	62
Information service activities	63
Real Estate Activities	68
Renting and leasing; except real estate	69
Research and Development	70
Professional Services	71
Architectural, Engineering and Other Scientific Technical Services	72
Professional, Scientific and Technical Services, n.e.c.	73
Business Facilities Management and Landscape Services	74
Business Support Services	75
Education	85
Creative, Arts and Recreation Related Services	90
Sports activities and amusement activities	91
Maintenance and Repair Services	95
Other Personal Services Activities	96

B Tables

Table A2: Alternative crisis period 2008-2009: cross-sectional estimation

	(1)	(2)	(3)	(4)
	Leverage	Baseline	Maturity	Currency
Sales growth (07-08)	0.044*** (0.015)	0.042*** (0.015)	0.041*** (0.015)	0.042*** (0.015)
Chaebol	0.088*** (0.019)	0.086*** (0.019)	0.084*** (0.019)	0.085*** (0.019)
Age	-0.002*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)
Size	-0.054*** (0.005)	-0.056*** (0.005)	-0.056*** (0.005)	-0.056*** (0.005)
Return on sales	-0.079** (0.034)	-0.078** (0.033)	-0.079** (0.033)	-0.078** (0.033)
Export/sales	-0.011 (0.025)	-0.009 (0.025)	-0.007 (0.025)	-0.011 (0.026)
Leverage	-0.085*** (0.022)	Bank credit -0.069*** (0.024)	ST bank credit -0.098*** (0.028)	KR bank credit -0.065*** (0.025)
			LT bank credit -0.026 (0.034)	FX bank credit -0.107* (0.062)
		Trade credit -0.241*** (0.037)	ST trade credit -0.239*** (0.037)	KR trade credit -0.097 (0.116)
			LT trade credit 0.663 (1.329)	FX trade credit -0.261*** (0.035)
		Bond 0.207** (0.096)	ST bond 0.177 (0.164)	Bond 0.209** (0.096)
			LT bond 0.226* (0.131)	
		Rest 0.039 (0.050)	Rest 0.043 (0.050)	Rest 0.040 (0.050)
Observations	12783	Observations 12783	Observations 12783	Observations 12783
R^2	0.068	R^2 0.071	R^2 0.072	R^2 0.072

Notes: The dependent variable is sales growth between 2008 and 2009. The explanatory variables are for year 2007. All regressions include industry dummies at the two-digit level. Robust standard errors are in parentheses. *, **, and *** denote a p-value less than 10%, 5%, and 1%, respectively.

Table A3: Heterogeneous effect of trade credit: size and credit score interaction

	(1)	(2)	(3)	(4)
	Size	Credit score	Size	Credit score
Bank credit	0.861** (0.347)	0.326*** (0.055)	1.367*** (0.352)	0.331*** (0.054)
BC × Crisis	-0.150 (0.325)	-0.156** (0.066)	-0.091 (0.318)	-0.115* (0.066)
BC × FA	-0.018 (0.015)	-0.022*** (0.008)	-0.040*** (0.015)	-0.023*** (0.008)
BC × Crisis × FA	0.004 (0.014)	0.024** (0.010)	0.002 (0.013)	0.023** (0.010)
Trade credit	0.245 (0.470)	0.024 (0.079)	0.931* (0.480)	0.051 (0.079)
TC × Crisis	0.894** (0.445)	-0.226** (0.090)	1.019** (0.449)	-0.216** (0.089)
TC × FA	-0.002 (0.020)	0.018 (0.012)	-0.033 (0.020)	0.011 (0.012)
TC × Crisis × FA	-0.041** (0.018)	0.026* (0.015)	-0.045** (0.019)	0.031** (0.015)
Covariates	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	No	No
Industry × year FE	No	No	Yes	Yes
Observations	73323	69023	73323	69023
Number of firms	8683	8519	8683	8519
R^2	0.095	0.095	0.123	0.125

Notes: The dependent variable is firm's annual sales growth. The explanatory variables are one-year lagged. FA refers to financial access dummy, which is specified in each column. Robust standard errors, clustered at firm-level, are in parentheses. *, **, and *** denote a p-value less than 10%, 5%, and 1%, respectively.

Table A4: Heterogeneous effect of trade credit: manufacturing industry

	(1)	(2)	(3)	(4)
	Manufacturing industry			
	Listed	Large	Foreign	High
Bank credit	0.461*** (0.029)	0.466*** (0.030)	0.471*** (0.029)	0.425*** (0.029)
BC × Crisis	-0.058*** (0.021)	-0.068*** (0.024)	-0.052** (0.021)	-0.062** (0.026)
BC × FA	-0.163** (0.064)	-0.107*** (0.040)	-0.262*** (0.070)	-0.069 (0.059)
BC × Crisis × FA	-0.051 (0.068)	0.020 (0.043)	-0.068 (0.068)	0.002 (0.096)
Trade credit	0.244*** (0.042)	0.242*** (0.044)	0.250*** (0.043)	0.215*** (0.043)
TC × Crisis	-0.131*** (0.038)	-0.106** (0.043)	-0.115*** (0.039)	-0.158*** (0.041)
TC × FA	0.009 (0.124)	-0.011 (0.065)	-0.044 (0.139)	0.092 (0.070)
TC × Crisis × FA	-0.320*** (0.124)	-0.250*** (0.076)	-0.485*** (0.108)	0.094 (0.132)
Covariates	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	43639	43639	43639	43639
Number of firms	5043	5043	5043	5043
R^2	0.110	0.110	0.110	0.110

Notes: The dependent variable is firm's annual sales growth. The explanatory variables are one-year lagged. FA refers to financial access dummy, which is specified in each column. Robust standard errors, clustered at firm-level, are in parentheses. *, **, and *** denote a p-value less than 10%, 5%, and 1%, respectively.

Table A5: Potential role of market power: within-firm estimation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Manufacturing industry							
	HHI \geq median				HHI $<$ median			
	Listed	Large	Foreign	Sales	Listed	Large	Foreign	Sales
BC	0.465*** (0.039)	0.470*** (0.042)	0.479*** (0.039)	0.462*** (0.040)	0.458*** (0.047)	0.456*** (0.048)	0.462*** (0.048)	0.429*** (0.047)
BC \times Crisis	-0.108*** (0.027)	-0.138*** (0.030)	-0.107*** (0.027)	-0.130*** (0.028)	0.010 (0.036)	0.024 (0.039)	0.025 (0.036)	0.024 (0.038)
BC \times FA	-0.160* (0.088)	-0.088 (0.054)	-0.301*** (0.101)	-0.131** (0.057)	-0.120 (0.108)	-0.095 (0.068)	-0.175 (0.122)	-0.063 (0.070)
BC \times Crisis \times FA	-0.125 (0.083)	0.040 (0.053)	-0.092 (0.082)	0.055 (0.060)	0.117 (0.120)	0.038 (0.076)	-0.003 (0.120)	0.071 (0.081)
TC	0.250*** (0.053)	0.251*** (0.056)	0.262*** (0.053)	0.268*** (0.055)	0.169** (0.071)	0.162** (0.073)	0.175** (0.072)	0.204*** (0.074)
TC \times Crisis	-0.076 (0.049)	-0.022 (0.056)	-0.051 (0.050)	-0.016 (0.054)	-0.163** (0.066)	-0.154** (0.071)	-0.161** (0.065)	-0.198*** (0.070)
TC \times FA	0.192 (0.146)	0.026 (0.082)	0.040 (0.162)	0.017 (0.083)	-0.328 (0.270)	-0.076 (0.125)	-0.389 (0.328)	-0.230* (0.121)
TC \times Crisis \times FA	-0.310** (0.154)	-0.358*** (0.098)	-0.493*** (0.128)	-0.297*** (0.098)	-0.357 (0.238)	-0.072 (0.153)	-0.295 (0.243)	0.208 (0.159)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	23297	23297	23297	23297	20342	20342	20342	20342
Number of firms	3762	3762	3762	3762	3331	3331	3331	3331
R^2	0.135	0.134	0.134	0.139	0.098	0.098	0.098	0.106

Notes: The dependent variable is firm's annual sales growth. The explanatory variables are one-year lagged. FA refers to financial access dummy, which is specified in each column. An industry is defined more concentrated if its HHI is equal or above the median of manufacturing industry. Sales refers to dummy which takes value one if firm's sales share is in the upper 20% in its industry. Robust standard errors, clustered at firm-level, are in parentheses. *, **, and *** denote a p-value less than 10%, 5%, and 1%, respectively.

Table A6: Net trade credit during the crisis: separate regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Stock exchange		Size		Ownership		Credit score	
<i>Net TC</i>	Listed	Non-listed	Large	SMEs	Foreign	Domestic	High	Low
Crisis	0.022*** (0.006)	0.003 (0.003)	0.016*** (0.004)	0.003 (0.003)	0.025*** (0.006)	0.003 (0.003)	-0.006 (0.010)	0.003 (0.003)
Cash flow	0.088 (0.057)	0.122*** (0.024)	0.081** (0.037)	0.121*** (0.025)	0.137** (0.058)	0.116*** (0.023)	0.314*** (0.069)	0.112*** (0.019)
Cash	-0.078 (0.060)	0.082** (0.038)	-0.006 (0.052)	0.078** (0.038)	-0.116** (0.059)	0.088** (0.037)	0.185** (0.073)	0.049 (0.035)
Tangible asset	0.278*** (0.053)	0.304*** (0.021)	0.173*** (0.042)	0.321*** (0.021)	0.217*** (0.060)	0.312*** (0.020)	0.459*** (0.074)	0.237*** (0.017)
ST debt	0.282*** (0.033)	0.293*** (0.016)	0.264*** (0.027)	0.311*** (0.017)	0.288*** (0.036)	0.300*** (0.016)	0.702*** (0.093)	0.202*** (0.013)
Age	0.009*** (0.002)	0.001 (0.001)	0.002* (0.001)	0.002** (0.001)	0.009*** (0.002)	0.001 (0.001)	0.008** (0.003)	0.002*** (0.001)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7503	49431	12456	44478	7092	49842	10046	46888
Number of firms	943	5662	1384	4942	788	5538	2520	6097
R^2	0.034	0.021	0.023	0.022	0.034	0.021	0.025	0.018

Notes: The dependent variable is net trade credit, defined as trade account payable minus account receivable, as a share of total liabilities. The explanatory variables are one-year lagged. Robust standard errors, clustered at firm-level, are in parentheses. *, **, and *** denote a p-value less than 10%, 5%, and 1%, respectively.

Table A7: Gross trade credit during the crisis: separate regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Stock exchange		Size		Ownership		Credit score	
<i>Panel A. Received TC</i>	Listed	Non-listed	Large	SMEs	Foreign	Domestic	High	Low
Crisis	-0.022*** (0.003)	-0.012*** (0.001)	-0.015*** (0.002)	-0.013*** (0.001)	-0.023*** (0.003)	-0.012*** (0.001)	-0.008*** (0.003)	-0.015*** (0.001)
Cash flow	0.120*** (0.026)	0.073*** (0.009)	0.101*** (0.017)	0.077*** (0.009)	0.155*** (0.025)	0.072*** (0.009)	-0.001 (0.021)	0.081*** (0.009)
Cash	0.012 (0.036)	0.025** (0.012)	0.081*** (0.028)	0.014 (0.013)	0.036 (0.036)	0.021* (0.012)	0.042* (0.023)	0.009 (0.013)
Tangible asset	-0.150*** (0.024)	-0.130*** (0.008)	-0.135*** (0.018)	-0.134*** (0.008)	-0.125*** (0.025)	-0.135*** (0.008)	-0.081*** (0.024)	-0.126*** (0.008)
ST debt	0.001 (0.019)	0.033*** (0.007)	0.029* (0.016)	0.028*** (0.007)	0.013 (0.020)	0.030*** (0.007)	0.029 (0.027)	0.041*** (0.006)
Age	-0.000 (0.001)	0.000 (0.000)	0.001* (0.001)	-0.000 (0.000)	0.001 (0.001)	-0.000 (0.000)	0.005*** (0.001)	-0.001** (0.000)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7503	49431	12456	44478	7092	49842	10046	46888
Number of firms	943	5662	1384	4942	788	5538	2520	6097
R ²	0.026	0.023	0.027	0.023	0.027	0.023	0.015	0.027
<i>Panel B. Extended TC</i>								
Crisis	-0.044*** (0.006)	-0.015*** (0.003)	-0.031*** (0.004)	-0.016*** (0.003)	-0.048*** (0.006)	-0.015*** (0.003)	-0.002 (0.010)	-0.017*** (0.003)
Cash flow	0.032 (0.061)	-0.049** (0.024)	0.020 (0.037)	-0.044* (0.026)	0.019 (0.059)	-0.043* (0.024)	-0.314*** (0.067)	-0.031 (0.019)
Cash	0.090 (0.069)	-0.058 (0.037)	0.087* (0.052)	-0.064* (0.038)	0.153** (0.067)	-0.066* (0.037)	-0.143** (0.073)	-0.040 (0.035)
Tangible asset	-0.427*** (0.059)	-0.434*** (0.022)	-0.302*** (0.044)	-0.455*** (0.022)	-0.341*** (0.064)	-0.447*** (0.021)	-0.540*** (0.074)	-0.363*** (0.018)
ST debt	-0.281*** (0.037)	-0.260*** (0.017)	-0.235*** (0.028)	-0.283*** (0.017)	-0.275*** (0.039)	-0.270*** (0.016)	-0.673*** (0.092)	-0.161*** (0.013)
Age	-0.009*** (0.002)	-0.001 (0.001)	-0.001 (0.001)	-0.002*** (0.001)	-0.008*** (0.002)	-0.001 (0.001)	-0.004 (0.003)	-0.003*** (0.001)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7503	49431	12456	44478	7092	49842	10046	46888
Number of firms	943	5662	1384	4942	788	5538	2520	6097
R ²	0.047	0.027	0.032	0.029	0.042	0.029	0.028	0.028

Notes: The dependent variable in Panel A is received trade credit (trade account payable) and in Panel B is extended trade credit (account receivable), respectively, both as a share of total liabilities. The explanatory variables are one-year lagged. Robust standard errors, clustered at firm-level, are in parentheses. *, **, and *** denote a p-value less than 10%, 5%, and 1%, respectively.

C Figures

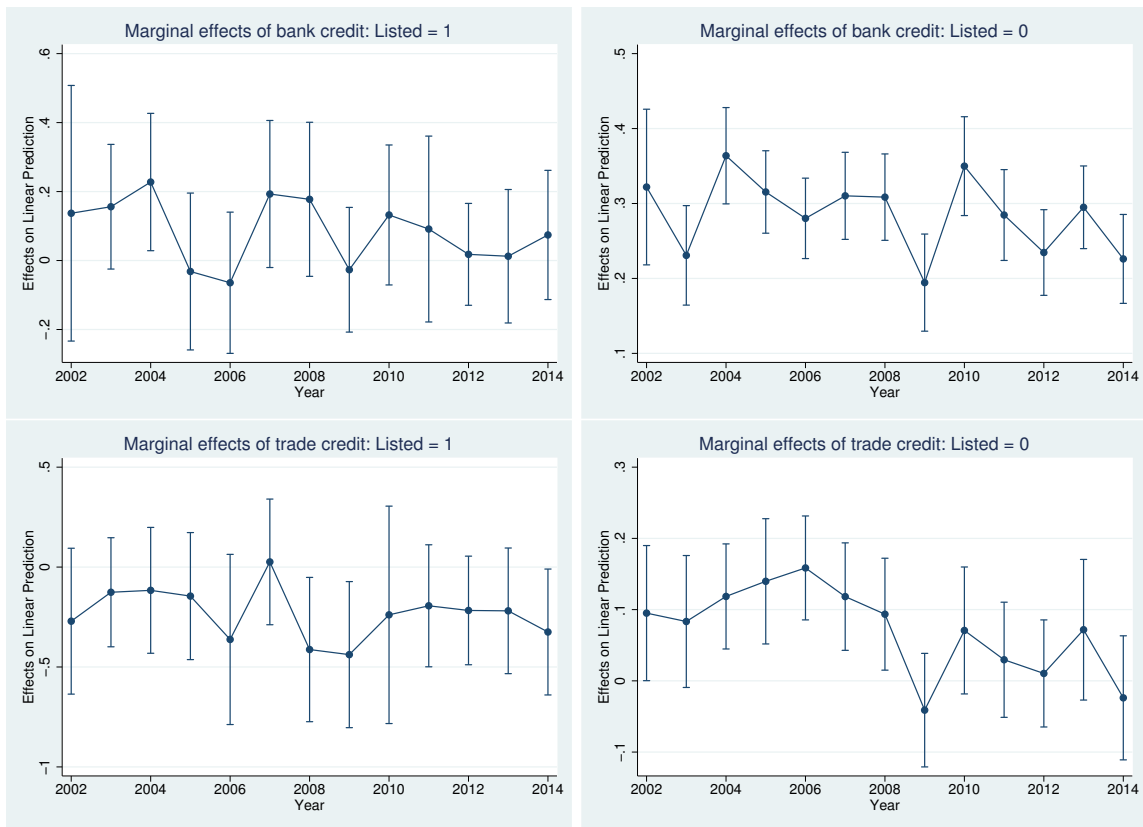


Figure 6: Marginal effects of bank credit and trade credit: publicly-listed vs. non-listed firms

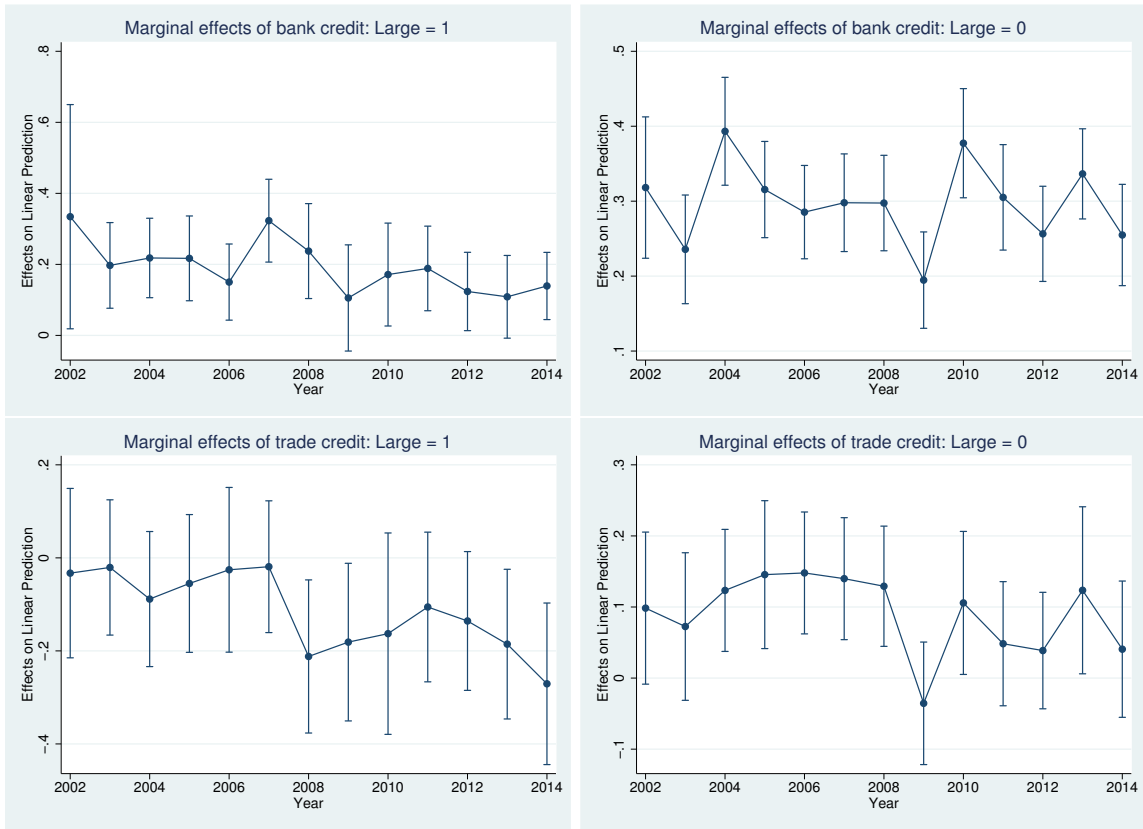


Figure 7: Marginal effects of bank credit and trade credit: large firms vs. SMEs

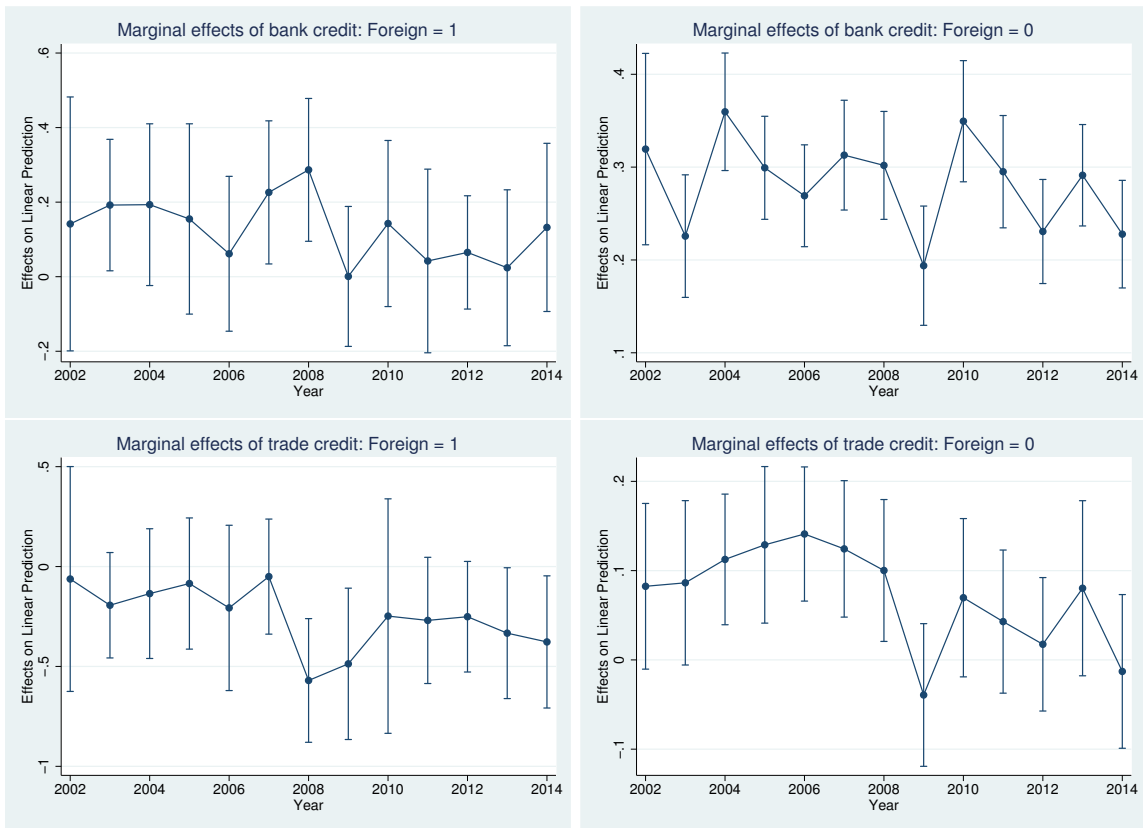


Figure 8: Marginal effects of bank credit and trade credit: foreign-owned vs. domestic-owned firms

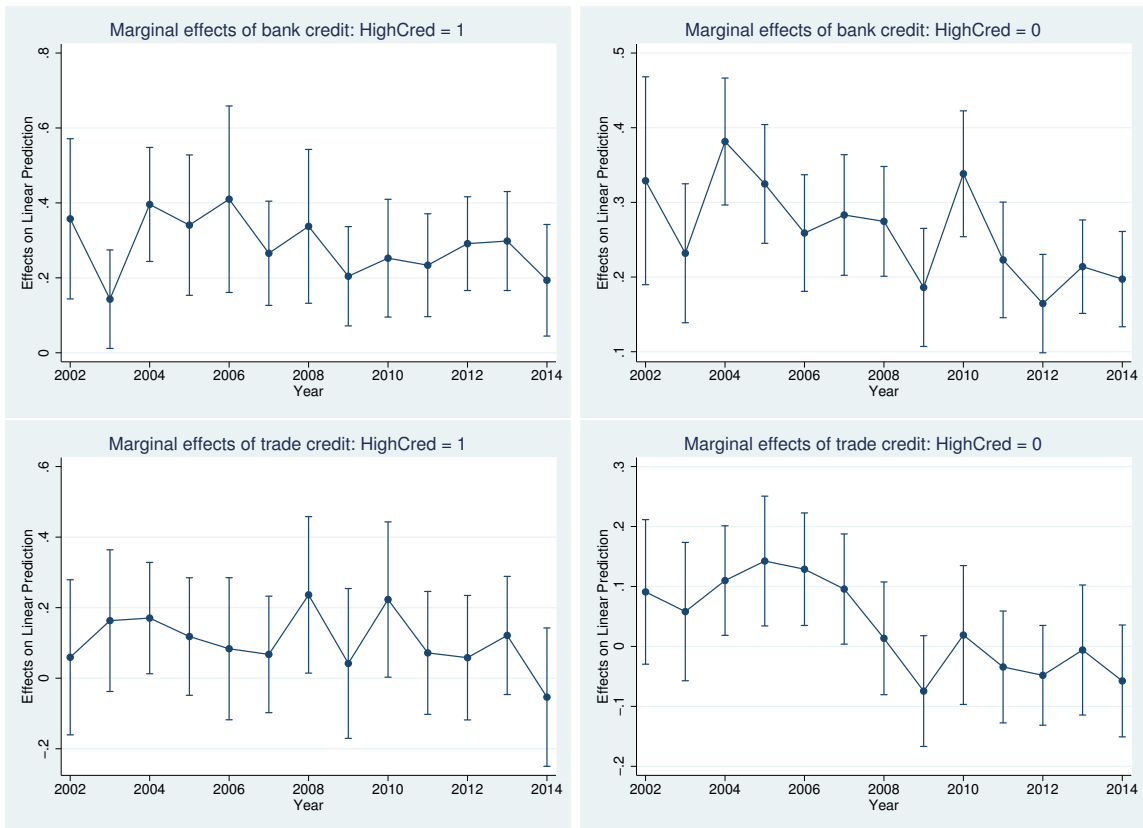


Figure 9: Marginal effects of bank credit and trade credit: high credit score vs. low credit score firms