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Capital Structure Choices and Stock Market Volatility: Evidence from Chinese Listed Firms

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ABSTRACT

An essential issue of listed firms is adjusting their capital structure as stock market volatility increases. Our study examines this concern by using panel data of the Shanghai Stock Exchange for the period 2008–2018. We find that stock market volatility has immediate positive effects on both total market leverage and short-term market leverage but a negative influence on the long-term market leverage of Chinese listed firms. In this scenario, Chinese listed firms adjust their debt structure by using high bank debts and cutting trade credit due to lower debt costs. Further analyses confirm that the proportion of bank debts to total debts visibly increases while that of trade credit to total debts distinctly decreases. Furthermore, we implement robust tests regarding potential issues, such as sample selection, model selection, endogenous factors, and quantile regression to strengthen the robustness of the main findings. This study provides the first framework for investigating a link between the stock market volatility and capital structure decisions in a typical emerging market.

KEYWORDS

Stock market volatility; market leverages; bank debts; trade credit; panel data; quantile regression (QR)

Introduction

To date, determinants of capital structure have remained an incomprehensible subject in corporate finance. When firms are allowed to issue stocks on the equity market, equity issuance plays a vital role in the surging corporate capital. In terms of volatility, Welch (2004) documents that a critical matter of corporate finance is the volatility of stock price as a driver of notable changes in the behaviors and financial decisions of corporate managers. Figlewski and Wang (2000) demonstrate that the increase of the volatilities of stock market returns and individual stock returns leads to the decline in market values at the firm level. Following market timing theory, listed companies tend to issue equity when their market values are comparatively high relative to their book and past market values, and then repurchase their issued equity when their market values are low, which exerts a persistent effect on corporate capital structure (Baker & Wurgler, 2002). Chen et al. (2014) and Ahmed and Hla (2019) show that the volatility of individual stock returns significantly influences the capital structure of listed firms in the United States (US) and Pakistan markets, respectively. Most of their findings support the prediction of Tradeoff Theory (TOT) that companies diminish debts to balance and deal with the increasing prospect of default owing

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to high volatility risk; still, the practical results of Ahmed and Hla (2019) from the Pakistan market are pretty complicated. Similar to Pakistan, China is known as a developing equity market that is unstable, sensitive, and enormously volatile with unexpected shocks from the global market. In addition, the unique capital structure and debt structure of Chinese enterprises are inherently an exciting topic and thus widely explored in research (Fan et al., 2021; Zhang et al., 2015). To our best knowledge, the nexus between stock market volatility and corporate capital structure has not been explored. Surviving literature and evidence have powerfully prompted us to investigate the effect of stock market volatility on the capital structure choices of listed firms in the concrete context of the China stock market rather than imitating previous studies which focus on the volatility effect of individual stock returns on the corporate leverage.

In civil law countries, enterprises rely heavily on internal financing to support their investments (Hull et al., 2011). Civil law dominates most of China's economic activities, and Chinese firms consider debt financing from banks and financial institutions as a primary or even a sole external source of funds (Allen et al., 2009). Similarly, Sara (2019) and Huang et al. (2020) emphasize that banks still dominate the Chinese financial system. In addition, Chinese firms tend to use a higher short-term debt ratio than a long-term one (Huang & Song, 2006). In the corporate financial statements, trade credit is an account payable where the credit activities are tied to the purchase, leading to flexibility but with higher financial costs than those of bank debts. Ge and Qiu (2007) suppose that the Chinese market has meager formal financial channels, and thus Chinese firms coevally exploit trade credit as an informal financial source. The equity issue form is not binding. Given these prima problems, Chinese listed firms prefer to issue equity in the stock market rather than use debts in the years before 2007. In reality, Chen (2004) surveys 88 listed enterprises of the Dow–China 88 Index from 1995 to 2000 and then indicates that the capital structure decisions of Chinese firms comply with a "new" pecking order; first is retained earnings, then equity, and the last is long-term debts. In surveying over 1,200 Chinese listed firms for 10 years (1994–2003), Huang and Song (2006) points out that Chinese firms prefer to access equity financing. Mentioned studies mainly explain the capital structure of Chinese listed firms in the pre-2007 period on the basis of two basic assumptions, namely, the Pecking Order and TOT. Nevertheless, evaluations of capital structure choices from the capital usage routines of Chinese companies are largely ignored.

Since 2007, the number of traded stocks of Chinese listed firms has massively increased, referring to the considerable dependence of Chinese corporate capital structure on the equity market. Additionally, the China stock market undergoes huge volatilities due to the effects of significant macro events in the period of 2008–2018, such as the global financial crisis (2008), China stock market's turbulence (2015), and the US–China trade war (2018). Hence, the first motivation in the present study stems from the significant increase in volatility of China stock market; that is, how do Chinese listed firms promptly align their market leverage in the post-2007 period to respond against volatilities?

Shanghai and Shenzhen are the two major stock indexes in the China equity market (Ni et al., 2016; Xu, 2001). Figure 1 plots the annual lending interest rate[1] and the stock market's volatility per year[2] in China from 2001 to 2019. The black dashed line represents the annual lending interest rate in China's debt market in percentage. The solid red and the blue dashed lines illustrate the volatilities of returns of the Shanghai Composite Index (SSEC) and of the Shenzhen Composite Index (SZSC) per year. The annual volatility varies in the China stock market, which helps precisely determine the volatility effect of China stock market on the optimal capital structure choices of Chinese listed firms across years. The volatility of SSEC's returns is similar to that of SZSC's returns. Both the SSEC and SZSC fluctuated sharply in 2008 and 2015. An interesting point in Figure 1 is that after 2007, the volatility of the China stock market tends to be the opposite of the lending interest rate of China's debt market. Clearly, two peaks are observed for the volatilities of SSEC's and SZSC's returns over the entire sample, appearing in 2008 and 2015.

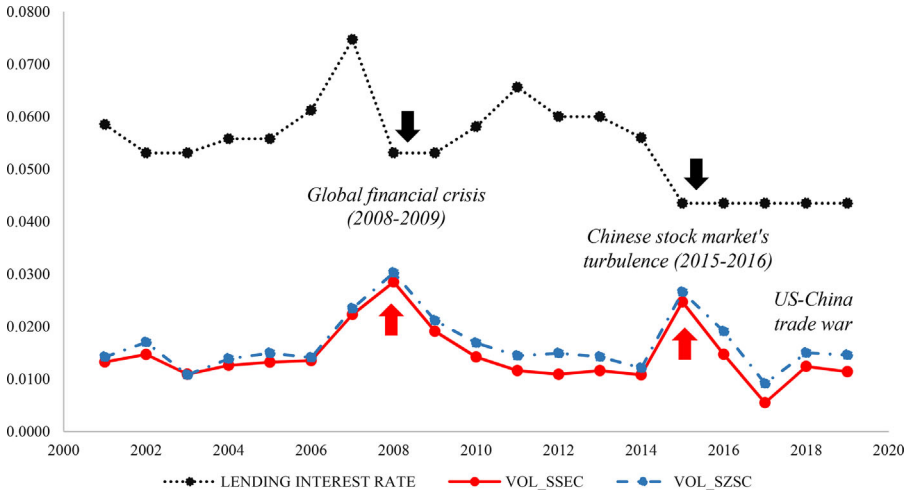

Figure 1. China stock market's volatility per year and annual China's lending interest rate (2001–2019).

Around these two peaks, China's lending interest rate also reaches its lowest levels. The global financial crisis in 2008 caused the collapse of the international banking system. Accordingly, China's lending interest rate declined to approximately 5.31% over two years—2008 and 2009. Moreover, the China stock market witnessed massive turbulence in 2015. The stock market price rapidly declined, and the SSEC Index decreased by 8.5% in July 2015. At the same time, China's lending interest rates fell to a record of 4.53% within 15 years (2001–2015).

Stock market volatility immediately reduces individual stock returns, leading to a decrease in the listed firm's market value (Bollerslev et al., 2006). The lending interest rate declines to signal the surge of loan supplies from banks and financial institutions. Given these considerable Chinese equity market volatilities, the debt financing demand of Chinese listed firms may increase. The growing volatility of the China stock market and a decrease in lending interest rate in the same year are predicted to encourage Chinese managers of listed firms to shift from market equity to debt financing. Chinese listed firms increase their likelihood to reach high market leverage ratios. Hence, we carry on the in-depth investigations on the fluctuations in the debt structures of Chinese listed firms. More specifically, this study seeks to determine which debt financing channel (bank debt or trade credit) is preferred by Chinese listed firms when China stock market's volatility increases simultaneously with the decline of bank loan costs.

With over 1,500 listed firms, the Shanghai Stock Exchange is renowned for being the largest and most important stock exchange in the China equity market, which in turn is a prominent emerging equity market in the Asia–Pacific. This study investigates the effect of volatility of the SSEC's returns on the capital structure choices of nonfinancial listed firms on the Shanghai Stock Exchange by using panel models covering the period of 2008–2018. Market leverages are used to measure capital structure for nonfinancial listed firms. Total market leverage is separated into short-term market leverage and long-term market leverage to assess their decisive role in Chinese listed firms. Our results indicate that the volatility of SSEC's returns immediately causes positive effects on total market leverage and short-term market leverage but has an inverse association with the long-term market leverage of Chinese listed firms. Moreover, we point out the effect of the volatility of SSEC's returns on the debt structure of Chinese listed firms through two popular debt sources. First, the increased volatility of SSEC's returns leads to a significant increase in borrowings from banks and financial institutions. In line with this result, we find a meaningful inverse relationship between the volatility of SSEC's returns and the debt costs of Chinese listed firms. Second, we test the effect of the volatility of SSEC's returns on the exploitation of trade credit and demonstrate its negative correlation.

Subsequently, we implement further tests on the debt structure of Chinese listed firms and find increases in the weight of bank debts in total liabilities; by contrast, the density of trade credit in total debts declines as the volatility of SSEC's returns increases. These results are in line with prior conclusions that the financing cost of bank loans is commonly lower than that of trade credit (Petersen & Rajan, 1997; Ge & Qiu, 2007). As a result, listed Chinese firms prefer to use bank debts, mainly short-term ones, rather than exploit trade credit when the China stock market's volatility increases and China's lending interest decreases. Furthermore, our empirical evidence is robust to trials involving sample selection, model selection, endogenous factor, and quantile regression (QR). The findings are vital to managers of Chinese listed firms and securities investors in China stock market. This study provides a pattern for examining similar concerns in other emerging markets in the context of the growing stock market volatility.

This paper is divided into six sections. Section 1 is the introduction; Section 2 summarizes the related literature; Section 3 describes the research sample, empirical models, and all variables; Section 4 reports the estimated results from both the baseline model and submodels; Section 5 comprises robust checks; and finally, Section 6 presents the conclusion.

Literature review and hypothesis development

The financial leverage and volatility feedback effects are adversative with reverse causality (Bollerslev et al., 2006). In general, these effects revolve around three baseline issues: stock return volatility, stock return/stock price, and financial leverage. Black (1976) and Christie (1982) report that the leverage effect assumes that the decrease in stock value leads to the rise in financial leverage and its stock return volatility, thereby implying an inverse link. By comparison, the volatility feedback effect supposes that when the volatility is priced, its increase immediately reduces the stock price and raises the future stock returns. As such, this effect implies that the stock return volatility has a positive link with the future stock return but an inverse relationship with the current stock price.

Previous evidence supports both leverage and volatility feedback effects. Figlewski and Wang (2000) investigate the leverage effect based on two aspects. The first is a link between the stock return and its volatility, while the second is the nexus between the stock return and financial leverage by using the S&P100 Index and its individual stocks. Overall, estimated results indicate that the leverage effect is strong in the relationships between the firm's stock returns and the volatilities of individual stock returns and the stock market. However, the link between the stock returns (individual and market returns) and financial leverage is nontrivial. The findings prove that the rise of stock market volatility leads to a decline in the firm's market capitalization. Hence, listed firms are more likely to use debt financing. By contrast, the empirical results of Smith and Yamagata (2011) reveal a positive relationship between the stock market volatility and individual stock returns of the S&P500 Index. This evidence aligns with the volatility feedback effect, implying that an increase in the return volatility at the market level leads to increased market value at the firm level. In addition, Smith and Yamagata (2011) prove that the volatility feedback effect of the stock market returns and the firm's stock returns exposure at the firm level. Their findings confirm that the return volatility affects the firm's stock returns can be considered in two tiers: volatility of stock market returns and volatility of firm's stock returns. Furthermore, the volatility feedback effect of the individual stock returns appears weaker than the volatility feedback effect relative to stock market returns.

In reality, Graham and Harvey (2001) discover that two-thirds of Chief Financial Officers concur that "the amount by which our stock is undervalued or overvalued was an important or crucial consideration" in issuing equity. Most of them concur that "if our stock price has recently risen, the price at which we can sell is high'" (page. 216). Baker and Wurgler (2002) synthesize the empirical evidence and detect that market timing theory turns around several study groups,

as follows. First, analysis of the actual financing decisions indicates that firms are more likely to issue equity rather than debt when the market value relatively increases to book value and past market values, and then are more likely to repurchase equity when the market value decreases. Second, firms commonly issue equity when its cost is low and repurchase equity when its cost is high. Third, analyzing returns forecasts and realizations around equity issues suppose that firms may tend to issue equity at times when investors are highly excited about returns prospects. Derived from existing literature on market timing theory, leverage effect, and volatility feedback effect, we anticipate that stock market volatility is most likely to influence a variation in individual stock returns appreciably, thereby immediately affecting corporate financing decisions.

The effect of stock return volatility on leverage shows ambiguous results. Ahmed and Hla (2019) suppose that the volatility of individual stock returns appears to be corporate characteristic volatility, which unfavorably affects the stock market conditions and raises risks in the business environment. Chen et al. (2014) point out a negative relationship between the volatility of individual stock returns and debt ratios, where an increase in the firm's stock return volatility reduces both leverages defined by book and market values. As such, firms with negative earnings and high costs of external financing reduce the solvency of debt obligations and raise the cost of bankruptcy in the future. In this context, companies reduce the optimal debt ratio to minimize fixed costs and expenses during financial distress. Ahmed and Hla (2019) find similar evidence that the adverse relationship between the volatility of individual stock returns and financial leverages (total book leverage and long-term market leverage) in Pakistan listed firms from 2001 to 2014. Inversely, the volatility of individual stock returns also increases in total market leverage and short-term market leverage in Pakistan listed firms. Ahmed and Hla (2019) explain that these companies have close relationships and rely heavily on debt financing from banks, and thus can even borrow debts when their business operations even when unprofitable. In the growing instability of the stock market, Pakistan listed firms use bank debts more instead of issuing shares. Additionally, Bayeh (2013) concludes the positive effect of volatility on the capital structure of Ethiopian insurance firms. Corporate managers are commonly quite sensitive to increased stock return volatility; enterprises tend to accept greater risk with high debt ratios. Moreover, corporate managers prefer financial leverage rather than other funding sources because the performance of usage debts is less important and receives low attention at low-supervision companies (Nam et al., 2003). The financial structure has a persistent and positive association with increasing volatility, and investors are always willing to place orders to broadly sell their stocks in the stock market (Yeh et al., 2013).

The literature related to the link between stock market volatility and corporate leverage remains scant, although studies on the change in the stock market price and corporate capital structure are quite abundant. Deesomsak et al. (2004) find that the stock market return has an inverse relation with the book leverage in Southeast Asian and Australian firms, inferring that corporations tend to issue greater equity than use debts as stock price increases. Antoniou et al. (2008) also indicate a negative relationship between market leverage and stock market returns in US and European firms, implying that the increase in stock market return leads to the decline in financial leverage at the firm level. According to the hypothesis of equity market supply issues, an increase in economic policy uncertainty leads to increased market leverage ratios in Brazilian firms (Schwarz & Dalmácio, 2021). Liu and Zhang (2015) find the positive nexus between economic policy uncertainty and stock market volatility. Given results imply that it is most likely that listed firms tend to use leverage at higher degrees when stock market volatility reaches higher levels.

In summary, previous papers relevant to the effect of the volatility of individual stock returns on corporate capital structure provide relatively ambiguous findings. Second, the limitation of these papers is the neglect of concurrent volatility of individual stock returns alongside the change in debt financing channels for corporate capital structure. Third, as mentioned, literature

mainly concentrates on the link between the volatility of stock market returns and individual stock returns or even between the former and corporate capital structure. Meanwhile, empirical evidence on stock market volatility and capital structure choices of listed firms are relatively scarce. Consequently, the present study provides the first framework for investigating the effect of stock market volatility on capital structure choices of listed firms.

In recent years, the China stock market has received considerable global attention because of its rapid increase and high growth rate along with the Chinese economy (Wang et al., 2020). Chinese total market capitalization was 12,214,466 million US$, ranked the second position in the global equity market in 2020[3]. However, China's stock market is fragile and vulnerable to shocks from the international market and uncertain economic policy conditions (Mensi et al., 2021; Wang et al., 2020). The extreme stock market volatility may make individual stock prices and stock returns of listed firms change significantly. This forces listed companies to adjust their market leverage. The 2008–2018 stage is considered the most volatile period of China's equity market, with massive instabilities in 2008, 2015, and 2018. China's debt market also showed a downtrend in the lending interest rate during this period. The most prominent event is that China has lost its status as the world's second-largest stock market and ceded to the Japanese equity market amid the US–China trade war[4]. The illustrated data in Figure 1 urge us to examine the effect of the volatility of China stock market on the market leverage of Chinese listed firms in 2008–2018. We expect that our study can clearly show how stock market volatility influences the choices of corporate capital structure from the specific context of China in this period. As mentioned in the Introduction, Chinese firms' capital structure and debt structure have unique characteristics exploited by many Chinese scholars. Therefore, besides capital structure, we implement further investigations of the variation in the debt structure of Chinese listed firms when facing the increased Chinese stock market volatility and decreased lending interest rate. To complete these tasks and fill gaps in previous studies based on the concrete conditions of China market, we concentrate on the following two hypotheses:

Hypothesis 1: Stock market volatility significantly affects the market leverage of Chinese listed firms.

Hypothesis 2: Stock market volatility significantly affects bank debts and trade credit of Chinese listed firms.

Sample, models and variables

Sample

This study uses a database from the annual financial statements of listed firms on the Shanghai Stock Exchange to investigate the yearly volatility impact of the Shanghai Composite Index (SSEC)'s returns on corporate financing decisions covering 2008–2018. Our sample excludes financial firms because of their distinctive capital structure. The daily stock prices of the SSEC Index are downloaded from Thomson Reuters Eikon from January 2008 to December 2018. The selected research period can cover the three terrible shocks in the China stock market. The accounting reports are extracted from the Taiwan Economic Journal database. We also exclude companies that omit observations from 2008 to 2018 to obtain strongly balanced panel data for 11 years, the last of which comprises 8,811 year-observations of 801 Chinese listed companies.

Models and variables

From our forecasts in Figure 1, we establish the baseline model (1) and five sub models (1.1), (1.2), (1.3), (1.4), (1.5) to investigate the immediate effect of the SSEC Index's volatility on capital

Table 1. Definition of variables.

Name	Variables	Definition
Short-term market leverage	SMKTLEV	Short-term liabilities divided by Market value plus Total liabilities
Long-term market leverage	LMKTLEV	Long-term liabilities divided by Market value plus Total liabilities
Total market leverage	TMKTLEV	Total liabilities divided by Market value plus Total liabilities
Profitability	PROFIT	Earnings before interest and tax divided by Total assets
Fixed assets	FIXASSET	The ratio of Fixed assets to Total assets
Firm size	SIZE	Logarithm of Total assets
Market to book ratio	MB	Market value plus Total liabilities divided by Total assets
Liquidity	LIQ	The ratio of total current assets to Total assets
Total bank debts	BANKDEBT	Total borrowings from banks and financial institutions divided by Total assets
Short-term bank debts	S-BANKDEBT	Short-term borrowings from banks and financial institutions (less than one year) divided by Total assets
Long-term bank debts	L-BANKDEBT	Long-term borrowings from banks and financial institutions (more than one year) divided by Total assets
Trade credit	TC	The ratio of Accounts payable to Total assets
Volatility of SSEC's returns	VOL_{SSEC}	The standard deviation of all daily stock returns of the Shanghai Composite Index (SSEC) for the same year.
The debt costs	COSTOFDEBT	The ratio of Interest expenses to Total liabilities
The ratio of bank debts to total debts	BANKDEBT-DEBT ratio	Total borrowings from banks and financial institutions divided by Total liabilities
The ratio of trade credit to total debts	TC-DEBT ratio	Accounts payable divided by Total liabilities

structure choices of listed firms on the Shanghai Stock Exchange. First, the baseline model (1) is used to survey the volatility impact of SSEC's returns on corporate market leverages, as follows:

$$\begin{aligned} MLEV_{i,t} &= ß_0 + ß_1{*}PROFIT_{i,t} + ß_2{*}FIXASSET_{i,t} + ß_3{*}\ SIZE_{i,t} + ß_4{*}MB_{i,t} + ß_5{*}LIQ_{i,t} \\ &\quad + ß_6{*}VOL_{SSEC_t} + \mu_{i,t} \end{aligned} \tag{1}$$

where MLEV denotes corporate market leverage in the baseline model (1) and consists of total market leverage (TMKTLEV), short-term market leverage (SMKTLEV), and long-term market leverage (LMKTLEV). The TMKTLEV is divided into two components (SMKTLEV, LMKTLEV) to shed light on their dominant role in Chinese firms' total debts in the context of increasing stock market volatility. The structural reform in 2005 and 2006 of China stock market required listed firms to convert nontradable to tradable shares. Thus, since 2007, trading volumes of Chinese listed companies have become more significant, and individual market values have been easily defined (Zhang et al., 2015). In addition, our primary purpose focuses on the volatility effect of SSEC's returns on capital structure choices of listed firms on the Shanghai Stock Exchange. Compared with book leverage, market leverage is more accurate and appropriate because of its greater proximity to the actual value when the equity market value varies substantially. Following Schwert (1990), we calculate the China stock market's volatility (VOL_{SSEC_t}) as the standard deviation of all daily SSEC's returns in the year (t). According to Shyam-Sunder and Myers (1999); Ni and Yu (2008); Leary and Roberts (2010); Pessarossi and Weill (2013), five control variables are used in the baseline model (1), including $PROFIT_{i,t}$, $FIXASSET_{i,t}$, $SIZE_{i,t}$, $MB_{i,t}$, and $LIQ_{i,t}$ to examine the effect of corporate characteristics on the market leverages for the firm (i) at time (t). $\mu_{i,t}$ is defined as an error term for the firm (i) at time (t). Table 1 describes all the used variables in this study.

We estimate the entire panel models by the pooled OLS regression with the fixed effect. Our research methodology is assisted by the Breusch–Pagan LM test (pooled versus random effect), Modified Ward test (heteroscedasticity), and Robust Hausman test (fixed effect versus random effect). Robust standard errors are clustered by the firm to consider heteroscedasticity. The collinearity diagnostics are explicitly reported in all regressions. The magnitude of the VIF test is expected to be less than 3 to exclude the multicollinearity issue. According to the classification of

Table 2. Number of firms in different industries.

	Industry	Number of firms
1	Agriculture, Forestry and Fishery	13
2	Mining	38
3	Manufacturing	412
4	Elec, Heat, Gas and Water	44
5	Construction	21
6	Wholesale and Retail	78
7	Transportation, Warehouse and Post	49
8	Accommodation and Restaurant Industry	4
9	Information Technology and soft ware	32
10	Real Estate	68
11	Leasing and Business	7
12	Science Research and Technical Services	3
13	Water, Environment and Utilities	6
14	Education	2
15	Health and Social Work	2
16	Culture, Sports and Entertainment	10
17	Conglomeration	12
Total firms		801

the China Securities Regulatory Commission (CSRC) in 2012, the Chinese industries are divided into 17 sectors in Table 2, excluding the financial industry.

Summary statistics

Table 3 briefly describes all variables included in our models through descriptive statistics and the correlation matrix. Panel A of Table 3 summarizes basic statistics of both dependent and independent variables. Observed firms are achieving mean total market leverage by approximately 34.80%. The mean of long-term market leverage is approximately 8.59%, while an average of short-term market leverage of 26.21%. The standard deviation of short-term market leverage is 16.82%; long-term market leverage is 10.57%; total market leverage is 21.41%. These results indicate that short-term market leverage is strongly volatile in the observed period. By contrast, the scattering of long-term market leverage is slighter, referring to the frequently adjusted short-term debts of Chinese listed firms. In Chinese firms, the proportion of long-term debts in total debts is commonly lower than that of short-term debts. Having various plausible reasons can explain this matter. First, the protection right of bondholders in China market is lacking. Second, long-term bondholders suffer high agency costs and significant information asymmetry. Third, using more short-term debts can eliminate the overinvestment problem because creditors can better control managers, and thus the risk-shifting issues are minimized. Finally, firms obtain a high debt tax shield from short-term debts with high interest rates. Moreover, short-term debts immediately meet the financing demands of firms in investment activities.

At a preliminary glance, we can easily detect that total bank debts account for 33.28% of total liabilities of Chinese listed firms. Chinese banks and financial institutions universally prefer to provide short-term loans rather than long-term loans for Chinese firms because to strictly and easily control short-term loans through renewals (Yiming et al., 2008). China's equity market witnessed tremendous instabilities covering the period 2008-2018, and thus average volatility of SSEC's returns reaches 0.0149 in unsurprising.

Panel B of Table 3 shows the correlation matrix of all used variables. TMKTLEV variable negatively correlates with the PROFIT, MB, and VOL_{SSEC} variables, but it has a positive correlation with the FIXASSET, SIZE, LIQ, BANKDEBT, and TC variables. Notably, the volatility of SSEC's returns (VOL_{SSEC}) has positive correlations with total bank debts ratio (BANKDEBT, BANKDEBT-DEBT ratio) and short-term bank debts ratio (S-BANKDEBT). Still, it is negatively

Table 3. Descriptive statistics and correlation matrix.

Panel A: Descriptive statistics of all variables

Variable	Mean	Maximum	Minimum	Std. Dev	Obs.	.25	.50	.75
SMKTLEV	0.2621	0.9335	0.0002	0.1682	8811	0.1282	0.2304	0.3700
LMKTLEV	0.0859	0.6635	0.0000	0.1057	8811	0.0097	0.0453	0.1239
TMKTLEV	0.3480	0.9852	0.0002	0.2141	8811	0.1698	0.3133	0.5051
PROFIT	0.0377	0.7494	−2.8592	0.0850	8811	0.0127	0.0352	0.0668
FIXASSET	0.2546	0.9709	0.0000	0.1944	8811	0.0963	0.2138	0.3826
SIZE	8.7147	14.7045	4.5134	1.4371	8811	7.7230	8.5584	9.5964
MB	2.0635	15.8049	0.6438	1.4213	8811	1.2051	1.6232	2.3911
LIQ	0.5147	0.9989	0.0000	0.2291	8811	0.3407	0.5211	0.6917
VOL_{SSEC}	0.0149	0.0285	0.0055	0.0064	8811	0.0109	0.0124	0.0191
BANKDEBT	0.1897	0.8935	0.0000	0.1498	8811	0.0622	0.1721	0.2859
S-BANKDEBT	0.1193	0.8492	0.0000	0.1171	8811	0.0219	0.0908	0.1824
L-BANKDEBT	0.0704	0.7751	0.0000	0.1009	8811	0.0000	0.0257	0.1038
COSTOFDEBT	0.0228	0.3477	0.0000	0.0185	8811	0.0037	0.0104	0.0188
BANKDEBT-DEBT ratio	0.3328	0.9854	0.0000	0.2253	8811	0.1469	0.3312	0.4941
TC	0.0935	0.6830	0.0000	0.0735	8811	0.0404	0.0745	0.1276
TC-DEBT ratio	0.1925	1.4289	0.0000	0.1478	8811	0.0841	0.1516	0.2698

Note: Statistics are described in detail by three quantile levels (0.25, 0.50, 0.75).

Panel B: Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
TMKTLEV (1)	1.0000															
LMKTLEV (2)	0.6347	1.0000														
SMKTLEV (3)	0.8743	0.1798	1.0000													
BANKDEBT (4)	0.5083	0.4738	0.3494	1.0000												
S-BANKDEBT (5)	0.2708	−0.0890	0.4006	0.7406	1.0000											
L-BANKDEBT (6)	0.4407	0.8071	0.0540	0.6259	−0.0606	1.0000										
COSTOFDEBT (7)	0.1330	0.1964	0.0460	0.4366	0.3884	0.1977	1.0000									
BANKDEBT-DEBT ratio (8)	0.2712	0.3502	0.1252	0.8741	0.6577	0.5350	0.4979	1.0000								
TC (9)	0.2022	−0.1710	0.3649	−0.1447	−0.0332	−0.1764	−0.2547	−0.2987	1.0000							
TC-DEBT ratio (10)	−0.2288	−0.3658	−0.0615	−0.4674	−0.2942	−0.3528	−0.3784	−0.4978	0.7312	1.0000						
PROFIT (11)	−0.2086	−0.1157	−0.1929	−0.2446	−0.2412	−0.0834	−0.1605	−0.1458	−0.0675	0.0829	1.0000					
FIXASSET (12)	0.0776	0.2264	−0.0435	0.2607	0.1493	0.2140	0.2687	0.2749	−0.0820	−0.0928	−0.0656	1.0000				
SIZE (13)	0.6013	0.5202	0.4386	0.1677	−0.0654	0.3251	0.0072	0.0808	0.0784	−0.1170	0.0952	0.0666	1.0000			
MB (14)	−0.6174	−0.3807	−0.5469	−0.2308	−0.0995	−0.2274	−0.0716	−0.1930	−0.0540	0.0968	0.0567	−0.0960	−0.4824	1.0000		
LIQ (15)	0.0017	−0.3101	0.1969	−0.2360	−0.0707	−0.2686	−0.3256	−0.3162	0.2882	0.2706	0.0664	−0.6850	−0.0838	0.0731	1.0000	
VOL_{SSEC} (16)	−0.0539	−0.0770	−0.0202	0.0620	0.0846	−0.0061	−0.0070	0.0849	−0.0190	−0.0252	−0.0338	0.0544	−0.1369	0.0740	−0.0257	1.0000

related to long-term bank debts ratio (L-BANKDEBT), cost of debts (COSTOFDEBT), and trade credit ratio (TC, TC-DEBT ratio).

Empirical results

The volatility impact of China stock market on market leverages of Chinese listed firms

Table 4 reports the empirical results of the baseline model (1) regarding the nexus between the volatility of SSEC's returns (VOL_{SSEC}) and market leverages of listed firms on the Shanghai Stock Exchange in the period of 2008–2018.

First, we carry out regression on the baseline model (1) on the TMKTLEV dependent variable. A vital control variable, VOL_{SSEC}, is related positively to the TMKTLEV at a 99% confidence interval in Column (1). According to the leverage effect's prediction and the immediate effect of the volatility feedback effect, the stock market volatility increases the adverse conditions of the equity market and reduces the listed firm's market capitalization due to the decline in individual stock returns (Figlewski & Wang, 2000). This is the main reason for the rise in the total market leverage of listed firms. When listed firms with underperforming traded stocks commonly bear higher equity costs because investors require discounts. Given these causes, firms listed on the stock exchange respond to financing demands by using greater debts when the stock returns are highly volatile (Pandey & Chotigeat, 2004).

Moreover, firms normally prefer to use debt financing in a bank-oriented environment because of the ease of accessing bank loans. The potential costs of nonrepayment may minimize debt settlement (Antoniou et al., 2008). Concurrently, banks and financial institutions can better control their loans. Meanwhile, in developing countries, bank loans are still critical external financing of enterprises. The bank loans remain the most accessible even when corporate profits are uncertain. Hence, higher stock market volatility is expected to cause listed firms to more likely rely on debts sourced from banks (Ahmed & Hla, 2019). The growing bank debts and a decline in market capitalization may lead to the formidable rise of total market leverage (Ghosh et al., 2000). Choi and Richardson (2016) provide a similar conclusion that the volatility of stock returns has a higher ability to raise corporate market leverage.

Subsequently, we substitute the SMKTLEV and LMKTLEV for the TMKTLEV in the baseline model (1). Empirical results are respectively reported in the subsequent columns of Table 4. The results indicate that the VOL_{SSEC} is positively involved in the SMKTLEV variable in Column (2). However, the increased volatility of SSEC's returns reduces the long-term market leverage in Column (3). Moreover, the coefficient of the SMKTLEV overwhelms the coefficient of the LMKTLEV. The rising stock market volatility immediately reduces the stock market returns and the individual stock returns (Figlewski & Wang, 2000). Therefore, listed firms decline in profit growth and lose the ability to pay their long-term debts in the future. The reduced profits also indicate the listed firms' low performance such that banks and financial institutions commonly require high interest rates with long-term debts. In addition, listed firms are also exposed to the risk of diminishing equity value. Specifically, risk premiums are requested more highly for investing in stocks of these firms. An increase in the cost of equity may prevent listed firms from paying off their debts due to insufficient funds. In special cases, the financial distress costs tend to raise leadings to the listed firms and reduce the proportion of long-term debts to avoid default costs (Ovtchinnikov, 2010). Similarly, a large number of studies also find that the volatility of stock returns negatively relates to the long-term market leverage ratio (Ahmed & Hla, 2019; Keefe & Yaghoubi, 2016).

PROFIT is negatively associated with three market leverage variables, and is robust to the prediction of Pecking–Order Theory (POT) and previous findings on the Chinese firm's capital structure (Chen, 2004; Huang & Song, 2006; Ni & Yu, 2008; Tong & Green, 2005). The

Table 4. The volatility impact of China stock market on market leverages of Chinese listed firms (2008–2018).

Dependent variables	Market leverages		
Coefficients	TMKTLEV (1)	SMKTLEV (2)	LMKTLEV (3)
ß $_{Constant}$	−0.0842[a]	0.0092	−0.0934[c]
	(0.0460)	(0.0404)	(0.0241)
ß $_{PROFIT}$	−0.3224[c]	−0.2078[c]	−0.1146[c]
	(0.0463)	(0.0321)	(0.0217)
ß $_{FIXASSET}$	0.1228[c]	0.1412[c]	−0.0185
	(0.0282)	(0.0206)	(0.0195)
ß $_{SIZE}$	0.0561[c]	0.0271[c]	0.0290[c]
	(0.0042)	(0.0038)	(0.0021)
ß $_{MB}$	−0.0522[c]	−0.0438[c]	−0.0084[c]
	(0.0030)	(0.0026)	(0.0007)
ß $_{LIQ}$	0.0476[a]	0.1291[c]	−0.0815[c]
	(0.0270)	(0.0226)	(0.0144)
ß $_{VOL_{SSEC}}$	0.4766[b]	0.8161[c]	−0.3394[c]
	(0.1860)	(0.1708)	(0.1005)
R^2 *within*	0.3939	0.3090	0.1895
R^2 *between*	0.6125	0.4659	0.4453
R^2 *overall*	0.5454	0.4107	0.3712
F-statistic *(p-value)*	0.0000[c]	0.0000[c]	0.0000[c]
Breusch-Pagan LM *(p-value)*	0.0000[c]	0.0000[c]	0.0000[c]
Modified Wald *(p-value)*	0.0000[c]	0.0000[c]	0.0000[c]
Robust Hausman *(p-value)*	0.0000[c]	0.0000[c]	0.0001[c]
Observations	8811	8811	8811

Collinearity Diagnostics

Variable (1)	VIF	Variable (2)	VIF	Variable (3)	VIF
TMKTLEV	2.29	SMKTLEV	1.84	LMKTLEV	1.61
PROFIT	1.15	PROFIT	1.11	PROFIT	1.06
FIXASSET	1.92	FIXASSET	1.93	FIXASSET	1.90
SIZE	1.80	SIZE	1.50	SIZE	1.67
MB	1.69	MB	1.64	MB	1.36
LIQ	1.94	LIQ	2.12	LIQ	2.00
VOL_{SSEC}	1.03	VOL_{SSEC}	1.03	VOL_{SSEC}	1.02
Mean (VIF)	1.69	Mean (VIF)	1.59	Mean (VIF)	1.52

Note: Table 4 reports the estimated results from the baseline model (1) using the pooled OLS regression for panel model with the fixed-effect. [a,b,c] characteristics indicate that the coefficient is significantly different from zero corresponding to 10%, 5%, and 1% levels; The Modified Wald test calculates for the Groupwise heteroscedasticity in the residuals of the panel model with the fixed-effect. The heteroscedasticity-robust standard errors are gathered by firms are reported in parentheses.

FIXASSET variable is positively correlated with total market leverage and short-term market leverage (Qian et al., 2009). In line with TOT expectation, firms have fewer agency problems or suffer lower distress costs as they own large tangible assets. The SIZE is positively related to all market leverages. These results are in accordance with the TOT that larger firms have a lower bankruptcy probability. Using a similar measure for firm size, Chen (2004), Tong and Green (2005), Zou and Xiao (2006), Bhabra et al. (2008), and Yang et al. (2015) report the same conclusion. The market-to-book ratio (MB) is a representative variable for the firm's investment opportunities. The POT predicts that the increased MB ratio can reduce debts and raise equity financing in the future. The negative coefficients of the MB are also found by Baker and Wurgler (2002). Jensen (1986) supposes that firms use higher debts to reduce free cash flow because of interest payment. Similarly, Guney et al. (2011) find that liquidity measured by the current ratio is adversely correlated to debts. LIQ variable negatively links with the LMKTLEV but positively connects with both TMKTLEV and SMKTLEV. Clearly, the growing short-term debts rapidly raise the cash and cash equivalents of Chinese listed firms, which likely use short-term debts to abate long-term debts, leading to an inverse relationship between the LMKTLEV and LIQ.

In brief, estimations from the baseline model demonstrate that Chinese listed firms increasingly use total market leverage and short-term market leverage and reduce the usage of long-term market leverage in order to immediately respond to the increased volatility of China stock market due to the effect of the terrible shocks on the equity market in the period of 2008–2018. The growing volatility of the China stock market tends to reduce the individual stock returns (leverage effect) and immediately decrease the individual stock prices (volatility feedback effect). As a result, the market value of listed firms significantly declines. Chinese listed firms prefer to use debt financing than issue equity. Another most plausible reason is that bank debt costs considerably decrease in the same year. Moreover, we detect the dominant role of short-term debts in the total debts of Chinese listed firms as stock market volatility increases. Going in-depth on peculiarities of the China market, we expand our investigations on the related debt financing sources that through the volatility of SSEC's returns is more likely to impact on adjusting market leverages of Chinese listed firms by using the submodels (1.1), (1.2), (1.3), (1.4), and (1.5) in the coming sections.

Effect of the volatility of China stock market on bank debts of Chinese listed firms

We forecast that heightened volatility of the stock market may drive the rising debts sourced from banks and financial institutions in the capital structure of Chinese listed firms. In addition, this positive effect is more pronounced when the cost of debts tends to decrease. The three submodels (1.1), (1.2), and (1.3) examine whether the volatility of SSEC's returns relates to the debts derived from banks and financial institutions of Chinese listed firms.

First, we survey the nexus between the volatility of SSEC's returns (VOL_{SSEC}) and the debt ratios borrowed from banks and financial institutions of Chinese listed firms (BANKDEBT, S-BANKDEBT, L-BANKDEBT) from 2008 to 2018 in the submodel (1.1), as follows:

$$\begin{aligned} \text{BANKDEBT}_{i,t} = {} & ß_0 + ß_1{*}\text{PROFIT}_{i,t} + ß_2{*}\text{FIXASSET}_{i,t} + ß_3{*}\text{SIZE}_{i,t} + ß_4{*}\text{MB}_{i,t} + ß_5{*}\text{LIQ}_{i,t} \\ & + ß_6{*}\text{VOL}_{\text{SSEC}_t} + \pi_{i,t} \end{aligned} \tag{1.1}$$

where BANKDEBT variable is defined as the total borrowings from banks and financial institutions divided by total assets. We separate total bank debts into short-term and long-term bank debts. The S-BANKDEBT variable is identified as the ratio of short-term debts from banks and financial institutions (less than one year) to total assets. L-BANKDEBT variable is determined as the ratio of long-term debts from banks and financial institutions (more than one year) to total assets. We use control variables, including PROFIT, FIXASSET, SIZE, MB, LIQ and estimate the submodel (1.1) by pooled OLS regression with the fixed effect.

Column 1 of Table 5 shows the estimated result on BANKDEBT dependent variable. We observe that when the volatility of SSEC's returns increases, the capital structures of Chinese listed firms include greater debts from banks and financial institutions. In the China stock exchange, the CSRC only allows eligible listed firms to issue shares to the public upon meeting required conditions. In addition, the offering rights have a negative relationship with the future stock returns of Chinese listed firms (Fonseka et al., 2012). According to the volatility feedback effect, the China stock market's volatility relates positively to future stock returns. Hence, Chinese listed firms are less able to issue equity. Moreover, Allen et al. (2005) insist that bank loans are the primary source of external financing for Chinese firms. Thus, we can expect that the increased loan supply forces Chinese listed firms to regulate their capital structures when China stock market's volatility surges at the same time. Columns 2 and 3 show that both the coefficients of S-BANKDEBT and L-BANKDEBT variables are significantly positive. Still, the magnitude of S-BANKDEBT coefficient is four times greater than that of L-BANKDEBT. This result suggests a

crucial role of short-term bank debts in the total bank debts of Chinese listed firms and the strict approach to long-term bank loans due to higher corporate bankruptcy costs in the context of increased China stock market's volatility.

Given that the China stock market's volatility positively impacts the bank debts of Chinese listed firms. It is inevitable to predict that the cost of bank debts declines. To prove this prediction, we continue to verify whether the volatility of SSEC's returns inversely relates to the debt financing costs[5] of listed firms in submodel (1.2):

$$\begin{aligned}\text{COSTOFDEBT}_{i,t} = {} & ß_0 + ß_1{*}\text{PROFIT}_{i,t} + ß_2{*}\text{FIXASSET}_{i,t} + ß_3{*}\ \text{SIZE}_{i,t} + ß_4{*}\text{MB}_{i,t} \\ & + ß_5{*}\text{LIQ}_{i,t} + ß_6{*}\text{VOL}_{\text{SSEC}_t} + \Omega_{i,t} \end{aligned} \tag{1.2}$$

where COSTOFDEBT is a proxy for the cost of debts that the firms are obliged to charge to their lenders. The specific interest rate of all borrowing contracts is quite hard to determine, and thus the debt costs are defined by the interest expenses scaled by total assets for firm (i) at time (t). In the submodel (1.2), we use control variables including PROFIT, FIXASSET, SIZE, MB, LIQ, and estimate the submodel (1.2) by pooled OLS regression with the fixed effect. In Column 4 of Table 5, the estimated coefficient of the VOL_{SSEC} is −0.0744 and significant at a 95% confidence interval. This negative coefficient confirms that the volatility of SSEC's returns has an inverse association with the debt costs of Chinese listed firms from 2008 to 2018.

To further confirm that the rise of total borrowings from banks and financial institutions results in the growing total debts of Chinese listed firms, we establish the submodel (1.3):

$$\begin{aligned}\text{BANKDEBT} - \text{DEBT ratio}_{i,t} = {} & ß_0 + ß_1{*}\text{PROFIT}_{i,t} + ß_2{*}\text{FIXASSET}_{i,t} + ß_3{*}\ \text{SIZE}_{i,t} \\ & + ß_4{*}\text{MB}_{i,t} + ß_5{*}\text{LIQ}_{i,t} + ß_6{*}\text{VOL}_{\text{SSEC}_t} + \pi_{i,t} \end{aligned} \tag{1.3}$$

where BANKDEBT-DEBT ratio is measured as total debts from banks and financial institutions scaled by total liabilities. We use control variables, including PROFIT, FIXASSET, SIZE, MB, LIQ, and estimate the submodel (1.3) by the pooled OLS regression with the fixed effect. Column 5 of Table 5 shows that a positive link between the BANKDEBT-DEBT ratio and the VOL_{SSEC} is significant at a 99% confidence interval. Evidently, the ratio of bank debts to total debts tends to increase in Chinese listed firms in reaction to the heightened volatility of China stock market in the post-2007 period. In general, the reported results in Table 5 demonstrate that the loan supply of Chinese banks and financial institutions combined with the debt demand of Chinese listed firms clearly explains a large proportion of bank debts in the total debts of Chinese listed firms when the volatility of China stock market surges.

Effect of the volatility of China stock market on trade credit of Chinese listed firms

Petersen and Rajan (1997); Fisman and Love (2003) emphasize that trade credit is one of the informal financing sources that are frequently exploited by Chinese firms. As enterprises encounter strict banking regulations and discriminations, Chinese firms tend to exploit their trade credit to fund financing requirements rather than bank loans (Allen et al., 2005; Ge & Qiu, 2007). Panel A of Table 3 clearly shows that total accounts payable approximately account for $1/5^{\text{th}}$ of the total liabilities of listed firms on the Shanghai Stock Exchange. This figure indicates that the density of trade credit in total debts of Chinese listed firms is not trivial. Therefore, we test the link between the volatility of SSEC's returns and the use of trade credit of Chinese listed firms in the period 2008–2018 following two sub models (1.4), (1.5):

$$\begin{aligned}\text{TC}_{i,t} = {} & ß_0 + ß_1{*}\text{PROFIT}_{i,t} + ß_2{*}\text{FIXASSET}_{i,t} + ß_3{*}\ \text{SIZE}_{i,t} + ß_4{*}\text{MB}_{i,t} + ß_5{*}\text{LIQ}_{i,t} \\ & + ß_6{*}\text{VOL}_{\text{SSEC}_t} + \pounds_{i,t} \end{aligned} \tag{1.4}$$

Table 5. The volatility impact of China stock market on bank debts of Chinese listed firms (2008–2018).

Dependent variables Coefficients	BANKDEBT (1)	S-BANKDEBT (2)	L-BANKDEBT (3)	COSTOFDEBT (4)	BANKDEBT-DEBT ratio (5)
ß $_{Constant}$	0.2408^{c}	0.2481^{c}	−0.0073	0.0311^{c}	0.5266^{c}
	(0.0485)	(0.0371)	(0.0296)	(0.0059)	(0.0699)
ß $_{PROFIT}$	−0.2084^{c}	−0.1708^{c}	−0.0376^{c}	−0.0123^{b}	−0.1078^{c}
	(0.0310)	(0.0265)	(0.0144)	(0.0048)	(0.0363)
ß $_{FIXASSET}$	0.1155^{c}	0.1029^{c}	0.0126	0.0160^{c}	0.0833^{a}
	(0.0345)	(0.0231)	(0.0252)	(0.0038)	(0.0478)
ß $_{SIZE}$	−0.0045	−0.0162^{c}	0.0117^{c}	−0.0005	−0.0163^{c}
	(0.0044)	(0.0036)	(0.0025)	(0.0005)	(0.0063)
ß $_{MB}$	−0.0114^{c}	−0.0098^{c}	−0.0016^{b}	−0.0003	−0.0177^{c}
	(0.0016)	(0.0016)	(0.0008)	(0.0003)	(0.0026)
ß $_{LIQ}$	−0.0527^{a}	−0.0034	−0.0493^{c}	−0.0107^{c}	−0.1349^{c}
	(0.0276)	(0.0209)	(0.0184)	(0.0035)	(0.0391)
ß $_{VOL_{SSEC}}$	1.1670^{c}	0.9616^{c}	0.2055^{b}	−0.0744^{b}	2.4726^{c}
	(0.1750)	(0.1509)	(0.1040)	(0.0310)	(0.2709)
R^2 *within*	0.0807	0.0931	0.0242	0.0300	0.0588
R^2 *between*	0.1846	0.0707	0.2616	0.2193	0.1762
R^2 *overall*	0.1431	0.0791	0.1773	0.1180	0.1273
F-statistic *(p-value)*	0.0000^{c}	0.0000^{c}	0.0000^{c}	0.0000^{c}	0.0000^{c}
Breusch-Pagan LM *(p-value)*	0.0000^{c}	0.0000^{c}	0.0000^{c}	0.0000^{c}	0.0000^{c}
Modified Wald *(p-value)*	0.0000^{c}	0.0000^{c}	0.0000^{c}	0.0000^{c}	0.0000^{c}
Robust Hausman *(p-value)*	0.0002^{c}	0.0025^{c}	0.0000^{c}	0.0000^{c}	0.0000^{c}
Observations	8811	8811	8811	8811	8811

Collinearity Diagnostics

Variable (1)	VIF	Variable (2)	VIF	Variable (3)	VIF	Variable (4)	VIF	Variable (5)	VIF
BANKDEBT	1.21	S-BANKDEBT	1.11	L-BANKDEBT	1.22	COSTOFDEBT	1.15	BANKDEBT-DEBT ratio	1.18
PROFIT	1.09	PROFIT	1.08	PROFIT	1.04	PROFIT	1.05	PROFIT	1.04
FIXASSET	1.93	FIXASSET	1.93	FIXASSET	1.90	FIXASSET	1.91	FIXASSET	1.91
SIZE	1.37	SIZE	1.37	SIZE	1.45	SIZE	1.35	SIZE	1.35
MB	1.35	MB	1.35	MB	1.33	MB	1.33	MB	1.36
LIQ	1.90	LIQ	1.90	LIQ	1.94	LIQ	1.97	LIQ	1.96
VOL_{SSEC}	1.03	VOL_{SSEC}	1.03	VOL_{SSEC}	1.02	VOL_{SSEC}	1.02	VOL_{SSEC}	1.03
Mean VIF	1.41	Mean VIF	1.39	Mean VIF	1.42	Mean VIF	1.40	Mean VIF	1.41

Note: Table 5 reports the estimated results from three submodels (1.1), (1.2), (1.3) using the pooled OLS regression for panel model with the fixed-effect. ^{a,b,c} characteristics indicate that the coefficient is significantly different from zero corresponding to 10%, 5%, and 1% levels; The Modified Wald test calculates for the Groupwise heteroscedasticity in the residuals of the panel model with the fixed-effect. The heteroscedasticity-robust standard errors are gathered by firms are reported in parentheses.

$$\begin{aligned} TC-DEBT\ ratio_{\,i,t} &= ß_0 + ß_1{*}PROFIT_{\,i,t} + ß_2{*}FIXASSET_{i,t} + ß_3{*}\ SIZE_{i,t} + ß_4{*}MB_{i,t} \\ &\quad + ß_5{*}LIQ_{\,i,t} + ß_6{*}VOL_{SSEC_t} + ϭ_{i,t} \end{aligned} \tag{1.5}$$

where TC is a proxy for trade credit. In the submodel (1.4), we define the TC by the accounts payable scaled by total assets (Fisman & Love, 2003). To indicate the relevant significance of trade credit exploitation to total debts, we establish a TC-DEBT ratio, which equals account payables divided by total liabilities in the submodel (1.5). We use control variables, including PROFIT, FIXASSET, SIZE, MB, LIQ, and estimate two sub models (1.4), (1.5) by pooled OLS regression with the fixed effect.

Column 1 of Table 6 reports that the TC is negatively related to the VOL_{SSEC} variable, suggesting that listed firms tend to reduce their use of trade credit in the context of the increased volatility of SSEC's returns. In Column 2, we firmly assert the adverse relationship between the VOL_{SSEC} and TC-DEBT ratio, implying that the ratio of trade credit to total debts decreases as the volatility of SSEC's returns heightens.

In summary, our estimated results in both Tables 5 and 6 indicate how Chinese listed firms align their debt structure in response to the increased China stock market's volatility and the

Table 6. The volatility impact of China stock market on trade credit of Chinese listed firms (2008–2018).

Dependent variables Coefficients	TC (1)	TC –DEBT ratio (2)
ß $_{Constant}$	0.0098	0.1531[c]
	(0.0215)	(0.0416)
ß $_{PROFIT}$	−0.0312[c]	0.0990[c]
	(0.0091)	(0.0190)
ß $_{FIXASSET}$	0.0694[c]	0.0417[a]
	(0.0121)	(0.0233)
ß $_{SIZE}$	0.0049[b]	−0.0024
	(0.0020)	(0.0040)
ß $_{MB}$	0.0007	0.0038[c]
	(0.0007)	(0.0014)
ß $_{LIQ}$	0.0503[c]	0.0939[c]
	(0.0124)	(0.0213)
ß $_{VOL_{SSEC}}$	−0.1629[b]	−0.6590[c]
	(0.0738)	(0.1573)
R^2 *within*	0.0310	0.0300
R^2 *between*	0.0666	0.1389
R^2 *overall*	0.0569	0.0994
F-statistic *(p-value)*	0.0000[c]	0.0000[c]
Breusch-Pagan LM *(p-value)*	0.0000[c]	0.0000[c]
Modified Wald *(p-value)*	0.0000[c]	0.0000[c]
Robust Hausman *(p-value)*	0.0000[c]	0.0000[c]
Observations	8811	8811

Collinearity Diagnostics

Variable (1)	VIF	Variable (2)	VIF
TC	1.15	TC-DEBT ratio	1.12
PROFIT	1.04	PROFIT	1.04
FIXASSET	1.95	FIXASSET	1.94
SIZE	1.37	SIZE	1.36
MB	1.33	MB	1.33
LIQ	2.12	LIQ	2.05
VOL_{SSEC}	1.02	VOL_{SSEC}	1.03
Mean VIF	1.43	Mean VIF	1.41

Note: Table 6 reports the estimated results from two submodels (1.4), (1.5) using the pooled OLS regression for panel model with the fixed-effect. [a,b,c] characteristics indicate that the coefficient is significantly different from zero corresponding to 10%, 5%, and 1% levels; The Modified Wald test calculates for the Groupwise heteroscedasticity in the residuals of the panel model with the fixed-effect. The heteroscedasticity-robust standard errors are gathered by firms are reported in parentheses.

decrease of China's lending interest rate in the debt market. Moreover, the positive relationships between the volatility of SSEC's returns (VOL_{SSEC}) and bank debt ratios (BANKDEBT, S-BANKDEBT), the inverse link between the volatility of SSEC's returns (VOL_{SSEC}) and trade credit (TC), the positive relationship between VOL_{SSEC} and BANKDEBT-DEBT ratio, and the inverse link between VOL_{SSEC} and TC-DEBT ratio obviously demonstrate that Chinese listed firms prefer to use bank debts with lower costs rather than trade credit (Petersen & Rajan, 1997; Ge & Qiu, 2007) when the volatility of China stock market ascends.

In the context of heightened volatility of the stock market, the capital structure decisions of Chinese listed firms may be briefly explained as follows. First, listed firms are more likely to suffer a high cost of equity due to the reduction in their market value, and thus cause tremendous demand for debt financing. Second, the reduced costs of debt financing from banks and financial institutions combined with its increased demand justify the considerable bank debts in the capital structure of Chinese listed firms. By comparison, despite its flexibility, TC is likely to force firms to pay higher costs than bank debts. Third, short-term debts and short-term bank debts with their benefits still play a decisive role in the capital structure choices of Chinese listed firms as the volatility of China stock market increases.

Robust tests

Sample selection issues

Similar to most prior studies on capital structure, financial firms are firstly excluded in our sample because of their different capital structure. In line with the analysis of Liu and Zhang (2015), we also eliminate Chinese utility firms from our data to clarify the selected sample. According to the Chinese industry classification, the utility industry includes hydraulic, environmental, and public management firms. Table 7 shows, in a sample excluding utility firms (2008–2018), the effect of the volatility of the China stock market on three market leverages (TMKTLEV, SMKTLEV, LMKTLEV), and the debt structure (BANKDEBT-DEBT ratio, TC-DEBT ratio) of Chinese listed firms. The empirical results are consistent with the ones in Tables 4–6, indicating that the exclusion of utility firms has no significant effect on our sample selection.

Shenzhen Stock Exchange is also critical in the China stock market, ranking behind Shanghai Composite Exchange. Therefore, we survey the effect of the volatility of the Shenzhen Composite Index (SZSC)'s returns on the adjusting capital structure of listed firms on the Shenzhen Stock Exchange by using a strongly balanced panel sample of 867 listed firms covering the period 2008–2018. Table 8 reports the results, which are mainly identical to those in Table 4 involving three market leverages and Tables 5 and 6 in relation to debt structure. In other words, our findings are robust to the majority of Chinese listed firms.

Model selection issue

Another aspect of the volatility feedback effect is that stock market volatility positively impacts the listed firm's future stock returns. As a result, the stock market volatility of the previous year has a likelihood to negatively influence the financial leverages of listed firms due to the rise of individual market values overwhelming the increasing debts. To confirm that the model selection fits our research motivations and purposes as stated in the Introduction, we replace the VOL_{SSEC} and other control variables with their lag version in the baseline model (1) and two submodels (1.3) and (1.5). Table 9 shows the empirical results on the effect of past volatility of the China stock market on the market leverages and debt structures of Chinese listed firms from 2008 to 2018.

First, the effect of the lag of remaining control variables on three market leverages (TMKTLEV, SMKTLEV, LMKTLEV), BANKDEBT-DEBT ratio, and TC-DEBT ratio variables are largely identical to the empirical results in Tables 4–6. $LAG.VOL_{SSEC}$ is still positively associated with the BANKDEBT-DEBT ratio in Column (4) and negatively correlated to the TC-DEBT ratio in Column (5). Most importantly, empirical evidence in Table 9 indicates that $LAG.VOL_{SSEC}$ is negatively associated with the three market leverages (TMKTLEV, SMKTLEV, LMKTLEV) in Columns (1), (2), (3) at a 99% confident interval. These results posit that stock market volatility has a positive relationship with individual stock returns in the future. In this context, the Chinese listed firms prefer to issue equity rather than use debt. The concrete evidence is that the massive increase of bank debts cannot exceed that of issuing equity. As a result, the market leverages of Chinese listed firms decrease. Additionally, the results in Table 9 provide vital evidence on the prediction of the leverage effect and the immediate effect of the volatility feedback regarding the negative link between the stock market volatility and individual stock returns in Table 4. Hence, built models fit our research motivations and purposes in the Introduction part.

Endogeneity concerns

The final issue is that volatility of the China stock market is most likely not an absolute exogenous variable but rather may be subject to the effect of financial behaviors at the market level. Such behaviors simultaneously relate to the China stock market's volatility and to capital

Table 7. The volatility impact of China stock market on market leverages and debt structure of Chinese listed firms excluding utility firms (2008–2018).

Dependent variables	Market leverages			Debt structure	
	TMKTLEV	SMKTLEV	LMKTLEV	BANKDEBT-DEBT ratio	TC-DEBT ratio
Coefficients	(1)	(2)	(3)	(4)	(5)
ß Constant	−0.0850[a]	0.0097	−0.0947[c]	0.5224[c]	0.1537[c]
	(0.0461)	(0.0405)	(0.0242)	(0.0701)	(0.0417)
ß PROFIT	−0.3218[c]	−0.2074[c]	−0.1143[c]	−0.1081[c]	0.0990[c]
	(0.0463)	(0.0321)	(0.0218)	(0.0364)	(0.0191)
ß FIXASSET	0.1223[c]	0.1403[c]	−0.0180	0.0785[a]	0.0427[a]
	(0.0285)	(0.0208)	(0.0197)	(0.0481)	(0.0235)
ß SIZE	0.0563[c]	0.0272[c]	0.0291[c]	−0.0156[b]	−0.0025
	(0.0042)	(0.0038)	(0.0022)	(0.0064)	(0.0040)
ß MB	−0.0522[c]	−0.0439[c]	−0.0083[c]	−0.0177[c]	0.0039[c]
	(0.0031)	(0.0026)	(0.0007)	(0.0026)	(0.0014)
ß LIQ	0.0487[a]	0.1299[c]	−0.0812[c]	−0.1362[c]	0.0936[c]
	(0.0271)	(0.0227)	(0.0144)	(0.0393)	(0.0215)
ß VOL_{SSEC}	0.4529[b]	0.8054[c]	−0.3526[c]	2.4794[c]	−0.6461[c]
	(0.1865)	(0.1718)	(0.1004)	(0.2718)	(0.1582)
R^2 *within*	0.3945	0.3090	0.1904	0.0581	0.0299
R^2 *between*	0.6125	0.4660	0.4449	0.1781	0.1394
R^2 *overall*	0.5455	0.4106	0.3713	0.1279	0.0996
F-statistic *(p-value)*	0.0000[c]	0.0000[c]	0.0000[c]	0.0000[c]	0.0000[c]
Breusch-Pagan LM *(p-value)*	0.0000[c]	0.0000[c]	0.0000[c]	0.0000[c]	0.0000[c]
Modified Wald *(p-value)*	0.0000[c]	0.0000[c]	0.0000[c]	0.0000[c]	0.0000[c]
Robust Hausman *(p-value)*	0.0000[c]	0.0000[c]	0.0003[c]	0.0000[c]	0.0000[c]
Observations	8745	8745	8745	8745	8745

Collinearity Diagnostics

Variable (1)	VIF	Variable (2)	VIF	Variable (3)	VIF	Variable (4)	VIF	Variable (5)	VIF
TMKTLEV	2.29	SMKTLEV	1.83	LMKTLEV	1.61	BANKDEBT-DEBT ratio	1.18	TC-DEBT ratio	1.12
PROFIT	1.15	PROFIT	1.11	PROFIT	1.06	PROFIT	1.04	PROFIT	1.04
FIXASSET	1.92	FIXASSET	1.93	FIXASSET	1.90	FIXASSET	1.91	FIXASSET	1.94
SIZE	1.80	SIZE	1.50	SIZE	1.67	SIZE	1.35	SIZE	1.36
MB	1.68	MB	1.64	MB	1.36	MB	1.36	MB	1.33
LIQ	1.95	LIQ	2.12	LIQ	2.00	LIQ	1.96	LIQ	2.06
VOL_{SSEC}	1.03	VOL_{SSEC}	1.03	VOL_{SSEC}	1.02	VOL_{SSEC}	1.03	VOL_{SSEC}	1.03
Mean VIF	1.69	Mean VIF	1.59	Mean VIF	1.52	Mean VIF	1.41	Mean VIF	1.41

Note: Table 7 reports the estimated results from the baseline model (1) and two submodels (1.3), (1.5) using the pooled OLS regression for panel model with the fixed-effect, but excluding the Chinese utility firms. [a,b,c] characteristics indicate that the coefficient is significantly different from zero corresponding to 10%, 5%, and 1% levels; The Modified Wald test calculates for the Groupwise heteroscedasticity in the residuals of the panel model with the fixed-effect. The heteroscedasticity-robust standard errors are gathered by firms are reported in parentheses.

structure choices of listed firms, such as the volatility of the US stock market. It is not too unexpected because currently, the stock markets have become more integrated more than ever (Ahmed et al., 2022). Hence, to solve these endogeneity concerns, we use the volatility of S&P500's returns, namely, the VOL_S&P500 instrumental variable, to control SSEC's volatility and apply the Two-Stage Least Squares (2SLS) estimation with the fixed effect. Estimated results from the 2SLS regression are presented in Table 10.

In the first stage, the results indicate that the VOL_S&P500 positively correlates with the VOL_{SSEC}, implying that the volatility of the US stock market positively affects that of the China stock market. In the second stage, the positive relationships between the TMKTLEV, SMKTLEV, BANKDEBT-DEBT ratio, and VOL_{SSEC} estimated by the VOL_S&P500 instrument variable remain significant. In addition, the TC-DEBT ratio maintains a negative association with the VOL_{SSEC} at a 99% confident interval. However, the positive link between VOL_{SSEC} and LMKTLEV is negligible. The P-values of both the Stock–Wright LM and Anderson–Rubin Wald

Table 8. The volatility impact of China stock market on market leverage and debt structure of Chinese listed firms using a panel sample of Shenzhen stock exchange (2008–2018).

Dependent variables	Market leverages			Debt structure	
Coefficients	TMKTLEV (1)	SMKTLEV (2)	LMKTLEV (3)	BANKDEBT-DEBT ratio (4)	TC-DEBT ratio (5)
ß $_{Constant}$	0.0263	0.1734^{c}	−0.1471^{c}	0.4366^{c}	0.2924^{c}
	(0.0351)	(0.0334)	(0.0259)	(0.0537)	(0.0317)
ß $_{PROFIT}$	−0.2253^{c}	−0.1487^{c}	−0.0766^{c}	−0.0678^{b}	0.0848^{c}
	(0.0370)	(0.0323)	(0.0136)	(0.0291)	(0.0231)
ß $_{FIXASSET}$	0.0530^{b}	0.0148	0.0381^{a}	0.1666^{c}	−0.0050
	(0.0221)	(0.0209)	(0.0210)	(0.0390)	(0.0215)
ß $_{SIZE}$	0.0475^{c}	0.0189^{c}	0.0286^{c}	−0.0141^{c}	−0.0081^{b}
	(0.0036)	(0.0034)	(0.0026)	(0.0055)	(0.0033)
ß $_{MB}$	−0.0436^{c}	−0.0369^{c}	−0.0067^{c}	−0.0208^{c}	0.0034^{b}
	(0.0023)	(0.0019)	(0.0006)	(0.0022)	(0.0016)
ß $_{LIQ}$	−0.1081^{c}	−0.0576^{b}	−0.0505^{c}	−0.0768^{b}	−0.0489^{b}
	(0.0253)	(0.0218)	(0.0111)	(0.0371)	(0.0227)
ß $_{VOL\_SZSC}$	0.3101^{a}	0.4370^{b}	−0.1269^{a}	2.5272^{c}	−1.0946^{c}
	(0.1719)	(0.1609)	(0.0702)	(0.2748)	(0.1662)
R^2 *within*	0.3575	0.2611	0.1655	0.0613	0.0153
R^2 *between*	0.6726	0.4788	0.4390	0.2772	0.0229
R^2 *overall*	0.5698	0.3934	0.3558	0.1740	0.0195
F-statistic *(p-value)*	0.0000^{c}	0.0000^{c}	0.0000^{c}	0.0000^{c}	0.0000^{c}
Breusch-Pagan LM *(p-value)*	0.0000^{c}	0.0000^{c}	0.0000^{c}	0.0000^{c}	0.0000^{c}
Modified Wald *(p-value)*	0.0000^{c}	0.0000^{c}	0.0000^{c}	0.0000^{c}	0.0000^{c}
Robust Hausman *(p-value)*	0.0000^{c}	0.0000^{c}	0.0000^{c}	0.0000^{c}	0.0000^{c}
Observations	9537	9537	9537	9537	9537

Collinearity Diagnostics

Variable (1)	VIF	Variable (2)	VIF	Variable (3)	VIF	Variable (4)	VIF	Variable (5)	VIF
TMKTLEV	2.38	SMKTLEV	1.73	LMKTLEV	1.59	BANKDEBT-DEBT ratio	1.27	TC-DEBT ratio	1.07
PROF	1.14	PROF	1.11	PROF	1.07	PROF	1.07	PROF	1.06
TANG	1.13	TANG	1.15	TANG	1.17	TANG	1.19	TANG	1.13
SIZE	1.81	SIZE	1.48	SIZE	1.66	SIZE	1.34	SIZE	1.35
MB	1.69	MB	1.65	MB	1.36	MB	1.39	MB	1.34
LIQ	1.21	LIQ	1.19	LIQ	1.21	LIQ	1.23	LIQ	1.20
VOL_SZSC	1.03	VOL_SZSC	1.03	VOL_SZSC	1.03	VOL_SZSC	1.04	VOL_SZSC	1.03
Mean VIF	1.48	Mean VIF	1.33	Mean VIF	1.30	Mean VIF	1.22	Mean VIF	1.17

Note: Table 8 reports the estimated results from the baseline model (1), two submodels (1.3), (1.5) using the pooled OLS regression for panel model with the fixed-effect, but employing a sample of listed firms on the Shenzhen Stock Exchange from 2008 to 2018. ^{a,b,c} characteristics indicate that the coefficient is significantly different from zero corresponding to 10%, 5%, and 1% levels; The Modified Wald test calculates for the Groupwise heteroscedasticity in the residuals of the panel model with the fixed-effect. The heteroscedasticity-robust standard errors are gathered by firms are reported in parentheses. VOL_SZSC is the volatility of the Shenzhen Composite Index (SZSC)'s returns in the period 2008–2018.

tests show that our instrument variable is robust for the estimations in Columns (1), (2), (4), (5), but weak for the regression in Column (3). The results from the 2SLS regression with the fixed effect considerably minimize the endogeneity concerns in the baseline model (1) and two submodels (1.3), (1.5).

Usage of the quantile regression (QR)

Compared with the pooled OLS regression, the QR for panel data has more evident advantages in a linear model with large outlier observations. Significantly, QR can show the linear relationships at different distributions. Following Nguyen et al. (2020), we apply a QR for the baseline model (1) and two submodels (1.3), (1.5) with the fixed effect at three quantile levels (0.25, 0.50, 0.75). Table 11 reports the estimated results from the baseline model (1) using QR with the fixed

Table 9. The impact of the lag of China stock market's volatility on market leverages and debt structure of Chinese listed firms (2008–2018).

Dependent variable	Market leverages			Debt structure	
Coefficients	TMKTLEV (1)	SMKTLEV (2)	LMKTLEV (3)	BANKDEBT-DEBT ratio (4)	TC-DEBT ratio (5)
ß $_{Constant}$	−0.0219	0.0148	−0.0367	0.5613[c]	0.1818[c]
	(0.0413)	(0.0343)	(0.0228)	(0.0649)	(0.0383)
ß $_{LAG.PROFIT}$	−0.2768[c]	−0.1824[c]	−0.0944[c]	−0.0137	0.1187[c]
	(0.0355)	(0.0292)	(0.0197)	(0.0409)	(0.0226)
ß $_{LAG.FIXASSET}$	0.0253	0.0923[c]	−0.0669[c]	0.0256	−0.0099
	(0.0257)	(0.0201)	(0.0183)	(0.0461)	(0.0224)
ß $_{LAG.SIZE}$	0.0529[c]	0.0306[c]	0.0223[c]	−0.0214[c]	−0.0019
	(0.0041)	(0.0034)	(0.0021)	(0.0059)	(0.0035)
ß $_{LAG.MB}$	−0.0210[c]	−0.0167[c]	−0.0043[c]	−0.0208[c]	0.0040[b]
	(0.0017)	(0.0014)	(0.0006)	(0.0026)	(0.0016)
ß $_{LAG.LIQ}$	0.0342	0.0882[c]	−0.0540[c]	−0.0803[b]	0.0522[b]
	(0.0243)	(0.0195)	(0.0129)	(0.0383)	(0.0210)
ß $_{LAG.VOL_{SSEC}}$	−4.0762[c]	−3.3383[c]	−0.7379[c]	1.9088[c]	−0.5832[c]
	(0.1900)	(0.1601)	(0.0974)	(0.2585)	(0.1409)
R^2 *within*	0.2602	0.1992	0.1169	0.0464	0.0257
R^2 *between*	0.6207	0.4674	0.3761	0.1013	0.0909
R^2 *overall*	0.4998	0.3665	0.2970	0.0756	0.0685
F-statistic *(p-value)*	0.0000[c]	0.0000[c]	0.0000[c]	0.0000[c]	0.0000[c]
Breusch-Pagan LM *(p-value)*	0.0056[c]	0.0000[c]	0.0000[c]	0.0000[c]	0.0000[c]
Modified Wald *(p-value)*	0.0000[c]	0.0000[c]	0.0000[c]	0.0000[c]	0.0000[c]
Robust Hausman *(p-value)*	0.0000[c]	0.0000[c]	0.0000[c]	0.0000[c]	0.0000[c]
Observations	8010	8010	8010	8010	8010

Note: Table 9 reports the estimated results from the baseline model (1) and two submodels (1.3), (1.5) with all independent variables at lag (1) by using the pooled OLS regression for panel model with the fixed-effect; [a,b,c] characteristics indicate that the coefficient is significantly different from zero corresponding to 10%, 5%, and 1% levels; The Modified Wald test calculates for the Groupwise heteroscedasticity in the residuals of the panel model with the fixed-effect. The heteroscedasticity-robust standard errors clustered by firms are reported in parentheses.

effect corresponding to three market leverages (TMKTLEV, SMKTLEV, LMKTLEV) in Panel A and two components of total debts in Panel B, respectively. Furthermore, the equality test of coefficients for pair quantiles (0.25 versus 0.50, 0.50 versus 0.75, and 0.25 versus 0.75, respectively) are shown in the three bottom rows of each panel.

At different quantiles, the findings of Table 11 are primarily identical to the estimated results in Tables 4–6 by using the pooled OLS regression with the fixed effect. In Panel A of Table 11, the positive coefficients of TMKTLEV are significant across three quantile levels (0.25, 0.50, 0.75) in Column (1). SMKTLEV is positively related to VOL_{SSEC} and considerable at three quantile levels in Column (2). By contrast, LMKTLEV is negatively associated with VOL_{SSEC} but only significant at two quantile levels (0.25 and 0.50) in Column (3). For Panel B, the BANKDEBT-DEBT ratio positively relates to VOL_{SSEC} in Column (1) at a 99% confident interval, while the TC-DEBT ratio is negatively and significantly associated with VOL_{SSEC} in Column (2) at three quantile levels.

All Chi-square values in the three bottom rows of Panels A and B are positive at a 1% significance level. This result indicates that the principal estimated coefficients from the QR vary across the different quantiles. In other words, the QR approach for the panel model strengthens our main results in Tables 4–6.

Conclusion

Choosing the capital structure as the increased stock market volatility is a vital concern of listed firms. This matter becomes more critical for listed firms activating in emerging markets, especially in China's equity market, due to the following problems. First, emerging equity markets are

Table 10. Controlling for an endogenous factor (2008–2018) – IV regression.

Dependent variable	Market leverages			Debt structure	
Coefficients	TMKTLEV (1)	SMKTLEV (2)	LMKTLEV (3)	BANKDEBT-DEBT ratio (4)	TC-DEBT ratio (5)
$\alpha_{VOL\_S\&P500}$	1.1319 [c]	1.1319 [c]	1.1319 [c]	1.1319 [c]	1.1319 [c]
	(0.0062)	(0.0062)	(0.0062)	(0.0062)	(0.0062)
$ß_{PROFIT}$	−0.3140 [c]	−0.2009 [c]	−0.1131 [c]	−0.1001 [c]	0.0970 [c]
	(0.0441)	(0.0305)	(0.0214)	(0.0349)	(0.0187)
$ß_{FIXASSET}$	0.1103 [c]	0.1311 [c]	−0.0207	0.0719	0.0448 [a]
	(0.0281)	(0.0206)	(0.0195)	(0.0470)	(0.0232)
$ß_{SIZE}$	0.0675 [c]	0.0365 [c]	0.0311 [c]	−0.0058	−0.0052
	(0.0043)	(0.0038)	(0.0023)	(0.0065)	(0.0042)
$ß_{MB}$	−0.0523 [c]	−0.0440 [c]	−0.0084 [c]	−0.0178 [c]	0.0039 [c]
	(0.0031)	(0.0026)	(0.0008)	(0.0025)	(0.0014)
$ß_{LIQ}$	0.0498 [a]	0.1309 [c]	−0.0811 [c]	−0.1329 [c]	0.0934 [c]
	(0.0268)	(0.0226)	(0.0143)	(0.0387)	(0.0213)
$ß_{VOL_{SSEC}}$	3.7302 [c]	3.4797 [c]	0.2505	5.4601 [c]	−1.4490 [c]
	(0.2940)	(0.2773)	(0.1696)	(0.4764)	(0.2869)
Stock-Wright LM (*p*-value)	0.0000 [c]	0.0000 [c]	0.1400	0.0000 [c]	0.0000 [c]
Anderson-Rubin Wald (*p*-value)	0.0000 [c]	0.0000 [c]	0.1397	0.0000 [c]	0.0000 [c]
F-statistic *(p-value)*	0.0000 [c]	0.0000 [c]	0.0000 [c]	0.0000 [c]	0.0000 [c]
Observations	8811	8811	8811	8811	8811

Note: Table 10 shows the estimated results from the baseline model (1) and two submodels (1.3), (1.5) by using the Two-Stage Least Squares (2SLS) regression with the fixed-effect. VOL_S&P500 is the volatility of the Standard & Poor's 500 (S&P500) Index. The daily stock price of the S&P500 Index is downloaded from Thomson Reuters Eikon in the period 2008-2018. The coefficient of the VOL_S&P500 variable in the first stage expresses directly the nexus between the VOL_{SSEC} and VOL_S&P500 variables. In the second stage, we analyze the impact of VOL_{SSEC} variable estimated by the VOL_S&P500 instrument variable on three market leverages (Column 1, Column 2, and Column 3) and debt structure (Column 4, Column 5); [a,b,c] characteristics indicate that the coefficient is significantly different from zero corresponding to 10%, 5%, and 1% levels; The heteroscedasticity-robust standard errors gathered by firms are reported in parentheses. The Stock-Wright LM test and the Anderson-Rubin Wald test are used to examine the weakness of instruments.

immature and volatile. Simultaneously, listed firms in developing markets are quite sensitive to the equity market's volatility. Second, thus far, corporate financing in China market essentially proceeds from internal funding and bank debts. In addition, Chinese firms universally have a high proportion of mature debts. Third, trade credit is an unofficial debt channel popularly used by Chinese firms when facing strict procedures from banks and credit institutions.

Our study examines how the Chinese stock market volatility immediately affects the capital structure choices of Chinese listed firms from 2008 to 2018. The unique point of this research is the approach based on the capital use routines of Chinese firms instead of using two traditional capital structure theories to explain Chinese corporate capital structure, as in excellent previous literature (Chen, 2004; Huang & Song, 2006; Ni & Yu, 2008; Tong & Green, 2005; Zou & Xiao, 2006). We find that Chinese listed firms use the total market leverage and short-term market leverage at high levels, but long-term market leverage is used at low levels when the China stock market volatility increases and the lending interest simultaneously decreases. Empirical results point out that the positive correlation between corporate market leverage and stock market volatility is derived from the decline in the listed firm's market value and the increase in bank debts. Trade credit significantly decreases while the bank debts tend to strongly increase in the debt structure of Chinese listed firms as the China stock market increases in volatility. Furthermore, we detect that short-term debts and bank debts are preferred in the capital structure of Chinese listed firms in response to the growing uncertainty of the China stock market and the change in lending interest rate.

This study contributes new literature related to corporate capital structure from several perspectives. First of all, this is the first practical evaluation of the link between the stock market volatility and capital structure choices of listed firms. Second, the research questions are addressed by providing persuaded evidence that heightened stock market volatility coupled with

Table 11. Estimated results using the quantile regression (QR) for the panel model with the fixed-effect (2008–2018).
Panel A: The volatility impact of China stock market on market leverages of Chinese listed firms

	Market leverages								
Dependent variable	TMKTLEV (1)			SMKTLEV (2)			LMKTLEV (3)		
Quantile	.25	.50	.75	.25	.50	.75	.25	.50	.75
ß $_{Constant}$	0.0661^{c}	−0.2936^{c}	−0.5877^{c}	0.0420^{c}	−0.1099^{c}	−0.2893^{c}	−0.0225^{c}	−0.0811^{c}	−0.2205^{c}
	(0.0186)	(0.0271)	(0.0340)	(0.0141)	(0.0198)	(0.0280)	(0.0038)	(0.0086)	(0.0187)
ß $_{PROFIT}$	−0.4273^{c}	−0.7699^{c}	−0.8359^{c}	−0.2939^{c}	−0.5025^{c}	−0.5930^{c}	−0.0454^{c}	−0.1376^{c}	−0.2772^{c}
	(0.0227)	(0.0329)	(0.0413)	(0.0172)	(0.0240)	(0.0340)	(0.0046)	(0.0105)	(0.0228)
ß $_{FIXASSET}$	0.0905^{c}	0.1198^{c}	0.1641^{c}	0.1103^{c}	0.1084^{c}	0.1329^{c}	−0.0150^{c}	−0.0200^{c}	−0.0068
	(0.0134)	(0.0195)	(0.0245)	(0.0102)	(0.0143)	(0.0202)	(0.0028)	(0.0062)	(0.0135)
ß $_{SIZE}$	0.0257^{c}	0.0785^{c}	0.1172^{c}	0.0113^{c}	0.0346^{c}	0.0596^{c}	0.0085^{c}	0.0255^{c}	0.0556^{c}
	(0.0015)	(0.0022)	(0.0028)	(0.0012)	(0.0016)	(0.0023)	(0.0003)	(0.0007)	(0.0015)
ß $_{MB}$	−0.0843^{c}	−0.0846^{c}	−0.0458^{c}	−0.0587^{c}	−0.0616^{c}	−0.0482^{c}	−0.0071^{c}	−0.0144^{c}	−0.0182^{c}
	(0.0015)	(0.0022)	(0.0028)	(0.0012)	(0.0016)	(0.0023)	(0.0003)	(0.0007)	(0.0015)
ß $_{LIQ}$	0.0650^{c}	0.1398^{c}	0.2581^{c}	0.1560^{c}	0.2580^{c}	0.4069^{c}	−0.0346^{c}	−0.0982^{c}	−0.1675^{c}
	(0.0114)	(0.0166)	(0.0208)	(0.0086)	(0.0121)	(0.0171)	(0.0023)	(0.0053)	(0.0114)
ß $_{VOL_{SSEC}}$	0.9333^{c}	1.6025^{c}	1.5060^{c}	0.8087^{c}	1.6275^{c}	1.2137^{c}	−0.2275^{c}	−0.3264^{b}	−0.2495
	(0.3003)	(0.4366)	(0.5478)	(0.2280)	(0.3185)	(0.4513)	(0.0615)	(0.1386)	(0.3017)
R-square	0.4069	0.3957	0.3066	0.3482	0.3264	0.2476	0.2515	0.3210	0.2644
Observations	8811	8811	8811	8811	8811	8811	8811	8811	8811
Q.25 vs Q.50	chi2(6) = 781.75; Prob. > chi2 = 0.0000			chi2(6) = 460.38; Prob. > chi2 = 0.0000			chi2(6) = 2004.85; Prob. > chi2 = 0.0000		
Q.50 vs Q.75	chi2(6) = 284.04; Prob. > chi2 = 0.0000			chi2(6) = 251.78; Prob. > chi2 = 0.0000			chi2(6) = 875.86; Prob. > chi2 = 0.0000		
Q.25 vs Q.75	chi2(6) = 940.90; Prob. > chi2 = 0.0000			chi2(6) = 702.48; Prob. > chi2 = 0.0000			chi2(6) = 2087.77; Prob. > chi2 = 0.0000		

Note: Panel A of Table 11 shows the estimated results from the baseline model (1) using the quantile regression (QR) for the panel model with the fixed-effect at three quantile levels (0.25, 0.50, 0.75). ^{a,b,c} characteristics indicate that the coefficient is significantly different from zero corresponding to 10%, 5%, and 1% levels; The standard errors are reported in parentheses.

Panel B: The volatility impact of China stock market on the debt structure of Chinese listed firms

	Debt structure					
Dependent variable	BANKDEBT-DEBT ratio (1)			TC-DEBT ratio (2)		
Quantile	.25	.50	.75	.25	.50	.75
ß $_{Constant}$	0.1447[c]	0.5313[c]	0.6943[c]	0.0101	0.0716[c]	0.1062[c]
	(0.0380)	(0.0325)	(0.0328)	(0.0117	(0.0167)	(0.0279)
ß $_{PROFIT}$	−0.5991[c]	−0.3605[c]	−0.1984[c]	0.0660[c]	0.1404[c]	0.2118[c]
	(0.0462)	(0.0395)	(0.0398)	(0.0142)	(0.0203)	(0.0339)
ß $_{FIXASSET}$	0.0909[c]	0.0940[c]	0.1723[c]	0.1527[c]	0.1607[c]	0.1418[c]
	(0.0274)	(0.0234)	(0.0236)	(0.0084)	(0.0120)	(0.0201)
ß $_{SIZE}$	0.0195[c]	−0.0042	−0.0118[c]	−0.0044[c]	−0.0088[c]	−0.0094[c]
	(0.0031)	(0.0027)	(0.0027)	(0.0010)	(0.0014)	(0.0023)
ß $_{MB}$	−0.0455[c]	−0.0338[c]	−0.0199[c]	−0.0011	0.0015	0.0096[c]
	(0.0031)	(0.0027)	(0.0027)	(0.0010)	(0.0014)	(0.0023)
ß $_{LIQ}$	−0.2353[c]	−0.2917[c]	−0.2816[c]	0.1555[c]	0.2367[c]	0.3846[c]
	(0.0232)	(0.0199)	(0.0200)	(0.0071)	(0.0102)	(0.0171)
ß $_{VOL_{SSEC}}$	3.1071[c]	3.0725[c]	3.5019[c]	−0.4779[c]	−0.9608[c]	−1.0987[b]
	(0.6126)	(0.5234)	(0.5279)	(0.1878)	(0.2685)	(0.4495)
R-square	0.1061	0.1025	0.0956	0.0590	0.0739	0.0835
Observations	8811	8811	8811	8811	8811	8811
Q.25 vs Q.50	chi2(6) = 191.08; Prob. > chi2 = 0.0000			chi2(6) = 228.46; Prob. > chi2 = 0.0000		
Q.50 vs Q.75	chi2(6) = 100.76; Prob. > chi2 = 0.0000			chi2(6) = 284.47; Prob. > chi2 = 0.0000		
Q.25 vs Q.75	chi2(6) = 325.20; Prob. > chi2 = 0.0000			chi2(6) = 503.29; Prob. > chi2 = 0.0000		

Note: Panel B of Table 11 reports the estimated results from two submodels (1.3), (1.5) using the quantile regression (QR) for the panel model with the fixed-effect at three quantile levels (0.25, 0.50, 0.75). [a,b,c] characteristics indicate that the coefficient is significantly different from zero corresponding to 10%, 5%, and 1% levels; The standard errors are reported in parentheses.

the cooling down of the debt market simultaneously affects corporate market leverages and debt structure in the specific context of China market. Finally, this article successfully depicts the financial behavior of Chinese corporate managers and securities investors in the most volatile period of the China stock market.

Notes

1. The World Bank database provides annual China's lending interest rate.
2. The annual volatility of China stock market in Figure 1 is calculated by the standard deviation of all daily stock returns of either the SSEC or SZSC for the same year.
3. The market capitalization of listed domestic companies (current US$). Data source: data.worldbank.org.
4. Newsfeeds from the website: cnbc.com on Friday, August 3rd, 2018.
5. The costs of bank debts account for the majority of the debt costs of Chinese firms (Liu & Zhang, 2015).

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