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The impact of cash flow volatility on firm leverage and debt maturity structure: evidence from China

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Abstract

Purpose – The purpose of this paper is to investigate the influence of cash flow volatility on firm's leverage levels. It also analyzes how cash flow volatility influences the debt maturity structure for the Chinese listed firms.

Design/methodology/approach – The authors construct the measure for cash flow variability as five-year rolling standard deviation of the cash flow from operations. The authors use generalized linear model approach to determine the effect of volatility on leverage. In addition, the authors design a categorical debt maturity variable and assign categories depending upon firm's usage of debt at various maturity levels. The authors apply Ordered Probit regression to analyze how volatility affects firm's debt maturity structure. The authors lag volatility and other independent variables in the estimation models so as to eliminate any possible endogeneity problems. Finally, the authors execute various techniques for verifying the robustness of the main findings.

Findings – The authors provide evidence that higher volatility of cash flows results in lower leverage levels, while the sub-sampling analysis reveals that there is no such inverse association in the case of Chinese state-owned enterprises. The authors also provide novel findings that irrespective of the ownership structure, firms facing high volatility choose debt of relatively shorter maturities and vice versa. Overall, a rise of one standard deviation in volatility causes 8.89 percent reduction in long-term market leverage ratio and 26.62 percent reduction in the likelihood of issuing debentures or long-term notes.

Research limitations/implications – This study advocates that cash flow volatility is an essential factor for determining both the debt levels and firm's term-to-maturity structure. The findings of this study can be helpful for the financial managers in maintaining optimal leverage and debt maturity structure, for lenders in reducing their risk of non-performing loans and for investors in their decision-making process.

Originality/value – Existing empirical literature regarding the influence of variability of cash flows on leverage and debt maturity structure is inconclusive. Moreover, prior research studies mainly focus only on the developed countries. No previous comprehensive study exists so far for Chinese firms in this regard. This paper endeavors to fulfill this research gap by furnishing novel findings in the context of atypical and distinctive institutional setup of Chinese firms.

Keywords Leverage, Cash flow volatility, Debt maturity, Chinese listed firms, State ownership

Paper type Research paper

1. Introduction

China is a leading emerging economy with an influential and prominent share in global economic system. Its economy is going through a transitional process from a centrally planned to a market-oriented economy. As compared to developed countries, China's capital markets are relatively young and are not capable of fully accomplishing the financing needs of companies and entrepreneurs, thereby making financial institutions a principal source of financing. Domination in the capital markets of China is of the state ownership. The state holds the controlling power of most listed firms in the form of equity holdings.

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Also, the banking system of China is being dominated by various large state-owned listed banks. Chang *et al.* (2014) argued that in monetary contraction periods, there are more chances that state-owned enterprises (SOEs) get priority for bank financing, thereby decreasing the availability of financing to non-state owned enterprises (NSOEs). Since short-term financing in China is widespread, various private enterprises have collapsed as a result of insufficient liquidity created due to banks' refusal to renew loans.

The existing literature about Chinese firms' leverage and debt maturity structure is limited. Cull and Xu (2003) found that bank financing has direct association with firm's profitability and measures of SOE reforms. For maintaining economic and social stability, banks can experience state's pressure to provide financing to Chinese SOEs, although it can be unfavorable to the interests of banks (Brandt and Li, 2003). Chinese NSOEs face financing friction by banks and consequently they choose more costly option of trade financing (Brandt and Li, 2003; Cull *et al.*, 2009). According to Fan *et al.* (2008), debt ratio and debt maturity of politically linked companies considerably reduced after the apprehension of their related corrupt bureaucrats. Firth *et al.* (2009) reported that private firms can acquire bank financing conveniently if state holds a minority ownership in those firms. For state-controlled listed firms, the state's presence implicitly provides loan guarantees and reduces the financial distress costs (Chang *et al.*, 2014). As far as China's bond market is concerned, it is quite young and is relatively underdeveloped with majority issuance of the treasury bonds, whereas the percentage of corporate bonds issuance is extremely small as compared to the huge amounts of bank loans to the firms (Chen *et al.*, 2014).

In this study, we attempt to analyze how volatility of cash flows (VCF) determines firm's leverage and debt maturity structure in the context of Chinese listed firms. VCF or business risk measures the likelihood of a firm to face financial distress. We define VCF as five-year rolling standard deviation of the cash flow from operations. Different survey evidences suggest that VCF is an important factor in financial managers' decisions regarding leverage policy (Brounen *et al.*, 2004; Graham and Harvey, 2001; Lee *et al.*, 2014). Optimal level of debt offsets the tax advantages of debt with financial distress costs (Dudley and James, 2015). Trade-off theory implies that firm's leverage level drops due to increase in VCF (Frank and Goyal, 2009) in order to balance the costs associated with debt, e.g., financial distress and bankruptcy costs, with the benefits associated with debt, e.g., tax advantages of debt, thereby maintaining an optimal level of debt (Bradley *et al.*, 1984; Kale *et al.*, 1991).

Despite strong theoretical explanations about why VCF should affect firm's financing decisions, the empirical literature is indecisive. For example, Rajan and Zingales (1995) and Frank and Goyal (2009) provided a list regarding reliable determinants of capital structure of a firm, but found that volatility does not significantly affect firm's leverage. Kayhan and Titman (2007) and Leary and Roberts (2005) did not include VCF in their studies. On the other hand, some past research studies such as Friend and Lang (1988) and Keefe and Yaghoubi (2016) found an inverse association of volatility with debt ratio, whereas according to Kim and Sorensen (1986), firm's level of debt is positively related to volatility.

According to Cai *et al.* (2008), the choice of debt maturity is very essential for a firm. Opting a particular maturity mix may help firms to avoid possible corporate liquidations, address agency problems, consider financing flexibility and signal their earnings quality. Through using an option valuation model, Kane *et al.* (1985) showed a negative impact of volatility of assets returns on debt maturity. Sarkar (1999) also determined that debt maturity has an inverse association with risk and further argues that volatility gives rise to the probability of financial distress, consequently leading to higher risk of bankruptcy. For shunning this risk, there are more chances that the firms will use shorter maturity debts.

The existing literature, thus, shows a relative lack of agreement on how volatility influences leverage. Moreover, most of the prior studies who aim to find the impact of volatility or business risk on leverage and debt maturity focus only on the developed countries. Keeping in view the lack of research in the case of emerging economies on this subject, this paper endeavors to provide the findings about the influence of VCF on both debt levels and debt maturity structure in the Chinese setting, which has a number of institutional differences with the developed countries.

To fulfill these objectives, we apply the generalized linear model (GLM) to analyze this impact of VCF on leverage. It is because the dependent variable leverage is a fractional or proportional variable and the conditional expectation is a non-linear function of explanatory variables (Cook *et al.*, 2008). We compute both book and market leverage ratios, where we measure debt as either all liabilities of the firm, long- and short-term debt or only long-term debt. The findings indicate that VCF has negative and significant effect on each leverage measure. The economic importance can be understood from the finding that a drop of around 7.87 percent in the long-term market leverage ratio takes place due to a rise of one standard deviation in VCF. Our sub-sample analysis provides evidence that VCF has no effect on the debt levels of SOEs. However, in the case of NSOEs, we find an inverse effect of volatility on debt levels, where a rise of one standard deviation in VCF causes a decline of around 8.89 percent in the long-term market leverage ratio.

In order to determine how VCF affects firm's debt maturity, we create a categorical debt maturity variable and assign categories depending upon firm's debt usage at various maturities. We place firms in category 1 if they do not hold any kind of debt and in category 2 if they use only short-term debt. We assign category 3 to the firms if they hold debt with maturity above one year, but have not issued any debentures or long-term notes payables. Lastly, if firms issue debentures or long-term notes payables, we put them in category 4. By applying the ordered probit model, our results indicate that the high (low) VCF enhances firm's likelihood to use debt having relatively shorter (longer) maturities. We also find that for both SOEs and NSOEs, debt maturity has a negative association with VCF, however, the association is stronger in the case of NSOEs. To show the economic magnitude, we find that a rise of one standard deviation in VCF causes approximately 26.62 percent reduction in the likelihood of a firm to hold debentures or long-term notes, and approximately 43.36 percent increase in the likelihood of a firm to use no debt at all.

This study uses several techniques to examine the robustness of our key estimates. First, we re-investigate our findings using alternative measures of VCF and debt maturity. Second, we compute volatility measure by using rolling standard deviation of operating cash flows over different window lengths of three and four years. Lastly, we re-analyze the relationship between VCF and leverage using ordinary least square (OLS) estimation method. While applying these various robustness tests, our results remain qualitatively unaffected.

Our organization for the remaining part of this paper is as follows. Section 2 provides the theoretical framework for developing hypotheses of this research. Section 3 reports the characteristics of our sample. It also shows the construction of variables and models. Section 4 provides the outcomes of the study and their related discussion. Section 5 shows the robustness tests from various dimensions. Finally, Section 6 concludes our research and provides implications of this study.

2. Development of hypothesis

High variability of cash flows and higher financial distress costs are the characteristics of riskier firms. Trade-off theory assumes that firms experiencing high risk opt relatively lower debt. There also exist other solid theoretical explanations which lead us to believe that volatility affects the leverage structure. For example, Merton (1974) models equity as a call option on the assets of the firm. According to this model, if firm's value of debt is higher than the value of assets at the time of maturity of the debt, it consequences to firm's default. This notion provides a simple manifestation for the probability of firm's default as a function of present value of the assets of the firm compared with the value of the debt and assets volatility. Leland (1994) derived optimal capital structure by proposing a model similar to that of Merton (1974), who argued that optimal leverage offsets debt-tax advantages with the expected financial distress costs. Escalating volatility raises the probability of occurrence of situation where the firm is no longer able to avail the debt-tax advantages.

In most of the previous research studies, the influence of volatility on level of debt is mentioned to be negative. It is because as volatility rises, it gives rise to the chances of facing financial distress and as a result decreases the current value of debt-tax advantages. Moreover, empirical study on the cost of debt by Minton and Schrand (1999) shows that VCF has positive correlation with the cost of debt. So, the firms facing high VCF decrease their leverage levels so that they can minimize their cost of debt. Therefore, we hypothesize that leverage has an inverse relationship with VCF:

H1. The association between leverage and cash flow volatility is negative.

Miltersen and Torous (2008) confirm that volatility is a key variable that influences the firm's optimal debt maturity. According to them, volatility has an inverse effect on debt maturity. Using comparative statistical analysis, Dangl and Zechner (2016) claim that high cash flow volatility reduces optimal debt maturity, whereas the cash flow growth rate and the transaction costs related to debt rollover extend the optimal maturity of the debt. By applying the Black and Scholes (1973) model to the capital structure, Keefe and Yaghoubi (2016) illustrated that when firms with high VCF issue debt of longer maturities, the value of debt declines thereby increasing the marginal cost of the debt. As a result, firms experiencing high volatile cash flows are more expected to issue debt of shorter maturities.

Ju and Ou-Yang (2006) found that firms having high asset volatility prefer to issue debt more frequently because it enables them to avail tax advantages associated with the debt or decrease the bankruptcy related costs, depending upon the situation. Once the value of assets rises, firms enhance the debt issuance so that they can acquire the tax advantages. As the value of assets drops, firms are more expected to decrease the debt issuance for decreasing the bankruptcy costs. Thus, firms tend to issue debt of shorter maturities, so that they are able to issue debt more frequently in order to deal with high asset volatility. Therefore, we hypothesize that firms opt shorter maturity debts when they face higher VCF:

H2. Firms with high (low) cash flow volatility are more expected to use the debt of short (long) maturities.

The state provides an implied guarantee on the loans obtained by SOEs, so the chances of failure for these firms are very few. There can be many reasons because of which the state shows unwillingness to the default of SOEs: achieving political and public welfare goals, like maintaining high employment rate and domestic investment; ambition to sustain main industries which are rendering vital services to the nation; and disinclination for being related to failed investments (Borisova *et al.*, 2015). Therefore, if SOEs encounter the situation where they are no longer able to pay back their financial obligations, it is highly possible that the state will provide financial assistance to them in the form of direct investments, loans and/or tax credits. The state can also provide support through waiver of any previous loans extended to these firms or by altering the terms of previous loans (Frydman *et al.*, 1999). On the contrary, NSOEs face financing friction by banks because of both the inelastic demand by SOEs for bank loans which creates limited resource availability for NSOEs, and operating inefficiency of state-controlled commercial banks (Wang and Li, 2013). Thus, due to higher financial constraints, we expect the sensitivity of NSOEs' response to VCF in both level of debt and debt maturity to be higher than SOEs:

H3. In both level of debt and debt maturity, sensitivity of NSOEs' reactions to cash flow volatility is higher than SOEs.

3. Research design

3.1 Sample

Our sample comprises all non-financial firms that have issued A-shares and are listed on Shenzhen Stock Exchange or Shanghai Stock Exchange over the period starting from 1997 to 2015. The pertinent annual data are taken from the RESSET Financial Research Database and China Stock Market and Accounting Research Database. Firms, whose book values for total assets, total liabilities or revenues are missing, have been eliminated from our sample. Firms having negative common equity, total assets or total revenues are also excluded.

To ensure that the sample does not contain any outliers, we follow Kale and Shahrur (2007) and winsorize our variables at the 1st and 99th percentiles. These procedures yield a final sample of 2,235 firms and 31,142 firm-year observations.

3.2 Measurement of VCF

There is no standard measure of VCF. Prior empirical studies use various volatility measures, such as annualized standard deviation of operating cash flows scaled by total assets (Dierker *et al.*, 2013), first difference of the percentage change in annual earnings minus average of the first differences (Antoniou *et al.*, 2009), standard deviation of the return on sales (Booth *et al.*, 2001), or standard deviation of earnings before interest and taxes (EBIT) divided by firm's assets (Friend and Lang, 1988).

According to Allayannis and Weston (2003), applying actual financial statements data reported by firms for constructing cash flow measure is superior than using alternative cash flow measures utilizing income statement or changes in balance sheet items. Therefore, we use cash flow from operations, as provided in the statement of cash flows, as our cash flow measure.

In order to measure VCF, we follow Friend and Lang (1988) and calculate five-year rolling standard deviation of the cash flow from operations. In addition, for our robustness tests, we follow Bradley *et al.* (1984) and Chaplinsky and Niehaus (1993) by computing the rolling standard deviation of first difference of the cash flow from operations over the five years window. We also re-compute the results using three and four year windows in our robustness section.

Several earlier research studies such as Bradley *et al.* (1984) and Dierker *et al.* (2013) scale volatility measure by firm's total assets. According to Pinkowitz and Williamson (2007), cash holdings of the firm are a function of VCF. To abolish this function, we eliminate cash from total assets. Thus, we use firm's net assets (total assets less cash and tradable securities) for scaling VCF. The benefit of scaling the volatility measure is that it makes the measure comparable across the firms.

For eliminating any possible outliers, we winsorize VCF at 1st and 99th percentiles. Finally, we lag volatility measure to deal with any possible endogeneity issues.

3.3 Measurement of leverage

There are plenty of ways to measure leverage. Following the literature, this study measures leverage by both book and market leverage ratios. By adopting six leverage measures used by Huang and Song (2006), we estimate total-liabilities book leverage ratio (BLR_TL) as total liabilities in the numerator and total liabilities plus equity's book value in the denominator. We construct total-debt book leverage ratio (BLR_TD) by dividing total debt (short-term plus long-term debt) by total debt plus equity's book value. Long-term book leverage ratio (BLR-LTD) is constructed as long-term debt in the numerator and long-term debt plus equity's book value in the denominator. In order to obtain market leverage ratios, we replace equity's book value in BLR_TL, BLR_TD and BLR_LTD by equity's market value and get total-liabilities market leverage ratio (MLR_TL), total-debt market leverage ratio (MLR_TD) and long-term debt market leverage ratio (MLR_LTD), respectively.

3.4 Construction of debt maturity

Debt maturity has been determined in multiple ways in earlier studies, for example, Fan *et al.* (2012) estimate it by dividing long-term debt with total debt. Barclay and Smith (1995) construct debt maturity as debt having more than three years of maturity divided by total debt. Keefe and Yaghoubi (2016) use a novel approach and assign categories depending upon the firm's debt usage at various maturity levels. We adopt the similar approach as used by Keefe and Yaghoubi (2016), but with some modification in the construction of debt maturity categories[1].

Based on the different maturities of debt used by a firm, we create an ordered categorical variable. Table I depicts that ordered categorical variable debt-maturity is set to category 1, when firms do not use any kind of debt. Debt-maturity variable is set to category 2 when firms only hold debt with maturity under one year. Firms are assigned category 3 if they have issued debt with maturity exceeding one year, but have not issued any debentures or long-term notes payable (which are usually with maturity of more than ten years). For category 3, it does not matter if the firms hold any short-term debt or not. Finally, debt-maturity variable is assigned category 4 when firms hold debentures or long-term notes payable. In short, a firm's debt maturity extends as our categorical variable moves from one to four.

Since various former studies use different proxies to measure debt maturity, therefore, we also use some of those proxies for our robustness checks. We adopt the measure used by Demirgüç-Kunt and Maksimovic (1999) and compute debt maturity as the ratio of long-term liabilities to total liabilities. We also adopt the proxy used by Barclay and Smith (1995) as the proportion of debt with maturity exceeding three years, but because our data source lacks the provision of data regarding the specific maturities of debt, so we slightly adjust the measure as the ratio of firm's total debt with maturity above one year to total liabilities.

3.5 Estimation models and control variables

3.5.1 VCF and leverage. To analyze the influence of VCF on leverage, we follow Papke and Wooldridge (1996) and Kieschnick and McCullough (2003) by applying the GLM with logit link function (G) because our dependent variable is a fraction whose value is restricted between 0 and 1. Cook *et al.* (2008) found that the conditional expectation for a fractional variable is a non-linear function of the explanatory variables, whereas applying a linear function may cause some common specification errors. Therefore, we use the GLM model as shown below:

$$E\left(Lev_{i,t}\right) = G\big(\beta_0 + \beta_1\ VCF_{i,t-1} + \beta_2\ Tang_{i,t-1} + \beta_3 Size_{i,t-1} + \beta_4\ I_{Lev_{j,t-1}} + \beta_5\ Prof_{i,t-1} + \beta_6\ PastProf_{i,t-1} + \beta_7\ NDTS_{i,t-1} + \beta_8\ F_{Age_{i,t-1}} + \beta_9\ Inf_{t-1} + \beta_{10}\ Growth_{i,t-1} + \varepsilon\big) \quad (1)$$

Table I. Construction of debt maturity variable

Debt maturity	Debentures and long-term notes payable	Total long-term debt	Total short-term debt
1	No	No	No
2	No	No	Yes
3	No	Yes	May be
4	Yes	Yes	May be

Notes: This table shows the construction of debt maturity variable. First column shows the number of categories for the debt maturity variable. "Yes" specifies that the firm is using that kind of debt, while "No" indicates that firm is not using that particular kind of debt. "May be" means firm may or may not be using that debt

The subscript "j" denotes industry because variable "I_Lev" is industry-specific rather than firm-specific. Similarly, "Inf" is not firm-specific, rather it is macroeconomic variable which varies only across time, therefore, we use subscript "t−1" for it.

In this model, we include various control variables to avoid any possible alternative explanations. In order to get rid of potential endogeneity issues, we lag VCF and all other independent variables. Following Rajan and Zingales (1995), we divide fixed assets by total assets to compute tangibility (Tang). To calculate firm size (Size), we adopt the measure used by Huang and Song (2006), that is, the natural logarithm of sales. Industry leverage (I_Lev) denotes the median industry leverage (Frank and Goyal, 2009), constructed as the median of total debt to total assets of the industry, based on the second level China Securities Regulatory Commission's industry classification. According to Kester (1986) and Wald (1999), profitability (Prof) exerts largest single impact on leverage (Lev). We measure profitability using EBIT scaled by total assets. We follow Ahsan *et al.* (2016) and calculate past profitability (PastProf) as the ratio of retained earnings to total assets. DeAngelo and Masulis (1980) found that the tax advantages of debt can be substituted by non-debt tax shields (NDTS), suggesting a negative association between NDTS and leverage. We use ratio of depreciation to total assets to measure NDTS. We compute firm age (F_Age) as the number of years since the incorporation of the firm. We obtain inflation rate (Consumer Prices) from World Development Indicators database and use it as the measure for Inflation (Inf). Following Cooper *et al.* (2008), year-on-year percentage change in total assets of the firm is used as a proxy for Growth.

3.5.2 VCF and debt maturity. To analyze how VCF affects firm's debt maturity, we apply an ordered probit model. The construction of debt maturity is described in Section 3.4. We assign four categories to debt maturity variable starting from firms holding zero debt to firms with debt of very long maturities such as debentures and long-term notes payables:

$$\begin{aligned}\Pr\left(DM > m \mid c, X_{t-1},\ v_j\right) = \emptyset\big(&\beta_1\ VCF_{t-1} + \beta_2\ Tang_{t-1} + \beta_3\ Size_{t-1} \\ &+ \beta_4\ I\_Lev_{t-1} + \beta_5\ Prof_{t-1} + \ \beta_6\ PastProf_{t-1} + \beta_7\ NDTS_{t-1} \\ &+ \beta_8\ F\_Age_{t-1} + \beta_9\ Inf_{t-1} + \beta_{10}\ Growth_{t-1} + v_j - c_m\big)\end{aligned} \quad (2)$$

In this model, m represents the category number, c denotes the set of cut points, $\varnothing$ is the cumulative distribution function of the standard normal distribution, and residual v_j has the standard normal distribution $N(0, 1)$. Since we use four categories for debt maturity variable, that is, $m = 4$, so the cut-points in this model are $c = 3$.

3.6 Sub-sample analysis

Keeping in mind the unique characteristics about institutional setup and ownership structure in Chinese firms, we consider it inevitable to divide our sample into NSOEs and SOEs. We run Equations (1) and (2) for each sub-sample and investigate whether the findings are consistent with the estimates obtained from our overall sample.

In addition to sub-sample results, we estimate Equations (1) and (2) for the entire sample with SOE(0/1) dummy variable and the interaction term SOE(0/1) × VCF as explanatory variables. The interaction SOE(0/1) × VCF tests for differences in sensitivity in both leverage and debt maturity of NSOEs vs SOEs to VCF.

4. Results and analysis

4.1 Descriptive statistics and correlation matrix

Table II provides the descriptive statistics of the variables used in this study. For the overall sample, NSOEs as well as SOEs, the means of BLR_TL, BLR_TD and BLR_LTD are higher

Table II.
Descriptive statistics

Variables	Overall					Non-state owned enterprises (NSOEs)					State-owned enterprises (SOEs)				
	n	Mean	SD	P25	P75	*n*	Mean	SD	P25	P75	*n*	Mean	SD	P25	P75
Tang	31,129	0.267	0.176	0.132	0.375	18,674	0.245	0.161	0.124	0.337	12,455	0.300	0.191	0.149	0.432
Size	31,142	20.793	1.468	19.795	21.655	18,684	20.617	1.424	19.659	21.455	12,458	21.056	1.493	20.039	21.955
I_Lev	31,142	0.484	0.072	0.428	0.537	18,684	0.479	0.070	0.428	0.517	12,458	0.491	0.075	0.445	0.549
Prof	31,142	0.071	0.070	0.034	0.102	18,684	0.077	0.074	0.037	0.112	12,458	0.061	0.063	0.032	0.089
PastProf	30,753	0.073	0.178	0.030	0.154	18,517	0.085	0.189	0.038	0.173	12,236	0.056	0.159	0.021	0.123
NDTS	28,692	0.023	0.016	0.011	0.031	17,230	0.021	0.015	0.011	0.029	11,462	0.025	0.017	0.012	0.034
F_Age	31,142	19.789	4.974	17.000	23.000	18,684	19.266	5.230	16.000	23.000	12,458	20.572	4.449	17.000	23.000
Inf	31,142	2.212	2.036	1.156	3.315	18,684	2.326	2.010	1.156	3.315	12,458	2.042	2.062	0.723	3.315
Growth	28,907	0.225	0.401	0.018	0.284	17,216	0.248	0.425	0.024	0.314	11,691	0.190	0.361	0.012	0.243
VCF	20,128	0.079	0.059	0.039	0.101	11,654	0.086	0.062	0.043	0.110	8,474	0.071	0.053	0.035	0.089
BLR_TL	31,142	0.476	0.194	0.333	0.622	18,684	0.463	0.196	0.318	0.611	12,458	0.494	0.188	0.359	0.636
BLR_TD	31,141	0.311	0.207	0.140	0.466	18,684	0.300	0.206	0.127	0.451	12,457	0.328	0.208	0.158	0.486
BLR_LTD	31,142	0.109	0.154	0.000	0.176	18,684	0.093	0.145	0.000	0.143	12,458	0.134	0.164	0.000	0.221
MLR_TL	25,651	0.268	0.191	0.113	0.392	14,554	0.240	0.183	0.096	0.347	11,097	0.305	0.196	0.143	0.443
MLR_TD	25,651	0.169	0.163	0.039	0.256	14,554	0.149	0.152	0.031	0.223	11,097	0.195	0.173	0.053	0.300
MLR_LTD	25,651	0.062	0.110	0.000	0.073	14,554	0.049	0.098	0.000	0.052	11,097	0.080	0.122	0.000	0.106

Notes: This table presents the summary statistics of variables contained in our study for the overall sample, NSOEs and SOEs listed on Shanghai and Shenzhen Stock Exchanges from 1997 to 2015. Before computing summary statistics, all variables are winsorized at 1st and 99th percentiles than the means of MLR_TL, MLR_TD and MLR_LTD, respectively. It indicates that Chinese markets, on average, perceive a firm to be less risky than recorded in the books. Average age of the firm is 19.78 years for the overall sample. The book and the market values of leverage increase with broadening the debt, that is, the averages of BLR_TL and MLR_TL are higher than the averages of BLR_TD and MLR_TD, respectively, and the averages of BLR_TD and MLR_TD are higher than the averages of BLR_LTD and MLR_LTD, respectively.

Table III depicts frequency, percentage and cumulative frequency of the categorical variable debt maturity. Table illustrates that in approximately 6.15 percent firm-year observations of the overall sample, 6.97 percent of NSOEs and 4.91 percent of SOEs, firms do not hold any debt. SOE firm-year observations holding only short-term debt are around 25.17 percent. This proportion is quite less as compared to NSOEs with 39.03 percent. However, SOE firm-year observations holding debt with maturity above one year, but not as long as notes or debentures, are 58.23 percent as compared to 45.37 percent of NSOEs. Firm-year observation holding long-term debt including debentures and notes are around 11.69 percent for SOEs and 9.25 percent for NSOEs.

Table IV illustrates the correlation matrix of explanatory variables. VCF is negatively correlated with tangibility, size, past profitability, NDTS and firm age. Whereas, VCF has positive correlation with industry leverage, inflation, profitability and growth. Overall, firms having high VCF have lower tangibility, shorter age, more growth opportunities and are smaller in size belonging to the industries with higher levels of leverage. Furthermore, state ownership SOE(0/1) has inverse correlation with VCF, profitability and growth; whereas, it shows positive correlation with tangibility, size and industry leverage.

4.2 *Impact of VCF on leverage*

Table V provides the GLM estimates for our overall sample where the dependent variables are the six leverage measures and the variable of interest is VCF. All VCF coefficients are significant at less than 1 percent level in each leverage measure and are negative, indicating that the leverage decreases as the VCF increases. The magnitude of volatility coefficients also increases as the debt becomes narrower to include only long-term debt. Precisely, volatility coefficients are −0.729, −1.221 and −1.502 using BLR_TL, BLR_TD and BLR_LTD, respectively, whereas the volatility coefficients are −0.913, −1.364 and −1.428 using MLR_TL, MLR_TD and MLR_LTD, respectively. This suggests that firms having high VCF move from long-term debts toward short-term debts.

		Overall			NSOEs			SOEs		
Category	Description	Freq.	Percent	Cum.	Freq.	Percent	Cum.	Freq.	Percent	Cum.
1	Firms holding zero debt	1,914	6.15	6.15	1,302	6.97	6.97	612	4.91	4.91
2	Firms using short-term debt only	10,429	33.49	39.63	7,293	39.03	46	3,136	25.17	30.09
3	Firms using long-term debt with maturity that is not as long as debentures and notes	15,918	51.11	90.75	8,664	46.37	92.37	7,254	58.23	88.31
4	Firms using long-term debt including debentures and notes	2,881	9.25	100	1,425	7.63	100	1,456	11.69	100
Total		31,142	100		18,684	100		12,458	100	

Note: This table summarizes the categorical variable debt-maturity by showing frequency, percentage and cumulative percentage of firm-year observations in each category of debt maturity, for a sample of Chinese firms listed on Shanghai and Shenzhen Stock Exchanges from 1997 to 2015

Table III. Summary of debt maturity variable

Pairwise correlation Independent variables		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1)	Tang	1.000										
(2)	Size	0.031	1.000									
(3)	I_Lev	−0.081	0.172	1.000								
(4)	Prof	−0.023	0.001	−0.154	1.000							
(5)	PastProf	−0.057	0.250	−0.116	0.451	1.000						
(6)	NDTS	0.746	0.116	−0.112	0.006	−0.033	1.000					
(7)	F_Age	0.002	−0.069	0.150	−0.198	−0.248	−0.042	1.000				
(8)	Inf	−0.061	0.161	−0.029	0.052	0.069	0.019	−0.119	1.000			
(9)	Growth	−0.166	0.020	−0.005	0.189	0.144	−0.204	−0.110	0.005	1.000		
(10)	SOE(0/1)	0.153	0.146	0.082	−0.109	−0.077	0.104	0.129	−0.068	−0.072	1.000	
(11)	VCF	−0.304	−0.114	0.045	0.057	−0.024	−0.240	−0.020	0.031	0.085	−0.124	1.000

Notes: This table presents the pairwise correlation between independent variables. Numbers in rows and columns denote the variables which are related with the coefficients of pairwise correlation

Table IV.
Correlation matrix

The economic importance of VCF on leverage can be determined by calculating the changes in BLR_LTD and MLR_LTD due to a rise of one standard deviation in VCF. We use the volatility coefficients −1.502 and −1.428 to estimate BLR_LTD and MLR_LTD at mean and at mean plus one standard deviation of VCF. Remaining independent variables are estimated at their means. Estimated BLR_LTD and MLR_LTD at mean of VCF are 0.1071 and 0.0578, respectively and at mean plus one standard deviation are 0.1003 and 0.0532, respectively, indicating a one standard deviation rise in VCF causes 6.34 and 7.87 percent decrease in BLR_LTD and MLR_LTD, respectively.

Table V also reports that a vast majority of explanatory variables are statistically significant under 1 percent level. NDTS, profitability and past profitability are negatively associated with leverage, whereas, most of the other explanatory variables' coefficients are positive. Inflation does not show a statistically significant association with book leverage ratios.

4.3 Sub-sample analysis

We divide our sample into SOEs and NSOEs to check whether or not the results obtained from Table V hold for the sub-samples. The classification of SOEs and NSOEs has been done on the basis of Company Actual Controller data available in RESSET Financial Research Database.

Panels A and B of Table VI report the sub-sample analysis of NSOEs and SOEs, respectively. Analysis reveals that only in the case of NSOEs, VCF coefficients are negative and statistically significant in relation to each leverage measure. Whereas for SOEs, the relationship between volatility and leverage measures is mixed and highly insignificant. It refers to the fact that leverage for Chinese SOEs does not get affected by the VCF.

Thus, our overall results from Table V support our first hypothesis and indicate that firms facing high VCF employ less debt. These estimates are similar to the findings of Keefe and Yaghoubi (2016). Since the institutional environment of Chinese firms is entirely different from the firms in the USA, therefore, we perform sub-sample analysis as shown in Table VI, where the results for SOEs are not in favor of our first hypothesis.

Panel C of Table VI displays the GLM estimates for our overall sample containing SOE(0/1) dummy and interaction VCF × SOE(0/1) so as to examine any differences in sensitivity to VCF between NSOEs and SOEs on leverage. VCF coefficients as well as most of the differential

Table V. Effect of VCF on leverage

Variables	BLR_TL	BLR_TD	BLR_LTD	MLR_TL	MLR_TD	MLR_LTD
VCF	−0.729*** (0.278)	−1.221*** (0.309)	−1.502*** (0.456)	−0.913*** (0.317)	−1.364*** (0.384)	−1.428*** (0.599)
Tang	0.645*** (0.138)	1.496*** (0.144)	2.873*** (0.191)	1.235*** (0.150)	2.008*** (0.168)	3.364*** (0.234)
Size	0.245*** (0.0124)	0.241*** (0.0129)	0.277*** (0.0174)	0.342*** (0.0134)	0.332*** (0.0151)	0.378*** (0.0216)
*I*_Lev	2.562*** (0.232)	2.543*** (0.247)	4.093*** (0.348)	3.362*** (0.256)	3.118*** (0.296)	4.539*** (0.440)
Prof	−2.476*** (0.317)	−3.530*** (0.341)	−1.928*** (0.498)	−4.061*** (0.359)	−4.423*** (0.421)	−3.064*** (0.662)
PastProf	−1.543*** (0.111)	−1.193*** (0.114)	−0.781*** (0.172)	−0.629*** (0.122)	−0.535*** (0.146)	−0.208 (0.253)
NDTS	−10.20*** (1.562)	−12.64*** (1.675)	−24.06*** (2.398)	−13.51*** (1.744)	−16.09*** (2.000)	−27.28*** (2.987)
*F*_Age	0.0163*** (0.00340)	0.0164*** (0.00362)	0.0151*** (0.00506)	0.0239*** (0.00375)	0.0224*** (0.00431)	0.0178*** (0.00634)
Inf	−0.00107 (0.00826)	−0.00532 (0.00884)	0.0126 (0.0125)	0.0403*** (0.00916)	0.0342*** (0.0106)	0.0484*** (0.0159)
Growth	0.154*** (0.0475)	0.258*** (0.0494)	0.430*** (0.0613)	0.147*** (0.0511)	0.228*** (0.0574)	0.370*** (0.0760)
Constant	−6.475*** (0.268)	−7.204*** (0.283)	−10.33*** (0.393)	−10.10*** (0.299)	−10.46*** (0.338)	−13.54*** (0.496)
Observations	17,758	17,758	17,758	17,570	17,570	17,570

Notes: This table presents the results of GLM model applied to investigate the effect of volatility of cash flows on six measures of leverage. ***Significance at level 0.01. Standard errors are clustered at the firm-level and are provided in parentheses

Table VI.
Effect of VCF on leverage of SOEs and NSOEs

	BLR_TL	BLR_TD	BLR_LTD	MLR_TL	MLR_TD	MLR_LTD
Panel A: NSOEs						
VCF	−1.336*** (0.351)	−2.118*** (0.400)	−1.271** (0.609)	−1.165*** (0.414)	−1.787*** (0.513)	−1.128* (0.823)
n	10,114	10,114	10,114	9,972	9,972	9,972
Panel B: SOEs						
VCF	0.521 (0.468)	−0.462 (0.496)	−0.787 (0.686)	0.161 (0.501)	−0.627 (0.587)	−1.041 (0.870)
n	7,644	7,644	7,644	7,598	7,598	7,598
Panel C: Overall sample including SOE(0/1) dummy and interaction VCF × SOE(0/1)						
VCF	−1.411*** (0.341)	−2.261*** (0.390)	−1.457** (0.591)	−1.281*** (0.402)	−1.980*** (0.499)	−1.475* (0.797)
SOE(0/1)	−0.110** (0.0534)	−0.158*** (0.0570)	0.0937 (0.0798)	0.0764 (0.0586)	0.0114 (0.0680)	0.201** (0.101)
VCF × SOE(0/1)	2.017*** (0.553)	1.986*** (0.603)	0.745* (0.869)	1.199** (0.615)	1.508** (0.739)	0.543 (1.135)
n	17,758	17,758	17,758	17,570	17,570	17,570

Notes: This table presents the volatility of cash flows coefficients obtained by using GLM for the sub-samples of state-owned and non-state-owned enterprises in relation to six measures of leverage. It also presents the VCF coefficients for the overall sample with the inclusion of SOE(0/1) dummy and interaction SOE(0/1) × VCF. *,**,***Significance at 0.10, 0.05 and 0.01 levels, respectively. Standard errors are clustered at the firm-level and are provided in parentheses coefficients obtained from the interaction term are statistically significant. By adding the VCF and VCF × SOE(0/1) coefficients for the six leverage measures, we find the estimates for SOEs which are consistent with our sub-sample test results mentioned in panel B of Table VI. Thus, these estimates confirm the lack of impact of VCF on leverage of SOEs. The interaction coefficient also supports our third hypothesis by providing evidence that the leverage of NSOEs is more sensitive to VCF than SOEs.

In order to determine the economic magnitude, we calculate predictive margins for NSOEs. We take the volatility coefficients of BLR_LTD (−1.271) and MLR_LTD (−1.128) and estimate the probabilities at mean and at mean plus one standard deviation of VCF. We keep the estimates of remaining explanatory variables at their mean values. We find that the estimated BLR_LTD and MLR_LTD at mean of VCF are 0.0867 and 0.0806, respectively, whereas at mean plus one standard deviation of VCF are 0.0408 and 0.0372, respectively, indicating that one standard deviation rise in VCF for NSOEs causes approximately 7.10 and 8.89 percent decrease in BLR_LTD and MLR_LTD, respectively.

4.3.1 Why VCF does not affect SOEs' leverage?. Our results from Table VI indicate that VCF does not affect leverage of SOEs. It may be because of the structural difference between SOEs and NSOEs. For example, SOEs may maintain low cash flow volatility through centralized planning or in the interest of fulfilling social objectives. Li *et al.* (2009) also pointed out that the main objective of the Government of China is to maintain employment and social stability, instead of maximizing profits of SOEs. Therefore, the lack of effect of volatility on SOEs' leverage might be related to SOEs having relatively low cash flow volatility. In other words, there may not be enough observations of SOEs with high enough cash flow volatility to influence debt levels. To check if this is the issue, we divide the number of observations of each debt ratio into 20 quantiles of cash flow volatility for both SOEs and NSOEs as shown in Table VII.

Table VII reports the number of observations of six leverage ratios in each volatility quantile for SOEs and NSOEs. It is clear from the table that there are relatively less number of SOEs in higher quantiles, but the number of SOEs is still large enough to detect any relationship between VCF and leverage. For example, BLR_TL for SOEs has 19.46 percent observations in last five quantiles as compared to 29.03 percent for NSOEs. In the same way, MLR_TL has 19.47 percent observation in the last five quantiles for SOEs as compared to 29.24 percent for NSOEs. Thus, SOEs have enough observations with high enough cash flow volatility to influence leverage.

Hence, the lack of effect of VCF on leverage for SOEs may be because of the fact that there are quite less chances that these firms will face financial distress or bankruptcy as the state furnishes an implicit assurance that the firm will not default at the time of repayment, so the VCF does not become an impediment to the acquisition of debts. Moreover, in many of the large banks in China, state is the main stakeholder or owner. Allen *et al.* (2005) and Gordon and Li (2003) show that large state-owned banks provide excessively huge share of credit to SOEs because of having an intimate association with SOEs.

4.4 VCF and debt maturity

Table VIII provides the estimates obtained by using Ordered Probit model applied to determine how VCF can affect the debt maturity of a firm. First column shows the overall results of the entire sample. Third and fourth columns depict the results for sub-samples. Volatility coefficients are statistically significant at less than 1 percent level for the overall sample as well as for SOEs and NSOEs. All negative volatility coefficients indicate that higher the VCF, lower will be the category of debt maturity and vice versa. It means as the volatility increases (decreases), the chances that a firm will hold debt of longer maturity will decrease (increase). These estimation results are in favor of our second hypothesis. Though

Table VII. Number of observations for leverage in 20 VCF quantiles

	Non-state owned enterprises (NSOEs)						State-owned enterprises (SOEs)					
Quantile	BLR_TL	BLR_TD	BLR_LTD	MLR_TL	MLR_TD	MLR_LTD	BLR_TL	BLR_TD	BLR_LTD	MLR_TL	MLR_TD	MLR_LTD
1	453	453	453	445	445	445	554	554	554	546	546	546
2	483	483	483	473	473	473	523	523	523	517	517	517
3	518	518	518	510	510	510	489	489	489	481	481	481
4	504	504	504	496	496	496	502	502	502	500	500	500
5	531	531	531	518	518	518	475	475	475	466	466	466
6	550	550	550	543	543	543	457	457	457	454	454	454
7	542	542	542	528	528	528	464	464	464	461	461	461
8	563	563	563	549	549	549	444	444	444	438	438	438
9	543	543	543	531	531	531	463	463	463	461	461	461
10	572	572	572	552	552	552	434	434	434	432	432	432
11	566	566	566	548	548	548	441	441	441	436	436	436
12	587	587	587	570	570	570	419	419	419	416	416	416
13	610	610	610	587	587	587	397	397	397	395	395	395
14	590	590	590	571	571	571	416	416	416	414	414	414
15	659	659	659	638	638	638	347	347	347	342	342	342
16	650	650	650	643	643	643	357	357	357	355	355	355
17	669	669	669	656	656	656	337	337	337	334	334	334
18	699	699	699	692	692	692	308	308	308	307	307	307
19	662	662	662	644	644	644	344	344	344	341	341	341
20	703	703	703	696	696	696	303	303	303	298	298	298
Total	11,654	11,654	11,654	11,390	11,390	11,390	8,474	8,474	8,474	8,394	8,394	8,394

Note: This table presents the number of observations for six measures of leverage divided into 20 cash flow volatility quantiles for both SOEs and NSOEs

Variables	Overall	Overall with SOE(0/1) and VCF × SOE(0/1)	NSOEs	SOEs
	Debt maturity (categorical variable)			
VCF	−2.856*** (0.149)	−3.042*** (0.181)	−3.055*** (0.186)	−2.350*** (0.252)
Tang	1.432*** (0.0748)	1.419*** (0.0751)	1.493*** (0.111)	1.324*** (0.103)
Size	0.357*** (0.00693)	0.354*** (0.00700)	0.373*** (0.00930)	0.332*** (0.0107)
I_Lev	1.409*** (0.124)	1.383*** (0.124)	1.464*** (0.169)	1.296*** (0.185)
Prof	−1.507*** (0.166)	−1.505*** (0.167)	−1.818*** (0.215)	−1.048*** (0.264)
PastProf	−0.0244 (0.0580)	−0.0121 (0.0581)	−0.0993 (0.0731)	0.168* (0.0963)
NDTS	−13.86*** (0.840)	−13.86*** (0.840)	−16.26*** (1.225)	−11.59*** (1.161)
*F*_Age	0.00341* (0.00182)	0.00280 (0.00183)	0.0118*** (0.00229)	−0.0159*** (0.00309)
Inf	−0.00988** (0.00444)	−0.00950** (0.00444)	−0.0123** (0.00604)	−0.00602 (0.00658)
Growth	0.233*** (0.0255)	0.236*** (0.0255)	0.207*** (0.0323)	0.277*** (0.0418)
SOE(0/1)	N/A	0.00478 (0.0287)	N/A	N/A
VCF × SOE(0/1)	N/A	0.625** (0.295)	N/A	N/A
Observations	17,758	17,758	10,114	7,644

Notes: This table presents the results of ordered probit regression applied to investigate the influence of volatility of cash flows on debt maturity structure. *,**,***Significance at 0.10, 0.05 and 0.01 levels, respectively. Standard errors are clustered at the firm-level and are provided in parentheses

Table VIII. Influence of VCF on debt maturity

VCF does not influence SOEs' level of debt (see Table VI), it negatively affects debt maturity of SOEs (see Table VIII). It might be because of the reason that bankers are forced due to political influence to provide loans to SOEs, but they provide shorter maturity debts to SOEs in order to monitor them.

Second column of Table VIII displays the results obtained from entire sample but with the inclusion of SOE(0/1) dummy and interaction term VCF × SOE(0/1) as explanatory variables. The coefficients of both VCF and interaction term are significant. The difference in sensitivity of SOEs is 0.625 as compared to the base category of NSOEs. By adding the VCF coefficient and interaction coefficients, we get (−3.042 + 0.625 = −2.417), which shows that debt maturity of SOEs is less sensitive to VCF as compared to NSOEs. These estimates are in accordance with our third hypothesis.

We calculate the economic magnitude using predictive margins as presented in Table IX. It shows the absolute as well as percentage change in the likelihood of a firm to fall within one of the four categories because of a rise of one standard deviation in VCF. The probability of NSOEs to fall within category 4 at mean of VCF is 8.58 percent and at mean plus one standard deviation of VCF is 5.94 percent. It indicates that a rise of one standard deviation in VCF causes an absolute decline of around 0.264 or equivalently 30.84 percent relative decline in the probability of NSOEs to use debentures or long-term notes. Whereas for SOEs, one standard deviation rise in VCF causes only 19.11 percent decrease in the probability to use debentures or long-term notes. Likewise for category 2, one standard deviation rise in VCF brings an increase of around 15.30 percent for NSOEs and 14.16 percent for SOEs in the likelihood of issuing debt that matures within one year. Overall, one standard deviation rise in VCF decreases (increases) firm' probability to use debt of longer (shorter) maturities.

5. Robustness

5.1 Alternative volatility measure and window sizes

Table X contains the results of GLM used to estimate the effect of different measures of VCF, as mentioned in Section 3.2, on six measures of leverage. We use VCF_1st Diff (standard deviation of the first difference of cash flow from operations over five years window), VCF_4yr (standard deviation of the cash flow from operations over four years window)

	Debt maturity categories			
	1	2	3	4
	No short-term and long-term debt	Only short-term debt	Long-term debt excluding debentures and notes payable	Debentures and ong-term notes payable
Panel A: Overall sample				
At mean of VCF	0.0373	0.304	0.5556	0.1031
At mean + 1 SD of VCF	0.0535	0.3524	0.5185	0.0757
% change	43.36	15.94	−6.69	−26.62
Panel B: NSOEs				
At mean of VCF	0.0434	0.361	0.5098	0.0858
At mean + 1 SD of VCF	0.0643	0.4162	0.4601	0.0594
% change	48.28	15.30	−9.75	−30.84
Panel C: SOEs				
At mean of VCF	0.0309	0.2316	0.6083	0.1292
At mean + 1 SD of VCF	0.0408	0.2643	0.5903	0.1045
% change	31.98	14.16	−2.96	−19.11

Notes: This table presents the predicted values of debt maturity variable obtained by applying ordered probit regression. The predicted values of debt maturity variable are shown at mean and at mean plus one standard deviation of volatility of cash flows. Other independent variables are set to their mean values

Table IX.
Predictive margins

and VCF_3yr (standard deviation of the cash flow from operations over three years window) as VCF measures. Panel A displays the estimates obtained from our overall sample. Panels B and C show the estimates for sub-samples. Five years window used earlier in Section 4.2 uses least number of observations leading to a chance of sample selection bias. The number of observations rises as we decrease the size of window. According to the table, all VCF coefficients for NSOEs are negative and statistically significant. In contrast, most of the volatility coefficients are statistically insignificant for SOEs. These estimates are similar to our main results and do not seem to be affected by any sample bias issue.

5.2 Alternative debt maturity measure

Table XI reports the GLM results for the overall sample, SOEs and NSOEs using two alternative debt maturity measures as dependent variables as discussed in Section 3.4. DebtMaturity_DKM represents the measure adopted by Demirgüç-Kunt and Maksimovic (1999), whereas DebtMaturity_BS represents the measure used by Barclay and Smith (1995). Each VCF coefficient is negative and statistically significant at 1 or 5 percent level. Negative volatility coefficients point out that the use of debt of longer maturities decreases with rising VCF for all the firms in the sample. Thus, our main findings remain qualitatively unchanged even by applying alternative debt maturity measures.

5.3 Alternative estimation model

Although for a proportional dependent variable such as leverage, the conditional expectation is a non-linear function of explanatory variables, still we follow some prior empirical studies such as Chaplinsky and Niehaus (1993), Bauer (2004) and Frank and Goyal (2009), and re-estimate the relation of VCF with six leverage measures using OLS regression. Table XII reports the OLS estimation results. For the overall sample as well as NSOEs, all volatility coefficients are negative and significant. For the SOEs, there is no definite impact

Table X. Effect of VCF on leverage using alternative measures of VCF

	BLR_TL	BLR_TD	BLR_LTD	MLR_TL	MLR_TD	MLR_LTD
Panel A: overall sample						
VCF_1st Diff	−0.326* (0.197)	−0.746*** (0.216)	−0.536* (0.311)	−0.456** (0.222)	−0.698*** (0.268)	−0.613* (0.406)
n	15,685	15,685	15,685	15,542	15,542	15,542
VCF_4yr	−0.628** (0.255)	−1.280*** (0.283)	−1.290*** (0.428)	−0.721** (0.293)	−1.192*** (0.355)	−1.481*** (0.569)
n	20,005	20,005	20,005	19,676	19,676	19,676
VCF_3yr	−0.463** (0.232)	−0.965*** (0.256)	−1.298*** (0.397)	−0.554** (0.271)	−0.944*** (0.328)	−1.525*** (0.539)
n	22,225	22,224	22,225	21,431	21,431	21,431
Panel B: NSOEs						
VCF_1st Diff	−0.766*** (0.250)	−1.224*** (0.282)	−0.486* (0.416)	−0.657** (0.293)	−0.992*** (0.361)	−0.320* (0.558)
n	8,789	8,789	8,789	8,681	8,681	8,681
VCF_4yr	−1.112*** (0.321)	−1.723*** (0.365)	−1.182** (0.571)	−0.854** (0.381)	−1.395*** (0.472)	−1.098* (0.779)
n	11,601	11,601	11,601	11,344	11,344	11,344
VCF_3yr	−0.832*** (0.289)	−1.268*** (0.327)	−1.056** (0.522)	−0.599* (0.350)	−1.017** (0.433)	−0.953* (0.730)
n	13,052	13,052	13,052	12,401	12,401	12,401
Panel C: SOEs						
VCF_1st Diff	0.506 (0.327)	0.00128 (0.343)	−0.403 (0.470)	0.0519 (0.346)	−0.136 (0.402)	−0.592 (0.591)
n	6,896	6,896	6,896	6,861	6,861	6,861
VCF_4yr	0.407 (0.430)	−0.493 (0.456)	−1.071* (0.646)	−0.201 (0.463)	−0.645 (0.543)	−1.381* (0.827)
n	8,404	8,404	8,404	8,332	8,332	8,332
VCF_3yr	0.321 (0.393)	−0.415 (0.418)	−1.352* (0.608)	−0.243 (0.430)	−0.632 (0.505)	−1.760* (0.794)
n	9,173	9,172	9,173	9,030	9,030	9,030

Notes: This table presents the coefficients related to volatility of cash flows obtained by applying GLM model in relation to six measures of leverage for a different volatility measure and at the window lengths of 3 and 4 years. *,**,***Significance at 0.10, 0.05 and 0.01 levels, respectively. Standard errors are clustered at the firm-level and are provided in parentheses

Table XI.
Effect of VCF on debt maturity using alternative debt maturity measures

Variables	Overall	DebtMaturity_DKM NSOEs	SOEs	Overall	DebtMaturity_BS NSOEs	SOEs
VCF	−1.605*** (0.393)	−0.924** (0.499)	−2.215*** (0.637)	−1.679*** (0.460)	−1.171** (0.598)	−1.846*** (0.715)
Tang	2.511*** (0.166)	2.645*** (0.258)	2.210*** (0.219)	3.197*** (0.184)	3.450*** (0.290)	2.789*** (0.240)
Size	0.0799*** (0.0155)	0.114*** (0.0215)	0.0173 (0.0230)	0.145*** (0.0174)	0.193*** (0.0246)	0.0689*** (0.0254)
I_Lev	1.142*** (0.300)	1.145*** (0.430)	1.129*** (0.421)	2.204*** (0.343)	2.471*** (0.503)	1.943*** (0.471)
Prof	0.326 (0.420)	0.258 (0.569)	0.437 (0.630)	0.363 (0.492)	0.0143 (0.683)	0.742 (0.717)
PastProf	0.241 (0.157)	0.0861 (0.203)	0.576** (0.251)	0.277 (0.189)	0.104 (0.252)	0.659** (0.295)
NDTS	−15.31*** (1.995)	−19.55*** (3.118)	−11.52*** (2.589)	−20.87*** (2.277)	−25.76*** (3.635)	−16.62*** (2.906)
*F*_Age	0.00568 (0.00438)	0.0176*** (0.00571)	−0.0186*** (0.00712)	0.00922* (0.00499)	0.0254*** (0.00660)	−0.0204** (0.00794)
Inf	0.0127 (0.0107)	0.0110 (0.0153)	0.0162 (0.0150)	0.00746 (0.0122)	0.0114 (0.0179)	0.00609 (0.0168)
Growth	0.328*** (0.0557)	0.286*** (0.0744)	0.391*** (0.0848)	0.400*** (0.0608)	0.363*** (0.0832)	0.454*** (0.0901)
Constant	−4.284*** (0.336)	−5.282*** (0.465)	−2.346*** (0.510)	−6.707*** (0.382)	−8.236*** (0.539)	−4.249*** (0.568)
Observations	17,758	10,114	7,644	17,758	10,114	7,644

Notes: This table presents the results of GLM model applied to validate the impact of volatility of cash flows on debt maturity structure using two different measure of debt maturity as mentioned in Section 3.4. *,**,***Significance at 0.10, 0.05 and 0.01 levels, respectively. Standard errors are clustered at the firm-level and are provided in parentheses

	BLR_TL	BLR_TD	BLR_LTD	BLR_TL	BLR_TD	BLR_LTD
Panel A: Overall sample						
VCF	−0.166*** (0.0206)	−0.272*** (0.0243)	−0.0976*** (0.0197)	−0.147*** (0.0205)	−0.155*** (0.0193)	−0.0572*** (0.0143)
n	17,758	17,758	17,758	17,570	17,570	17,570
Panel B: NSOEs						
VCF	−0.300*** (0.0260)	−0.367*** (0.0296)	−0.0823*** (0.0228)	−0.173*** (0.0244)	−0.173*** (0.0222)	−0.0329** (0.0156)
n	10,114	10,114	10,114	9,972	9,972	9,972
Panel B: SOEs						
VCF	0.122*** (0.0338)	−0.0902 (0.0422)	−0.0979** (0.0361)	−0.0276 (0.0360)	−0.0846 (0.0357)	−0.0761* (0.0276)
n	7,644	7,644	7,644	7,598	7,598	7,598

Notes: This table presents the coefficients related with volatility of cash flows for each leverage measure obtained by applying OLS regression for the overall sample and the sub-samples of SOEs and NSOEs. *,**,***Significance at 0.10, 0.05 and 0.01 levels, respectively. Standard errors are clustered at the firm-level and are provided in parentheses

Table XII. Effect of VCF on leverage using alternative estimation model

of VCF on leverage as there are mixed signs of coefficients and also most of the volatility coefficients are highly insignificant. These findings are consistent with our main GLM estimates in Tables V and VI.

6. Conclusion

This study endeavors to determine how VCF can affect leverage and debt maturity for Chinese listed firms. First, we conclude that higher VCF leads to lower levels of leverage. The economic importance can be illustrated by our finding that a decrease of approximately 6.34 percent in BLR_LTD and 7.87 percent in MLR_LTD occurs due to a rise of one standard deviation in VCF.

Second, sub-sample analysis of SOEs vs NSOEs reveals that the inverse association of VCF with leverage is valid only for NSOEs. The possible explanation is that the chances for SOEs to experience financial distress are quite low and consequently they are less expected to face bankruptcy. Therefore, despite having high VCF, these firms may not encounter much difficulties in obtaining debts. Besides, state-owned enterprises might be able to receive extremely large amount of debt due to having intimate association with large state-owned banks. Thus, we find that due to fewer financial constraints, SOEs' level of debt is less sensitive to VCF as compared to NSOEs.

Third, using a relatively newer and better approach of creating categorical debt maturity variable helps to better understand the relationship of VCF with debt maturity structure. Our findings suggest that all the firms, regardless of their ownership structure, with higher VCF choose debt of relatively shorter maturities, implying an inverse association between VCF and debt maturity. To explain the economic importance, we find that around 15.94 percent increase in the probability of using category 2, that is only short-term debt, and 26.62 percent decrease in the probability of using category 4, that is debentures or long-term notes, occurs due to a rise of one standard deviation in VCF. The coefficient of interaction VCF × SOE(0/1) confirms that debt maturity of SOEs shows less sensitivity to VCF as compared to NSOEs.

Lastly, our findings are robust to different measures of VCF, leverage and debt maturity. We also test our findings through alternative estimation models. Additionally, we measure volatility variable at different window lengths of three and four years. By applying all these robustness tests, we observe that our main estimates stay qualitatively unaffected. Taking all these findings together, this study contributes to the existing literature by suggesting that VCF is a crucial factor in determining the leverage levels and the debt maturity choices for the unique and bizarre institutional structure of Chinese firms.

This study reports several findings which can be beneficial in the following dimensions. First, firms encountering high VCF can reduce their costs of financial distress or bankruptcy by shrinking their leverage levels or by using shorter maturity debts. Second, we conclude that state-ownership is a crucial element which must be considered by the financial managers in their decision-making process as it influences the firm's optimal capital structure. Third, our results indicate that banks in China offer convenient credit facilities to SOEs, regardless of their cash flow volatility level, which may not be beneficial for the development of SOEs. Fourth, results of this research imply that the banks and other financial institutions may decrease their risk of non-performing loans by limiting their financing or by increasing the cost of debt for the NSOEs having high VCF. Finally, our findings might also be useful for the investors as they can analyze the risk level of the firm by examining its variability of cash flows before taking any investment decisions.

Note

1. Keefe and Yaghoubi (2016) construct debt maturity variable consisting of five categories. They use a separate category for long-term notes, whereas we slightly modify their construct by putting both long-term notes and debentures into one category. It is because of the reason that only few firms in our sample hold long-term notes. Therefore, we combine long-term notes with debentures.

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