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How Does Long-Term Finance Affect Economic Volatility?[1]

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Abstract: In an approach analogous to Rajan and Zingales (1998), we examine how the ability to access long-term debt affects firm-level growth volatility. We find that firms in industries with stronger preference to use long-term finance relative to short-term finance experience lower growth volatility in countries with better-developed financial systems, as these firms may benefit from reduced refinancing risk. Institutions that facilitate the availability of credit information and contract enforcement mitigate refinancing risk and therefore growth volatility associated with short-term financing. Increased availability of long-term finance reduces growth volatility in crisis as well as non-crisis periods.

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[1] This paper's findings, interpretations, and conclusions are entirely those of the authors and do not necessarily represent the views of the World Bank, its Executive Directors, or the countries they represent.

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1 Introduction

The tendency of firms to match the maturity of their assets and liabilities is well established in the literature (Hart and Moore, 1995; Demirgüç-Kunt and Maksimovic, 1999). Firms that operate in environments where the availability of long-term finance is limited due to market failures and policy weaknesses, such as weak information infrastructures, macro and political instability, poor contract enforcement, and weak investor protection, tend to be at a disadvantage when it comes to financing their long-term investments. A firm that can only use short-term debt to finance long-term assets continually needs to roll over its credit, which introduces liquidity risk as creditors may at some point refuse to roll over their financing.

Liquidity risk potentially increases firm-level economic volatility, as firms that cannot refinance their investments may be forced to prematurely sell them at reduced prices possibly inducing bankruptcy. Anticipating future liquidity risk, a firm with access to only short-term finance may be reluctant to invest in long-term assets, with adverse consequences for its growth. This suggests that the availability of long-term finance has potentially important implications for economic volatility as well as for the level and growth rate of economic activity.

In this paper, we examine the relationship between long-term debt finance and economic volatility using firm-level data for a set of 76 countries over the 1995-2013 period. We consider a firm-level growth volatility variable based on accounting data, and an asset return volatility variable based on stock market data. In order to deal with the identification problem that less volatile firms may be attracting more long-term finance, we relate our measures of firm-level volatility to financial and institutional development proxies in combination with an index of a firm's preference for long-term debt use, following Rajan and Zingales (1998). A firm's preference for long-term debt is captured by US firms' use of long-term debt in that

industry, under the assumption that US firms are least likely to be constrained in their access to long term debt.

Our results suggest that the availability of long-term finance, be it in the form of bank loans or debt securities, reduces firm-level volatility, possibly because long-term finance mitigates liquidity risk. Liquidity risk is potentially more relevant at a time of financial crisis when bank credit is contracting. We also examine this in our analysis by splitting the overall sample period into a pre-crisis period 1995-2006, and a crisis-and-aftermath period 2007-2013. We find that the level of banking market development is important for reducing firm-level volatility in both periods.

In further analysis, we find that better information, proxied by higher accounting standards, mitigates the destabilizing influence of limited access to long-term finance. This is because with better information the liquidity risk of a pre-mature termination of deserving projects diminishes. In other words, short-term creditors will be less likely to refuse to roll over their credits because they cannot accurately access the prospects of the project due to lack of information. As a result, better quality information – as captured by higher accounting standards -reduces the volatility costs of relying on short-term debt.

In addition, we find that better legal infrastructures supporting credit markets reduce the economic volatility induced by a limited availability of long-term finance. Specifically, less financial development implying a more restricted availability of long-term finance increases economic volatility less, if there are legal infrastructures that facilitate the provision of credit, the enforcement of contracts, and the resolution of insolvencies. This may reflect that the volatility costs of short-term finance are again reduced with better infrastructure, as lower enforcement and bankruptcy costs reduce the likelihood of pre-mature liquidation.

Prior research has primarily focused on the implications of financial market development, including the availability of long-term finance, for economic growth. A large

body of papers finds that financial market development, and in particular the ability of firms to access long-term credit have positive growth effects (see King and Levine, 1993; Levine and Zevros, 1998; Levine, Loayza, and Beck, 2000; Beck, Laeven, and Levine, 2000; Rajan and Zingales, 1998; Demirgüç-Kunt and Maksimovic, 1998).[2] Earlier literature has also established that macroeconomic stability is positively related to financial market development and long-term debt use (see Beck, Demirgüç-Kunt, and Maksimovic, 2008; Demirgüç-Kunt and Maksimovic, 1999; Fan, Titman and Twite, 2012). We add to this literature by establishing that financial market development that increases the availability of long-term finance reduces firm-level economic volatility, potentially by reducing liquidity risk.

This paper is also related to a recent literature that examines the effects of shocks in the availability of credit on firm-level investment. Several papers, in particular, use the recent financial crisis as a source of exogenous variation in credit availability. Among these, Duchin, Ozbas, and Sensoy (2010) show that the impact of the crisis on corporate investment was greatest for firms with low cash reserves or high short-term debt. Along similar lines, Almeida, Campello, Laranjeira, and Weisbenner (2011) show that firms with a larger fraction of long-term debt maturing immediately after the third quarter of 2007 reduced their investment more than firms with longer remaining maturities. Vermoesen, Deloof and Laveren (2013) find qualitatively similar results for a sample of Belgian firms. Furthermore, Campello, Graham and Harvey (2010), and Campello, Giambona, Graham and Harvey (2011) use survey data to show that firms that were financially more constrained were more likely to change their investment plans, while Chodorow-Reich (2014) and Duygan-Bump,

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[2] See Levine (2005) and Beck (2012) for detailed overviews of the literature on finance and growth .

Levkov and Montoriol-Garriga (2015) find evidence that credit constrained firms reduced employment after 2007 relative to other firms. Our paper provides additional evidence that the availability of long-term debt is associated with lower firm growth volatility, particularly during the global crisis period.

More generally, several papers in the business cycle literature relate financial frictions to firm and macroeconomic instability. Bernanke and Gertler (1989) show how borrowers' net worth can act as an amplifier of a worsening of financial conditions, as lower net worth and higher agency costs in a financial crisis allow for less finance for investment, further aggravating the crisis. Similarly, the collateral value of firms' assets fluctuates over the business cycle, which in turn determines the availability of credit to firms (Kiyotaki and Moore, 1997). While these papers are mostly concerned with the effect of financial frictions on aggregate investment, Aghion et al. (2010) provide evidence that potentially binding future liquidity constraints discourage investment in long-term assets. Since long-term investments are both less volatile and growth enhancing, they argue that financial development leads to lower macroeconomic volatility and higher economic growth. Our paper provides firm-level evidence consistent with the findings of this literature.

The remainder of the paper is organized as follows. In section 2, we discuss the different channels through which financial market development potentially affects stability at the firm level. In section 3, we describe the data underlying the empirical analysis. In section 4 we present empirical results on how the availability of long-term finance affects firm-level volatility. Section 5 concludes.

2 How long-term finance affects firm risk

The impact of the availability of external debt finance, be it short-term or long-term, on firm risk is theoretically ambiguous. Several papers argue that debt finance can be optimal in circumstances where it minimizes monitoring costs of firm activity (see Townsend, 1979; Gale and Hellwig, 1985; Boyd and Smith, 1994). In line with this, several papers in the banking literature, for instance Holmström and Tirole (1997), reason that financial intermediation occurs, because bankers can have a comparative advantage at screening and monitoring firms. Diamond (1984), specifically, analyzes a model where banks have a cost advantage of monitoring, if individual savers "delegate" their monitoring to them, thereby reducing aggregate monitoring costs. Financial market development potentially reduces firm risk taking, if it increases monitoring efficacy of banks and other providers of external finance.[3]

Short-term creditors are in a relatively better position to monitor and discipline firm risk-taking, as these creditors can refuse to roll over their credits on short notice, if they conclude that the firm is not well-managed (see Rajan, 1992; Rey and Stiglitz, 1993; and Diamond and Rajan, 2001). As a consequence of more effective monitoring, external finance that is relatively short-term can reduce waste, increase efficiency and lead to lower firm volatility.

As a second channel, external debt finance of any duration may increase firm riskiness because of the moral hazard it creates regarding the firm's risk choice. Shareholders, in particular, have the incentive to choose relatively risky activities that are debt-financed, as

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[3] In the case of banks, generous financial safety nets and implicit and explicit bailout guarantees may reduce monitoring incentives for bank liability holders and encourage aggressive risk-taking (Demirgüç-Kunt and Kane, 2002).

they will benefit from strongly positive outcomes, while they can shift the risk of very negative outcomes to their creditors (Jensen and Meckling, 1976).

Through a third channel, external finance potentially increases firm riskiness, as it introduces the risk that creditors refuse to roll over their credits before a project can be profitably terminated. Diamond (1991) shows that lenders may even face incentives to liquidate viable projects. Liquidity risk is greater in the case of short-term debt as it has to be renewed relatively frequently. This can explain a preference for long-term debt on the part of firms, and increased firm volatility if long-term debt is not available when it is preferable. If long-term finance is undersupplied in a country due to reasons such as poor information or contract enforcement, firms can either reduce investment in long-term assets or bear additional liquidity risk (Aghion et al., 2010). To minimize liquidity risk as well as interest rate risk, firms often match the maturity structures of their assets and liabilities (Hart and Moore, 1995).[4] Limited access to long-term finance inhibits maturity matching when investing long-term, possibly resulting in more volatile firm growth.

In summary, long-term debt may reduce firm-level volatility by reducing roll-over risk, while conversely a lower ability to monitor and enforce debt contracts may lead to greater inefficiency and risk-taking by firms. We empirically explore these relationships by relating measures of firm volatility to proxies for the availability of long-term finance, also controlling for the availability of overall external finance in some specifications.

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[4] For empirical evidence on asset and liability maturity matching by firms, see Schiantarelli and Sembenelli (1997), Stohs and Mauer (1996), Jaramillo and Schiantarelli (2002), and Schiantarelli and Srivastava (1997).

3   The data

In this study, we relate measures of firm-level volatility to firm debt maturity structure. The sample consists of firms in all sectors with the exception of financial firms and firms in the public sector, as these firms' capital structure decisions and risk profiles are very different from other firms.

We use two measures of firm volatility. In particular, we construct Asset volatility (book) as the standard deviation of the growth rate of the book value of total assets over the 1995-2013 period using balance sheet information obtained from the Worldscope database. The Asset volatility (book) variable reflects investment variability over time. We exclude firms with fewer than five asset growth observations, and trim this and other firm-level variables at the 5th and 95th percentiles. This yields 27,093 asset volatility observations with a mean of 0.344, as seen in Table 1.

An alternative volatility variable, Asset volatility (stock), is calculated as the annual average of market-based annualized asset value volatility measures based on Merton's model following Anginer et al. (2014).[5] We use data from Datastream for the market value of equity and to estimate equity volatility. To ensure sufficient variability, we exclude firm-year observations with less than 90 days of nonzero stock returns. We further assume that the maturity of a firm's debt is one year, noting that the results are insensitive to this particular assumption.[6] Finally, the dividend yield is taken from Worldscope, while the risk-free return

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[5] See Appendix A1 of Anginer et al. (2014) for a description of Merton's method to calculate firms' asset volatility.
[6] We checked the robustness of this assumption by changing the assumed maturity of one year to the firm-specific weighted average of the maturities of short-term debt and long-term debt approximated to 0.5 and 2 years, respectively. The estimated coefficients and standard errors in the regressions of Table 3 change only slightly (unreported).

is proxied by the yield on one-year US Treasury bills. Altogether, we have 24,615 Asset volatility (stock) observations with a mean of 0.024, as reflected in Table 1.

Looking at the association between firm volatility and the maturity structure of debt can be problematic since the direction of causality can go either way, with less volatile firms being able to attract more long-term debt. We deal with this identification problem by using the approach of Rajan and Zingales (1998) to construct a measure of firms' "desired" debt maturity structure. This index, Maturity, is given by the use of long-term finance for sectors in the US on the assumption that firms in the US are not as constrained in their choice of short-term vs. long-term external finance. Specifically, Maturity is computed as the sectoral median of the firm-level average long-term debt to total debt ratio over 1995-2013 for US firms in each three-digit Standard Industrial Classification (SIC) sector.

Variation in Maturity across sectors reflects that firm preferences for long-term finance may differ for a variety of reasons. For example, Demirgüç-Kunt and Maksimovic (1999) find that the long-term debt ratio is positively related to the ratio of fixed assets to total assets as evidence that firms try to match the maturity of their assets and liabilities. Furthermore, they find that the long-term debt ratio is negatively related to profitability as firms that are more profitable may be better off financing their investments through retained earnings. In addition, Demirgüç-Kunt and Maksimovic (1999) also find that long-term debt use is positively related to firm size as proxied by total assets which could reflect that bigger firms are less risky or that they have found better ways to limit the potential for moral hazard associated with more long-term finance. The Maturity variable has a mean of 0.766.

Analogously to Rajan and Zingales (1998), the volatility regressions include an interaction of the Maturity variable with a financial development variable that reflects the financial depth of the country where the firm is located. Five financial development variables

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are considered.[7] First, Private credit reflects domestic credit provided by banks to the private

sector as a percentage of GDP, with a mean of 0.873. Second, Domestic credit is domestic

credit provided by the financial sector (including monetary authorities, banks, and other

financial corporations) as a percentage of GDP, with a mean of 1.141. Third, Capitalization is

the sum of Domestic credit and the stock market valuation of all listed companies as a

percentage of GDP. The mean of the Capitalization variable is 1.800. Fourth, Bonds is debt

securities issued by all issuers as a percentage of GDP, and has a mean of 0.105. Finally,

Total capitalization is the sum of Capitalization and Bonds with a mean of 1.900. Data on

credit aggregates and overall stock market valuation are from the World Development

Indicators database, while data for the bonds variable are from the debt securities database of

the Bank of International Settlements (BIS).

As additional control variables, in some specifications we also interact the financial

development proxies with a measure of firms' dependence on external finance. Analogously

to Maturity, we construct the desired dependence on external finance variable, DEF, for each

US sector as the share of financing of capital expenditures that cannot be covered by the

operating cash flow, i.e. as (capital expenditures − operating cash flow)/capital expenditures,

on the assumption that firms in the US are not constrained in their external financing.

Specifically, DEF is the sectoral median of the firm-level average value of (capital

expenditure - operating cashflow)/capital expenditure over the 1995-2013 period for US

firms in a three-digit SIC sector.[8] In Table 1 we see that DEF has a mean of 0.094.

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[7] We restrict the sample to the years 1995-2013, as availability of the financial development variables before
1995 is limited. Financial development variables are for the year 1995 to reduce concerns about the endogeneity
of these variables.

[8] To calculate DEF, we exclude firms with fewer than ten years of observed book value of assets to ensure that
we calculate this variable over a relatively extended period of capital expenditures and operating cash flows.

In addition, we examine how the relationship between the firm volatility variables and Maturity depends on several indices of institutional quality. These institutional indices measure the ease and cost of credit transactions in a certain country, and therefore might influence refinancing risk.

Accounting is a measure of accounting standards and captures the quality of information available on the firm. Such transparency may matter, as it enables debt holders to monitor firms better. Also, better quality information may reduce the perceived need for creditors to refuse to roll over their credits due to limited information on the firm. Accounting is an index of the disclosure standards for listed firms in a given country, compiled by the Center for International Financial Analysis and Research (CIFAR). Specifically, the Accounting variable informs on the presence, or absence, of 85 items in the annual reports of large publicly traded companies in 1993. The mean number of reported items is 72.73, as reported in Table 1.

Next, Getting credit is a measure of how easy it is to get credit as of 2006, with higher values of this variable meaning easier access to credit. The Getting credit variable reflects the existence of collateral and bankruptcy laws that facilitate lending as well as the coverage, scope and accessibility of credit information, for instance, through credit registries and credit bureaus. Greater ease of getting credit is expected to reduce a firm's refinancing risk. The Getting credit index is available from the Doing Business database of the World Bank.[9]

In addition, Contract enforcement measures the time and cost of resolving a commercial dispute through a local first-instance court in the year 2006, with higher values reflecting better enforcement. Faster and cheaper resolution of disputes is expected to

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[9] This variable is available only from 2006.

facilitate lending, which should be especially important for firms that are more reliant on short-term debt financing as these firms have to refinance their debts more frequently.

Further, the Resolving insolvency index measures the time, cost and outcome of insolvency proceedings as well as the strength of the legal framework applicable to liquidation and reorganization proceedings in 2006, with higher values indicating a more efficient bankruptcy resolution. A more efficient framework for resolving insolvency is expected to reduce refinancing risk, as the suppliers of short-term credit potentially have to rely on insolvency proceedings more frequently to ensure partial or full credit repayment.

A final measure of institutional quality is the Government effectiveness index, which captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures in 1996. Higher values of this variable indicate greater government effectiveness. Government effectiveness is important for private sector efficiency. Hence, this variable is an indication of how efficiently private credit transactions can be completed. Greater government effectiveness is expected to reduce the costs and risks associated with especially short-term credit, as short-term financing implies a sequence of refinancing transactions. The Government effectiveness index is available from the World Governance Indicators database of the World Bank.

Table 2 provides the correlations among the various variables. We see that two volatility measures are correlated negatively and significantly with Maturity, potentially because long-term finance reduces liquidity risk. Conversely, the volatility variables are correlated positively and significantly with the DEF variable, which could reflect moral hazard created by external finance regarding firms' risk choices as well as liquidity risks. The correlation between DEF and Maturity is negative and significant at -0.158, perhaps reflecting some trade-off between the total availability of external finance and its maturity. The correlations between the firm volatility and financial development variables, except the

bonds variable, are negative and significant. The tendency for firm volatility and financial development variables to be negatively correlated could reflect that external finance can prosper in less risky environments, or alternatively that the provision of external finance enhances risk monitoring which reduces firm volatility.

Figure 1 plots the average ratio of long-term debt to total assets over the 1995-2013 period separately for firms located in developing and in high-income countries according to World Bank classification in 1995. Long-term debt use in developing countries has generally been lower than in high-income countries, possibly reflecting greater macroeconomic instability and less developed institutional frameworks. The long-term debt to assets ratio declined in both developed and developing countries between 1995 and 2013, and it was relatively low in 2007 and 2008 in the two sets of countries at the time of the worldwide financial crisis.

4   Empirical results

In this section we present results of regressions that relate firm volatility measures to proxies for the availability of external finance, controlling for a firm's desired dependence on long-term external finance. In particular, we examine how the firm volatility variables are related to interactions of the various financial development variables with the Maturity variable, which proxies for firm preferences for long-term finance. Section 4.1 presents the basic results. Section 4.2 separately considers the before-crisis period, and the subsequent period. Finally, section 4.3 examines the role of information availability and the quality of the legal infrastructure.

4.1   Basic results

The basic results for the two volatility variables Asset volatility (book), and Asset volatility (stock) are presented in Panels A and B of Table 3, respectively. Each panel contains 5 regressions that each includes an interaction term of a different financial development variable (Private credit, Domestic credit, Capitalization, Bonds, or Total capitalization) with Maturity.

In the Asset volatility (book) regression 1 of Panel A of Table 3, the estimated coefficient of the interaction term of private credit and maturity is negative at -0.0554, and it is significant at the 1% level. A greater reliance on long-term finance may lower asset growth volatility by reducing the liquidity risk associated with the need to continually roll over short-term credit. In columns 2-5, the interactions of maturity with domestic credit, capitalization, bonds, and total capitalization similarly obtain negative estimated coefficients of -0.0500, -0.0179, -0.0532 and -0.0181, respectively, that are statistically significant at least at the 10% level.

In Panel B of Table 3, we present analogous regressions where asset volatility (stock) is the dependent variable. The interaction terms in all five regressions obtain negative coefficients that are statistically significant at least at the 5% level.

Overall, the results of Table 3 suggest that firms with a preference for more long-term finance, for instance on account of having more fixed assets, are able to achieve lower firm volatility in countries with better developed financial markets possibly as greater access to long-term finance lowers liquidity risk.[10]

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[10] In robustness checks we re-estimated the regressions in Table 3 for a sample that excludes the years 1995-1998 since Worldscope covers fewer firms around the beginning of our sample. The results suggest that the composition of the sample does not bias our results. In the unreported regressions, all ten estimated coefficients are negative and significant at least at the 10% level. Moreover, the magnitudes of the coefficients are the same as reported in Table 3 for the unrestricted sample.

The availability of long-term external finance in a country is likely to be related positively to the availability of external finance generally. To check whether long-term external finance has an impact on firm risk independently of overall external finance, we next re-estimate the regressions in Table 3, while adding an interaction of the included financial development variable with DEF, proxying for the dependence on overall external finance, as an additional control variable. The results are reported in Table 4.

In the Asset volatility (book) regression 1 of panel A of Table 4, the interaction of private credit with maturity obtains a negative coefficient of -0.0579 that is significant at the 1% level, while the interaction of private credit with DEF obtains a positive and insignificant coefficient. These results suggest that financial deepening reduces firm volatility through a lengthening of external debt maturity, rather than through a greater availability of external finance more generally. In regressions 2 to 5, the included interactions of a financial development proxy with maturity similarly obtain negative coefficients that are significant, except for the interaction of bonds with maturity in column 4. The interactions involving DEF are positive and insignificant, except for regression 5, where the interaction of total capitalization with DEF obtains a positive coefficient that is significant at 10%. The latter result suggests that financial deepening leads to higher firm risk insofar as it increases the availability of external finance generally. Additional external finance may increase firm risk, as it accentuates moral hazard regarding the firm's risk choices and as it increases liquidity risk.

Similar results obtain in panel B of Table 4, in which asset volatility (book) is replaced by asset volatility (stock) as dependent variable. The included interactions of a financial development variable with maturity obtain negative and significant coefficients in all five regressions, while the interactions of the financial development variable with DEF are estimated with positive and significant coefficients in regressions 1, 4 and 5.

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Overall, the results of Table 4 suggest that a greater availability of long-term external finance reduces firm volatility even if we control for the availability of external finance generally. Long-term finance may reduce firm risk as it mitigates liquidity risk. In contrast, there is some evidence that greater availability of external finance appears to lead to higher firm risk. This could reflect that use of overall external finance enhances firms' risk-shifting incentives and augments liquidity risks.

4.2   The pre-crisis period, and the crisis and its aftermath

The impact of long-term debt finance on firm stability can be expected to be especially pronounced during and immediately after a financial crisis. Specifically, negative asset growth and asset valuation outcomes associated with prior risk choices on the part of the firm, and also refinancing problems, are more likely to materialize during an economic and financial crisis. To investigate this, we split the sample into a pre-crisis period 1995-2006, and a crisis period and its aftermath 2007-2013. Specifically, we calculate our firm volatility measures separately for these two periods, and then re-estimate the regressions of Table 3 for the two samples. The results for the pre-crisis period, and the crisis period and its aftermath are reported in Tables 5 and 6, respectively.

In Panel A of Table 5 with pre-crisis regressions, asset volatility (book) is negatively and significantly related to the interactions of maturity with private credit and domestic credit, respectively. This suggests that long-term finance had a mitigating impact on firm risk also in the pre-crisis period. In the other three regressions of Panel A, however, the included interactions of a financial development variable with maturity are not estimated to be significant.

Panel B also shows some, but a limited impact of the availability of long-term finance on firm volatility in the pre-crisis period. In particular, the interaction of domestic credit with

maturity obtains a negative and significant coefficient in column 2, while all other interaction terms are estimated to be insignificant.

In Panel A of Table 6 for the years 2007-2013, we see that asset volatility (book) is negatively related to the included interaction terms in all five regressions, and that the estimated coefficients are statistically significant in all cases except for the interaction of bonds with maturity in column 4. In Panel B with asset volatility (stock) regressions, a similar picture emerges, as the estimated coefficients for the included interaction terms are all negative, and statistically significant. Overall, the results of Table 6 show a clear negative relationship between reliance on long-term debt and firm volatility during the crisis and its aftermath.

Comparing the results of Tables 5 and 6, we see that the interaction of bonds with maturity is significant in Panel B of Table 6 but in neither of the panels of Table 5. This could mean that the availability of bond finance only has a positive impact on firm stability during a crisis period, since the alternative, long-term bank finance, tends to be more limited during these periods. This is consistent with evidence in Adrian, Colla, and Shin (2012), and Becker and Ivashina (2014) that although bank loans decline during a financial crisis, bond financing actually increases to make up part of the gap. For other variables, across Tables 5 and 6 significantly estimated coefficients of similar magnitude arise in several instances. For example, the estimated coefficient for the interaction of private credit with maturity is -0.0348 in regression 1 of Panel A of Table 5 and significant at 10%, while it is -0.0338 in the corresponding regression in Table 6 and significant at 5%. In this case, it appears that the expected impact of the availability of long-term finance on firm volatility is similar in pre-crisis and crisis periods, even though the impact of long-term finance on firm volatility may be more difficult to estimate during the more tranquil pre-crisis period.

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4.3   The role of institutional quality

In this section, we examine how information and legal infrastructures affect the relationship between the availability of long-term finance and firm-level volatility.

To start, as a proxy for the availability of information we employ accounting standards. Greater transparency increases creditors' ability to monitor the firm, and hence is expected to reduce the firm's ability to engage in risk-shifting. This suggests that higher accounting standards should attenuate the tendency of external financing to increase firm volatility (as evident from Table 4). In addition, more transparency may reduce liquidity risk, as it should reduce the probability that creditors refuse to roll over their credits for lack of reliable data on the firm.

The beneficial effects of greater transparency in reducing the tendency of external finance to contribute to firm volatility should be especially pronounced in the case of short-term debt, as more transparency particularly strengthens the ability of short-term creditors to monitor and discipline the firm's risk-taking. Also, short-term credit needs to be continually rolled over, and hence good information is particularly important in the case of short-term credit in preventing credit-worthy projects from not being refinanced because of poor quality information.. For these reasons, with higher accounting standards we expect an increase in firm debt maturity to be associated with a relatively smaller reduction in volatility.

Table 7 shows regressions that investigate the role of accounting standards in affecting the relationship between access to long-term debt finance and firm volatility. Specifically, taking the specifications in Table 3, these regressions include triple interaction terms of a financial market development variable, Maturity, and Accounting.

In Panel A of Table 7, the dependent variable is asset volatility (book). In all five regressions, the included triple interaction terms obtain positive coefficients that are significant in regressions 1, 3, 4 and 5. In these four regressions, the double interaction terms

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of the included financial development variable and maturity obtain negative and significant coefficients. In the asset volatility (stock) regressions of panel B, we find that the triple interaction of bonds, maturity and accounting receives a positive and significant coefficient in regression 4, while the double interaction of bonds and maturity loads with a negative and significant coefficient in this regression. These results support the hypothesis that shorter maturity tends to increase firm volatility less in environments with better information, since with better information, pre-mature liquidation of deserving projects happens less frequently and the use of short-term debt increases liquidity risk less.

Next, in Table 8 we consider the role of the Getting credit variable, as an index of legal infrastructure that facilitates getting credit and of the existence of credit registries and credit bureaus. In the asset volatility (book) regressions of Panel A, the triple interactions of a financial market variable, Maturity and Getting credit receive positive coefficients that are statistically significant in regressions 3-5. The double interactions of Maturity and Getting credit obtain negative and significant coefficients in these regressions. These results suggest that with easier access to credit financial market development – implying greater availability of long-term debt - reduces asset growth volatility relatively less for firms with a preference for long-term debt. This reflects that being able to get credit easily is particularly important for firms with a preference for short-term credit.

In the asset volatility (stock) regressions Panel B of Table 8, triple interactions involving Getting credit obtain positive and significant coefficients, while the corresponding double interactions receive negative and significant coefficients. This is further evidence that the ability of get credit easily reduces the negative volatility consequences of a lack of financial market development and long-term finance.

Next, in Table 9 we consider regressions that include the Contract enforcement variable, which is an index of the time and cost of resolving a commercial dispute through a

first-instance court. In the asset volatility (book) regressions of Panel A, the triple interactions of a financial development variable, Maturity, and Contract enforcement are estimated with insignificant coefficients. In the asset volatility (stock) regressions in Panel B, these triple interactions instead receive positive coefficients that are statistically significant, while the corresponding double interactions are estimated with negative and significant coefficients. Easier contract enforcement thus appears to reduce the volatility benefits of financial development that facilitates long-term credit, as easier contract enforcement reduces volatility especially for firms with a preference for short-term credit. This may reflect that short-term creditors may be more patient and more likely to refinance their credits in countries with more efficient contract enforcement, which reduces the liquidity risk associated with short-term financing.

The regressions of Table 10 include triple and double interaction terms of the Resolving insolvency variable which measures the time, cost, and outcome of insolvency proceedings. The triple interactions are estimated with insignificant coefficients in the asset volatility (book) regressions of Panel A, while they receive positive and significant coefficients in asset volatility (stock) regressions 3 and 5 of Panel B. This provides some evidence that more efficient bankruptcy resolution again makes short-term creditors more patient, reducing liquidity risk of financing with short-term debt.

Finally, we consider the Government effectiveness variable as an overall measure of the effectiveness of public policies and governance, with the results reported in Table 11. In the asset volatility (book) regression 4 in Panel A, the interaction of Bonds with Maturity and Government effectiveness obtains a positive and significant coefficient, while the double interaction Bonds * Maturity obtains a negative and significant coefficient in this regression. In panel B, we obtain positive and significant coefficients for the triple interactions of Private credit, Capitalization and Total capitalization with Maturity and Government effectiveness in

asset volatility (book) regressions 1, 3 and 5, while the corresponding double interactions obtain negative and significant coefficients. These results suggest that more effective government policies reduce the negative impact of short-term debt on firm volatility, again potentially reflecting the greater patience of short-term creditors in dealing with debtors when they are more confident that their rights are protected in a better institutional environment. The reduced likelihood of pre-mature liquidation decreases the liquidity cost associated with short-term financing.

Overall, the results of this section suggest that the negative volatility consequences of a lack of financial development implying reduced access to long-term finance are attenuated in countries with high-quality information and legal infrastructures as these reduce the potential for short-term credit to add to firm-level volatility.

5   Conclusions

In this paper, we examine the relationship between access to long-term debt finance and economic volatility at the firm level. Using an approach similar to Rajan and Zingales (1998), we find that for firms with a greater demand for long-term debt, a greater availability of long-term debt finance, as proxied by different measures of the countries' financial development, reduces firm volatility, which suggests that availability of long-term finance may mitigate liquidity or refinancing risk.

Investigating the period before and after the global financial crisis separately, we see that the negative impact of the availability of long-term bank finance on firm volatility holds for the full sample of 1995-2013. However, when we proxy financial development by bond market development, we see that the contribution of bond market development to reducing

firm volatility is only found in the later period, perhaps because bond finance can be substituted to make up for the reduction in long-term bank finance during crisis periods.

Further, we show that adequate information availability and a high-quality contracting environment supporting credit markets reduce the negative implication for firm volatility of limited access to long-term debt, as these factors mitigate the liquidity risks associated with short-term debt. In particular, the liquidity risks associated with short-term finance appear to be lower if accounting standards are high, if legal institutions support access to credit, contract enforcement and efficient insolvency resolution, and if the government operates effectively.

Our evidence of a negative impact of the availability of long-term debt finance on firm volatility is robust to controlling for overall firm leverage. Hence, our results suggest that changes in financial development that tend to lengthen the maturity of credit have a potentially beneficial economic effect in terms of lower economic volatility, independently of the overall availability of external finance. For this reason, countries with limited availability of long-term debt finance resulting from market failures and policy weaknesses can benefit from policies that could increase its supply. Promoting macroeconomic and political stability, improving the information infrastructure, strengthening legal institutions including investor protection, and creating a contestable banking system that is adequately supervised and regulated may be effective policies in this regard.

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Appendix

Variable description and data sources

Variable	Description	Source
Asset volatility (book)	Standard deviation of the growth rate of the book value of total assets.	Worldscope
Asset volatility (stock)	Volatility of the value of a firm's assets calculated based on Merton's model, averaged over time.	Worldscope, Datastream
Maturity	Median of the average value over 1995-2013 of the ratio of long-term debt to total debt for US firms in a three-digit sector in the Standard Industrial Classification system.	Worldscope
DEF	Median of the average value over 1995-2013 of (capital expenditure - operating cashflow)/capital expenditure for US firms in a three-digit sector in the Standard Industrial Classification system.	Worldscope
Private credit	Domestic credit to the private sector by banks (% of GDP) as of year-end 1995. Domestic credit to the private sector by banks refers to financial resources provided to the private sector by deposit taking corporations except central banks, such as through loans, purchases of non-equity securities, and trade credits and other accounts receivable that establish a claim for repayment. For some countries these claims include credit to public enterprises.	WDI
Domestic credit	Domestic credit provided by the financial sector (% of GDP) as of year-end 1995. Domestic credit provided by the financial sector includes all credit to various sectors on a gross basis, with the exception of credit to the central government, which is net. The financial sector includes monetary authorities and deposit money banks, as well as other financial corporations where data are available (including corporations that do not accept transferable deposits but do incur such liabilities as time and savings deposits).	WDI
Capitalization	Domestic credit and the market capitalization of listed companies (% of GDP) as of year-end 1995.	WDI
Bonds	Debt securities issued by all issuers (% of GDP) as of year-end 1995.	BIS, WDI
Total capitalization	Sum of Capitalization and Bonds.	BIS, WDI
Accounting	Index of accounting standards in 1993. Higher values indicate more disclosure in firms' annual reports.	CIFAR
Getting credit	Index of the legal rights of borrowers and lenders that facilitate lending and a better availability of credit information in 2006 Higher values indicate easier access to credit.	Doing Business
Contract enforcement	Index measuring the time and cost of resolving a commercial dispute through a local first-instance court in 2006. Higher values indicate easier contract enforcement.	Doing Business
Resolving insolvency	Index measuring the time, cost and outcome of insolvency proceedings involving domestic entities as well as the strength of the legal framework applicable to liquidation and reorganization proceedings in 2006. Higher values indicate more efficient bankruptcy resolution.	Doing Business

| Government effectiveness | Index capturing perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies in 1996. Higher values indicate more effective government policies. | World Governance Indicators |

Figure 1: Ratio of average long-term debt to assets of firms in developing and high income countries

The graph shows the average ratio of LTD/TA for firms located in developing and high income countries based on World Bank classification in 1995. Developing countries include low and middle income countries. LTD/TA is the ratio of long-term debt to total assets. Sample is restricted to firms with data throughout the 1995-2013 period.

Table 1: Descriptive statistics

Asset volatility (book) is the standard deviation of the growth rate of the book value of total assets over the period 1995-2013. Asset volatility (stock) is the volatility of the value of a firm's assets calculated based on Merton's model averaged over the period 1995-2013. Maturity is the sectoral median of the average firm level ratio of long-term debt to total debt in the US over the period 1995-2013. DEF is the sectoral median of the average firm level value of (capex - operating cashflow)/capex in the US over the period 1995-2013. Private credit is domestic credit to private sector by banks (% of GDP) as of year-end 1995. Domestic credit is domestic credit provided by financial sector (% of GDP) as of year-end 1995. Capitalization is the sum of Domestic credit and the market capitalization of listed companies (% of GDP) as of year-end 1995. Bonds is debt securities (% of GDP) as of year-end 1995. Total capitalization is the sum of Capitalization and Bonds. Accounting is an index of accounting standards in 1993, with higher values indicating more disclosure. Getting credit is an index of the legal rights of borrowers and lenders that facilitate lending and a better availability of credit information in 2006, with higher values indicating easier access to credit. Contract enforcement is an index measuring the time and cost of resolving a commercial dispute through a local first-instance court in 2006, with higher values reflecting better enforcement. Resolving insolvency is an index measuring the time, cost and outcome of insolvency proceedings involving domestic entities as well as the strength of the legal framework applicable to liquidation and reorganization proceedings in 2006, with higher values indicating more efficient bankruptcy resolution. Government effectiveness is an index capturing perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures in 1996, with higher values indicating more effective government policies. Sample excludes US firms.

Variable	Obs	Mean	SD	Min	Max
Asset volatility (book)	27093	0.344	0.328	0.0624	1.965
Asset volatility (stock)	24615	0.0244	0.0113	0.00850	0.0648
Maturity	33099	0.766	0.125	0.0208	0.993
DEF	30960	0.0942	1.397	-3.089	7.863
Private credit	30979	0.873	0.504	0.0937	1.788
Domestic credit	30979	1.141	0.758	0.129	2.834
Capitalization	30979	1.800	1.090	0.295	3.774
Bonds	31027	0.105	0.172	0	3.176
Total capitalization	30976	1.900	1.104	0.298	3.856
Accounting	26129	72.73	7.486	56	85
Getting credit	33261	63.27	25.02	0	100
Contract enforcement	33261	65.94	15.03	20.82	93.36
Resolving insolvency	33261	64.72	30.49	0	99.71
Government effectiveness	33491	0.839	0.853	-1.255	2.101

Table 2: Correlations between variables
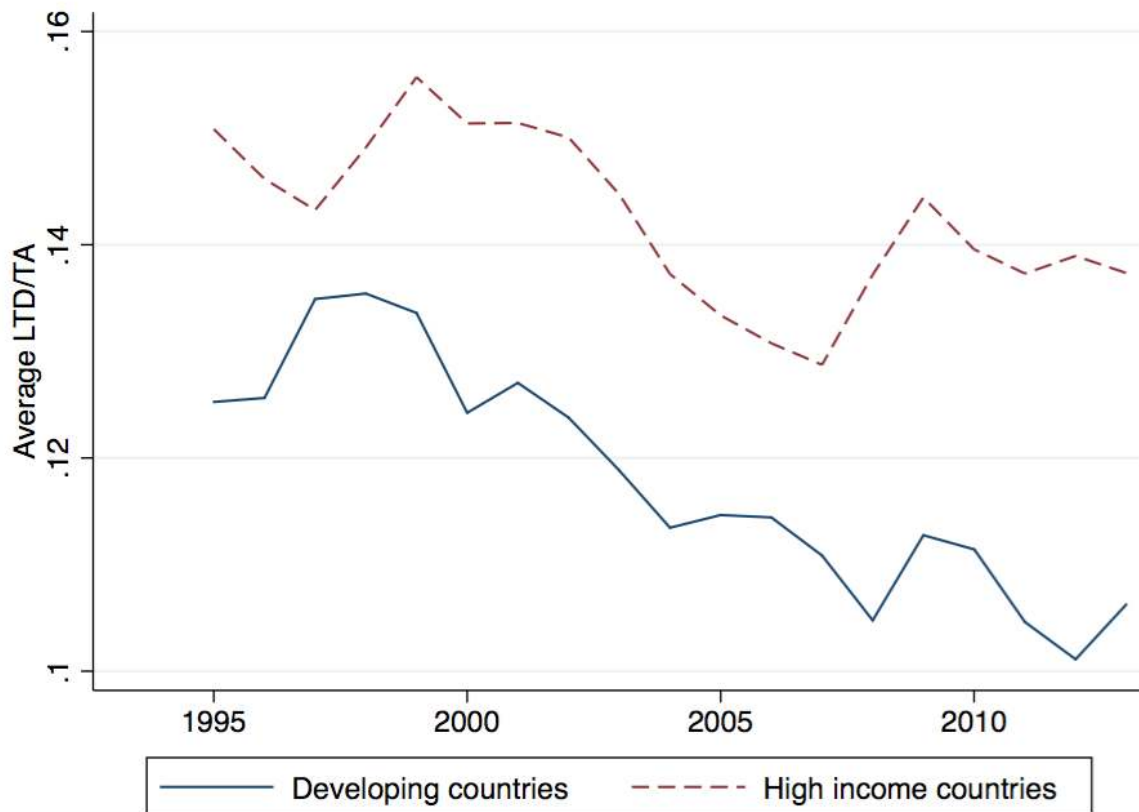
Asset volatility (book) is the standard deviation of the growth rate of the book value of total assets over the period 1995-2013. Asset volatility (stock) is the volatility of the value of a firm's assets calculated based on Merton's model averaged over the period 1995-2013. Maturity is the sectoral median of the average firm level ratio of long-term debt to total debt in the US over the period 1995-2013. DEF is the sectoral median of the average firm level value of (capex - operating cashflow)/capex in the US over the period 1995-2013. Private credit is domestic credit to private sector by banks (% of GDP) as of year-end 1995. Domestic credit is domestic credit provided by financial sector (% of GDP) as of year-end 1995. Capitalization is the sum of Domestic credit and the market capitalization of listed companies (% of GDP) as of year-end 1995. Bonds is debt securities (% of GDP) as of year-end 1995. Total capitalization is the sum of Capitalization and Bonds. Accounting is an index of accounting standards in 1993, with higher values indicating more disclosure. Getting credit is an index of the legal rights of borrowers and lenders that facilitate lending and a better availability of credit information in 2006, with higher values indicating easier access to credit. Contract enforcement is an index measuring the time and cost of resolving a commercial dispute through a local first-instance court in 2006, with higher values reflecting better enforcement. Resolving insolvency is an index measuring the time, cost and outcome of insolvency proceedings involving domestic entities as well as the strength of the legal framework applicable to liquidation and reorganization proceedings in 2006, with higher values indicating more efficient bankruptcy resolution. Government effectiveness is an index capturing perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures in 1996, with higher values indicating more effective government policies. Sample excludes US firms. *, **, and *** denote significance at 10%, 5%, and 1%.

	Asset volatility (book)	Asset volatility (stock)	Maturity	DEF	Private credit	Domestic credit	Capitalization	Bonds	Total capitalization	Accounting	Getting credit	Contract enforcement	Resolving insolvency	Government effectiveness
Asset volatility (book)	1													
Asset volatility (stock)	0.285***	1												
Maturity	-0.0565***	-0.164***	1											
DEF	0.112***	0.142***	-0.158***	1										
Private credit	-0.117***	-0.0807***	-0.0781***	-0.0452***	1									
Domestic credit	-0.154***	-0.107***	-0.0783***	-0.0494***	0.912***	1								
Capitalization	-0.116***	-0.0391***	-0.0624***	-0.0473***	0.881***	0.842***	1							
Bonds	0.0915***	0.0922***	0.0214***	0.0495***	-0.0503***	-0.0506***	0.0601***	1						
Total capitalization	-0.102***	-0.0247***	-0.0605***	-0.0396***	0.865***	0.826***	0.994***	0.168***	1					
Accounting	0.104***	0.137***	-0.0322***	0.0597***	0.262***	0.111***	0.366***	0.531***	0.420***	1				
Getting credit	0.0149**	0.0916***	-0.0559***	0.0181***	0.418***	0.340***	0.582***	0.475***	0.622***	0.677***	1			
Contract enforcement	0.0565***	0.108***	-0.0516***	0.0115**	0.419***	0.242***	0.310***	0.209***	0.327***	0.501***	0.372***	1		
Resolving insolvency	-0.0100	0.0510***	-0.0772***	0.0282***	0.541***	0.535***	0.510***	0.438***	0.546***	0.452***	0.730***	0.533***	1	

Government effectiveness	0.0673***	0.106***	-0.0613***	0.0441***	0.302***	0.241***	0.388***	0.422***	0.448***	0.724***	0.786***	0.461***	0.771***	1

Table 3: Firm volatility and use of long-term finance

Panel A: The dependent variable in all regressions is Asset volatility (book) which is the standard deviation of the growth rate of the book value of total assets over the period 1995-2013. Maturity is the sectoral median of the average firm level ratio of long-term debt to total debt in the US over the period 1995-2013. Private credit is domestic credit to private sector by banks (% of GDP) as of year-end 1995. Domestic credit is domestic credit provided by financial sector (% of GDP) as of year-end 1995. Capitalization is the sum of Domestic credit and the market capitalization of listed companies (% of GDP) as of year-end 1995. Bonds is debt securities (% of GDP) as of year-end 1995. Total capitalization is the sum of Capitalization and Bonds. Country and industry fixed effects are included. Sample includes all firms except financial firms and firms in the public sector. Standard errors are clustered at the country-industry level. *, **, and *** denote significance at 10%, 5%, and 1%.

	(1)	(2)	(3)	(4)	(5)
	Asset volatility (book)				
Private credit * Maturity	-0.0554***				
	(-2.76)				
Domestic credit * Maturity		-0.0500***			
		(-3.21)			
Capitalization * Maturity			-0.0179**		
			(-2.00)		
Bonds * Maturity				-0.0532*	
				(-1.85)	
Total capitalization * Maturity					-0.0181**
					(-2.06)
Observations	24763	24763	24763	24801	24763
Adjusted R-squared	0.141	0.141	0.140	0.140	0.140

Panel B: The dependent variable in all regressions is Asset volatility (stock) which is the volatility of the value of a firm's assets calculated based on Merton's model averaged over the period 1995-2013. Maturity is the sectoral median of the average firm level ratio of long-term debt to total debt in the US over the period 1995-2013. Private credit is domestic credit to private sector by banks (% of GDP) as of year-end 1995. Domestic credit is domestic credit provided by financial sector (% of GDP) as of year-end 1995. Capitalization is the sum of Domestic credit and the market capitalization of listed companies (% of GDP) as of year-end 1995. Bonds is debt securities (% of GDP) as of year-end 1995. Total capitalization is the sum of Capitalization and Bonds. Country and industry fixed effects are included. Sample includes all firms except financial firms and firms in the public sector. Standard errors are clustered at the country-industry level. *, **, and *** denote significance at 10%, 5%, and 1%.

	(1)	(2)	(3)	(4)	(5)
			Asset volatility (stock)		
Private credit * Maturity	-0.00274**				
	(-2.52)				
Domestic credit * Maturity		-0.00304***			
		(-4.02)			
Capitalization * Maturity			-0.00102**		
			(-2.26)		
Bonds * Maturity				-0.00401**	
				(-2.28)	
Total capitalization * Maturity					-0.00111**
					(-2.48)
Observations	22713	22713	22713	22747	22713
Adjusted R-squared	0.269	0.270	0.269	0.269	0.269

Table 4: Controlling for dependence on external finance

Panel A: The dependent variable in all regressions is Asset volatility (book) which is the standard deviation of the growth rate of the book value of total assets over the period 1995-2013. Maturity is the sectoral median of the average firm level ratio of long-term debt to total debt in the US over the period 1995-2013. DEF is the sectoral median of the average firm level value of (capex - operating cashflow)/capex in the US over the period 1995-2013. Private credit is domestic credit to private sector by banks (% of GDP) as of year-end 1995. Domestic credit is domestic credit provided by financial sector (% of GDP) as of year-end 1995. Capitalization is the sum of Domestic credit and the market capitalization of listed companies (% of GDP) as of year-end 1995. Bonds is debt securities (% of GDP) as of year-end 1995. Total capitalization is the sum of Capitalization and Bonds. Country and industry fixed effects are included. Sample includes all firms except financial firms and firms in the public sector. Standard errors are clustered at the country-industry level. *, **, and *** denote significance at 10%, 5%, and 1%.

	(1)	(2)	(3)	(4)	(5)
	Asset volatility (book)				
Private credit * Maturity	-0.0579***				
	(-2.70)				
Private credit * DEF	0.00664				
	(1.18)				
Domestic credit * Maturity		-0.0491***			
		(-2.91)			
Domestic credit * DEF		0.00424			
		(1.08)			
Capitalization * Maturity			-0.0188**		
			(-2.01)		
Capitalization * DEF			0.00406		
			(1.51)		
Bonds * Maturity				-0.0318	
				(-1.02)	
Bonds * DEF				0.0454	
				(1.45)	
Total capitalization * Maturity					-0.0184**

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					(-1.99)
Total capitalization * DEF					0.00504*
					(1.80)
Observations	23196	23196	23196	23234	23196
Adjusted R-squared	0.141	0.141	0.141	0.141	0.141

Panel B: The dependent variable in all regressions is Asset volatility (stock) which is the volatility of the value of a firm's assets calculated based on Merton's model averaged over the period 1995-2013. Maturity is the sectoral median of the average firm level ratio of long-term debt to total debt in the US over the period 1995-2013. DEF is the sectoral median of the average firm level value of (capex - operating cashflow)/capex in the US over the period 1995-2013. Private credit is domestic credit to private sector by banks (% of GDP) as of year-end 1995. Domestic credit is domestic credit provided by financial sector (% of GDP) as of year-end 1995. Capitalization is the sum of Domestic credit and the market capitalization of listed companies (% of GDP) as of year-end 1995. Bonds is debt securities (% of GDP) as of year-end 1995. Total capitalization is the sum of Capitalization and Bonds. Country and industry fixed effects are included. Sample includes all firms except financial firms and firms in the public sector. Standard errors are clustered at the country-industry level. *, **, and *** denote significance at 10%, 5%, and 1%.

	(1)	(2)	(3)	(4)	(5)
	Asset volatility (stock)				
Private credit * Maturity	-0.00257**				
	(-2.21)				
Private credit * DEF	0.000302*				
	(1.74)				
Domestic credit * Maturity		-0.00299***			
		(-3.73)			
Domestic credit * DEF		0.000191			
		(1.50)			
Capitalization * Maturity			-0.000981**		
			(-2.03)		
Capitalization * DEF			0.000108		
			(1.29)		
Bonds * Maturity				-0.00422***	
				(-2.73)	
Bonds * DEF				0.00376***	
				(4.99)	
Total capitalization * Maturity					-0.00105**
					(-2.21)
Total capitalization * DEF					0.000152*

					(1.83)
Observations	21403	21403	21403	21436	21403
Adjusted R-squared	0.267	0.268	0.267	0.270	0.267

Table 5: Firm volatility and use of long-term finance before 2007

Panel A: The dependent variable in all regressions is Asset volatility (book) which is the standard deviation of the growth rate of the book value of total assets over the period 1995-2006. Maturity is the sectoral median of the average firm level ratio of long-term debt to total debt in the US over the period 1995-2013. Private credit is domestic credit to private sector by banks (% of GDP) as of year-end 1995. Domestic credit is domestic credit provided by financial sector (% of GDP) as of year-end 1995. Capitalization is the sum of Domestic credit and the market capitalization of listed companies (% of GDP) as of year-end 1995. Bonds is debt securities (% of GDP) as of year-end 1995. Total capitalization is the sum of Capitalization and Bonds. Country and industry fixed effects are included. Sample includes all firms except financial firms and firms in the public sector. Standard errors are clustered at the country-industry level. *, **, and *** denote significance at 10%, 5%, and 1%.

	(1)	(2)	(3)	(4)	(5)
	Asset volatility (book)				
Private credit * Maturity	-0.0348*				
	(-1.89)				
Domestic credit * Maturity		-0.0282**			
		(-2.16)			
Capitalization * Maturity			0.000383		
			(0.05)		
Bonds * Maturity				0.0209	
				(0.62)	
Total capitalization * Maturity					0.00146
					(0.18)
Observations	15103	15103	15103	15121	15103
Adjusted R-squared	0.152	0.152	0.152	0.152	0.152

Panel B: The dependent variable in all regressions is Asset volatility (stock) which is the volatility of the value of a firm's assets calculated based on Merton's model averaged over the period 1995-2006. Maturity is the sectoral median of the average firm level ratio of long-term debt to total debt in the US over the period 1995-2013. Private credit is domestic credit to private sector by banks (% of GDP) as of year-end 1995. Domestic credit is domestic credit provided by financial sector (% of GDP) as of year-end 1995. Capitalization is the sum of Domestic credit and the market capitalization of listed companies (% of GDP) as of year-end 1995. Bonds debt securities (% of GDP) as of year-end 1995. Total capitalization is the sum of Capitalization and Bonds. Country and industry fixed effects are included. Sample includes all firms except financial firms and firms in the public sector. Standard errors are clustered at the country-industry level. *, **, and *** denote significance at 10%, 5%, and 1%.

	(1)	(2)	(3)	(4)	(5)
	Asset volatility (stock)				
Private credit * Maturity	-0.00132				
	(-1.07)				
Domestic credit * Maturity		-0.00191**			
		(-2.24)			
Capitalization * Maturity			-0.000305		
			(-0.57)		
Bonds * Maturity				-0.00307	
				(-1.57)	
Total capitalization * Maturity					-0.000389
					(-0.74)
Observations	16824	16824	16824	16845	16824
Adjusted R-squared	0.262	0.262	0.261	0.262	0.262

Table 6: Firm volatility and use of long-term finance between 2007 and 2013

Panel A: The dependent variable in all regressions is Asset volatility (book) which is the standard deviation of the growth rate of the book value of total assets over the period 2007-2013. Maturity is the sectoral median of the average firm level ratio of long-term debt to total debt in the US over the period 1995-2013. Private credit is domestic credit to private sector by banks (% of GDP) as of year-end 1995. Domestic credit is domestic credit provided by financial sector (% of GDP) as of year-end 1995. Capitalization is the sum of Domestic credit and the market capitalization of listed companies (% of GDP) as of year-end 1995. Bonds is debt securities (% of GDP) as of year-end 1995. Total capitalization is the sum of Capitalization and Bonds. Country and industry fixed effects are included. Sample includes all firms except financial firms and firms in the public sector. Standard errors are clustered at the country-industry level. *, **, and *** denote significance at 10%, 5%, and 1%.

	(1)	(2)	(3)	(4)	(5)
	Asset volatility (book)				
Private credit * Maturity	-0.0338**				
	(-2.46)				
Domestic credit * Maturity		-0.0337***			
		(-3.64)			
Capitalization * Maturity			-0.0179***		
			(-2.88)		
Bonds * Maturity				-0.0325	
				(-0.91)	
Total capitalization * Maturity					-0.0172***
					(-2.77)
Observations	18833	18833	18833	18858	18833
Adjusted R-squared	0.143	0.143	0.143	0.142	0.143

Panel B: The dependent variable in all regressions is Asset volatility (stock) which is the volatility of the value of a firm's assets calculated based on Merton's model averaged over the period 2007-2013. Maturity is the sectoral median of the average firm level ratio of long-term debt to total debt in the US over the period 1995-2013. Private credit is domestic credit to private sector by banks (% of GDP) as of year-end 1995. Domestic credit is domestic credit provided by financial sector (% of GDP) as of year-end 1995. Capitalization is the sum of Domestic credit and the market capitalization of listed companies (% of GDP) as of year-end 1995. Bonds is debt securities (% of GDP) as of year-end 1995. Total capitalization is the sum of Capitalization and Bonds. Country and industry fixed effects are included. Sample includes all firms except financial firms and firms in the public sector. Standard errors are clustered at the country-industry level. *, **, and *** denote significance at 10%, 5%, and 1%.

	(1)	(2)	(3)	(4)	(5)
			Asset volatility (stock)		
Private credit * Maturity	-0.00422***				
	(-3.51)				
Domestic credit * Maturity		-0.00361***			
		(-4.09)			
Capitalization * Maturity			-0.00168***		
			(-3.30)		
Bonds * Maturity				-0.00404*	
				(-1.76)	
Total capitalization * Maturity					-0.00167***
					(-3.37)
Observations	17997	17997	17997	18024	17997
Adjusted R-squared	0.253	0.254	0.253	0.252	0.253

Table 7: Firm volatility, long-term finance, and accounting standards

Panel A: The dependent variable in all regressions is Asset volatility (book) which is the standard deviation of the growth rate of the book value of total assets over the period 1995-2013. Maturity is the sectoral median of the average firm level ratio of long-term debt to total debt in the US over the period 1995-2013. Accounting is an index of accounting standards in 1993, with higher values indicate more disclosure. Private credit is domestic credit to private sector by banks (% of GDP) as of year-end 1995. Domestic credit is domestic credit provided by financial sector (% of GDP) as of year-end 1995. Capitalization is the sum of Domestic credit and the market capitalization of listed companies (% of GDP) as of year-end 1995. Bonds is debt securities (% of GDP) as of year-end 1995. Total capitalization is the sum of Capitalization and Bonds. Country and industry fixed effects are included. Sample includes all firms except financial firms and firms in the public sector. Standard errors are clustered at the country-industry level. *, **, and *** denote significance at 10%, 5%, and 1%.

	(1)	(2)	(3)	(4)	(5)
			Asset volatility (book)		
Private credit * Maturity * Accounting	0.00731*				
	(1.91)				
Private credit * Maturity	-0.575**				
	(-2.10)				
Domestic credit * Maturity * Accounting		0.00511			
		(1.19)			
Domestic credit * Maturity		-0.405			
		(-1.33)			
Capitalization * Maturity * Accounting			0.00551***		
			(2.97)		
Capitalization * Maturity			-0.411***		
			(-3.08)		
Bonds * Maturity * Accounting				0.0305**	
				(1.96)	
Bonds * Maturity				-2.307*	
				(-1.93)	
Total capitalization * Maturity * Accounting					0.00556***

					(3.08)
Total capitalization * Maturity					-0.414***
					(-3.20)
Maturity * Accounting	-0.00457	-0.00419	-0.00782**	-0.00384*	-0.00865***
	(-1.58)	(-1.08)	(-2.52)	(-1.74)	(-2.62)
Observations	20908	20908	20908	20908	20908
Adjusted R-squared	0.150	0.150	0.150	0.150	0.150

Panel B: The dependent variable in all regressions is Asset volatility (stock) which is the volatility of the value of a firm's assets calculated based on Merton's model averaged over the period 1995-2013. Maturity is the sectoral median of the average firm level ratio of long-term debt to total debt in the US over the period 1995-2013. Accounting is an index of accounting standards in 1993, with higher values indicate more disclosure. Private credit is domestic credit to private sector by banks (% of GDP) as of year-end 1995. Domestic credit is domestic credit provided by financial sector (% of GDP) as of year-end 1995. Capitalization is the sum of Domestic credit and the market capitalization of listed companies (% of GDP) as of year-end 1995. Bonds is debt securities (% of GDP) as of year-end 1995. Total capitalization is the sum of Capitalization and Bonds. Country and industry fixed effects are included. Sample includes all firms except financial firms and firms in the public sector. Standard errors are clustered at the country-industry level. *, **, and *** denote significance at 10%, 5%, and 1%.

	(1)	(2)	(3)	(4)	(5)
	Asset volatility (stock)				
Private credit * Maturity * Accounting	0.000306				
	(1.55)				
Private credit * Maturity	-0.0240*				
	(-1.67)				
Domestic credit * Maturity * Accounting		0.000217			
		(1.00)			
Domestic credit * Maturity		-0.0176			
		(-1.14)			
Capitalization * Maturity * Accounting			0.000109		
			(1.18)		
Capitalization * Maturity			-0.00849		
			(-1.25)		
Bonds * Maturity * Accounting				0.00171*	
				(1.90)	
Bonds * Maturity				-0.136**	
				(-1.96)	
Total capitalization * Maturity * Accounting					0.000114
					(1.22)
Total capitalization * Maturity					-0.00887

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					(-1.31)
Maturity * Accounting	-0.000316*	-0.000296	-0.000266	-0.000283*	-0.000282
	(-1.75)	(-1.29)	(-1.50)	(-1.94)	(-1.47)
Observations	18950	18950	18950	18950	18950
Adjusted R-squared	0.294	0.295	0.294	0.294	0.294

Table 8: Firm volatility, long-term finance, and ease of getting credit

Panel A: The dependent variable in all regressions is Asset volatility (book) which is the standard deviation of the growth rate of the book value of total assets over the period 1995-2013. Maturity is the sectoral median of the average firm level ratio of long-term debt to total debt in the US over the period 1995-2013. Getting credit is an index of the legal rights of borrowers and lenders that facilitate lending and a better availability of credit information in 2006, with higher values indicating easier access to credit. Private credit is domestic credit to private sector by banks (% of GDP) as of year-end 1995. Domestic credit is domestic credit provided by financial sector (% of GDP) as of year-end 1995. Capitalization is the sum of Domestic credit and the market capitalization of listed companies (% of GDP) as of year-end 1995. Bonds is debt securities (% of GDP) as of year-end 1995. Total capitalization is the sum of Capitalization and Bonds. Country and industry fixed effects are included. Sample includes all firms except financial firms and firms in the public sector. Standard errors are clustered at the country-industry level. *, **, and *** denote significance at 10%, 5%, and 1%.

	(1)	(2)	(3)	(4)	(5)
			Asset volatility (book)		
Private credit * Maturity * Getting credit	0.00117				
	(0.84)				
Private credit * Maturity	-0.129				
	(-1.27)				
Domestic credit * Maturity * Getting credit		0.00159			
		(0.95)			
Domestic credit * Maturity		-0.159			
		(-1.32)			
Capitalization * Maturity * Getting credit			0.00196***		
			(2.75)		
Capitalization * Maturity			-0.166***		
			(-2.99)		
Bonds * Maturity * Getting credit				0.0184***	
				(2.95)	
Bonds * Maturity				-1.405***	
				(-3.08)	
Total capitalization * Maturity * Getting credit					0.00194***

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					(2.90)
Total capitalization * Maturity					-0.166***
					(-3.18)
Maturity * Getting credit	-0.00123	-0.00170	-0.00279**	-0.00175***	-0.00282**
	(-0.93)	(-1.07)	(-2.33)	(-2.60)	(-2.34)
Observations	24718	24718	24718	24718	24718
Adjusted R-squared	0.141	0.141	0.141	0.141	0.141

Panel B: The dependent variable in all regressions is Asset volatility (stock) which is the volatility of the value of a firm's assets calculated based on Merton's model averaged over the period 1995-2013. Maturity is the sectoral median of the average firm level ratio of long-term debt to total debt in the US over the period 1995-2013. Getting credit is an index of the legal rights of borrowers and lenders that facilitate lending and a better availability of credit information in 2006, with higher values indicating easier access to credit. Private credit is domestic credit to private sector by banks (% of GDP) as of year-end 1995. Domestic credit is domestic credit provided by financial sector (% of GDP) as of year-end 1995. Capitalization is the sum of Domestic credit and the market capitalization of listed companies (% of GDP) as of year-end 1995. Bonds is debt securities (% of GDP) as of year-end 1995. Total capitalization is the sum of Capitalization and Bonds. Country and industry fixed effects are included. Sample includes all firms except financial firms and firms in the public sector. Standard errors are clustered at the country-industry level. *, **, and *** denote significance at 10%, 5%, and 1%.

	(1)	(2)	(3)	(4)	(5)
			Asset volatility (stock)		
Private credit * Maturity * Getting credit	0.000276***				
	(4.04)				
Private credit * Maturity	-0.0206***				
	(-4.08)				
Domestic credit * Maturity * Getting credit		0.000267***			
		(3.38)			
Domestic credit * Maturity		-0.0216***			
		(-3.75)			
Capitalization * Maturity * Getting credit			0.000171***		
			(5.14)		
Capitalization * Maturity			-0.0134***		
			(-4.97)		
Bonds * Maturity * Getting credit				0.000834***	
				(3.31)	
Bonds * Maturity				-0.0681***	
				(-3.71)	
Total capitalization * Maturity * Getting credit					0.000161***
					(5.24)

Total capitalization * Maturity					-0.0126***
					(-5.08)
Maturity * Getting credit	-0.000290***	-0.000286***	-0.000282***	-0.000104***	-0.000276***
	(-4.50)	(-3.72)	(-5.50)	(-3.59)	(-5.48)
Observations	22683	22683	22683	22683	22683
Adjusted R-squared	0.271	0.271	0.271	0.270	0.271

Table 9: Firm volatility, long-term finance, and contract enforcement

Panel A: The dependent variable in all regressions is Asset volatility (book) which is the standard deviation of the growth rate of the book value of total assets over the period 1995-2013. Maturity is the sectoral median of the average firm level ratio of long-term debt to total debt in the US over the period 1995-2013. Contract enforcement is an index measuring the time and cost for resolving a commercial dispute through a local first-instance court in 2006, with higher values reflecting better enforcement. Private credit is domestic credit to private sector by banks (% of GDP) as of year-end 1995. Domestic credit is domestic credit provided by financial sector (% of GDP) as of year-end 1995. Capitalization is the sum of Domestic credit and the market capitalization of listed companies (% of GDP) as of year-end 1995. Bonds is debt securities (% of GDP) as of year-end 1995. Total capitalization is the sum of Capitalization and Bonds. Country and industry fixed effects are included. Sample includes all firms except financial firms and firms in the public sector. Standard errors are clustered at the country-industry level. *, **, and *** denote significance at 10%, 5%, and 1%.

	(1)	(2)	(3)	(4)	(5)
			Asset volatility (book)		
Private credit * Maturity * Contract enforcement	-0.0000486				
	(-0.02)				
Private credit * Maturity	-0.0558				
	(-0.37)				
Domestic credit * Maturity * Contract enforcement		-0.00317			
		(-1.37)			
Domestic credit * Maturity		0.172			
		(1.07)			
Capitalization * Maturity * Contract enforcement			0.000477		
			(0.52)		
Capitalization * Maturity			-0.0529		
			(-0.78)		
Bonds * Maturity * Contract enforcement				0.00807	
				(0.67)	
Bonds * Maturity				-0.709	
				(-0.82)	
Total capitalization * Maturity * Contract enforcement					0.000519
					(0.59)
Total capitalization * Maturity					-0.0570
					(-0.87)
Maturity * Contract enforcement	0.000433	0.00222	-0.000525	-0.000745	-0.000534

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	(0.31)	(1.27)	(-0.39)	(-0.74)	(-0.39)
Observations	24718	24718	24718	24718	24718
Adjusted R-squared	0.141	0.141	0.141	0.141	0.141

Panel B: The dependent variable in all regressions is Asset volatility (stock) which is the volatility of the value of a firm's assets calculated based on Merton's model averaged over the period 1995-2013. Maturity is the sectoral median of the average firm level ratio of long-term debt to total debt in the US over the period 1995-2013. Contract enforcement is an index measuring the time and cost for resolving a commercial dispute through a local first-instance court in 2006, with higher values reflecting better enforcement. Private credit is domestic credit to private sector by banks (% of GDP) as of year-end 1995. Domestic credit is domestic credit provided by financial sector (% of GDP) as of year-end 1995. Capitalization is the sum of Domestic credit and the market capitalization of listed companies (% of GDP) as of year-end 1995. Bonds is debt securities (% of GDP) as of year-end 1995. Total capitalization is the sum of Capitalization and Bonds. Country and industry fixed effects are included. Sample includes all firms except financial firms and firms in the public sector. Standard errors are clustered at the country-industry level. *, **, and *** denote significance at 10%, 5%, and 1%.

	(1)	(2)	(3)	(4)	(5)
	Asset volatility (stock)				
Private credit * Maturity * Contract enforcement	0.000498***				
	(5.07)				
Private credit * Maturity	-0.0383***				
	(-5.31)				
Domestic credit * Maturity * Contract enforcement		0.000458***			
		(4.14)			
Domestic credit * Maturity		-0.0351***			
		(-4.47)			
Capitalization * Maturity * Contract enforcement			0.000237***		
			(5.45)		
Capitalization * Maturity			-0.0183***		
			(-5.58)		
Bonds * Maturity * Contract enforcement				0.00183***	
				(2.87)	
Bonds * Maturity				-0.144***	
				(-3.09)	
Total capitalization * Maturity * Contract enforcement					0.000233***
					(5.49)
Total capitalization * Maturity					-0.0181***
					(-5.66)
Maturity * Contract enforcement	-0.000242***	-0.000304***	-0.000283***	-0.000106*	-0.000284***
	(-3.19)	(-3.18)	(-3.74)	(-1.80)	(-3.74)

Observations	22683	22683	22683	22683	22683
Adjusted R-squared	0.271	0.271	0.271	0.270	0.271

Table 10: Firm volatility, long-term finance, and insolvency resolution

Panel A: The dependent variable in all regressions is Asset volatility (book) which is the standard deviation of the growth rate of the book value of total assets over the period 1995-2013. Maturity is the sectoral median of the average firm level ratio of long-term debt to total debt in the US over the period 1995-2013. Resolving insolvency is an index measuring the time, cost and outcome of insolvency proceedings involving domestic entities as well as the strength of the legal framework applicable to liquidation and reorganization proceedings in 2006, with higher values indicating more efficient bankruptcy resolution. Private credit is domestic credit to private sector by banks (% of GDP) as of year-end 1995. Domestic credit is domestic credit provided by financial sector (% of GDP) as of year-end 1995. Capitalization is the sum of Domestic credit and the market capitalization of listed companies (% of GDP) as of year-end 1995. Bonds is debt securities (% of GDP) as of year-end 1995. Total capitalization is the sum of Capitalization and Bonds. Country and industry fixed effects are included. Sample includes all firms except financial firms and firms in the public sector. Standard errors are clustered at the country-industry level. *, **, and *** denote significance at 10%, 5%, and 1%.

	(1)	(2)	(3)	(4)	(5)
			Asset volatility (book)		
Private credit * Maturity * Resolving insolvency	0.000276				
	(0.30)				
Private credit * Maturity	-0.0625				
	(-0.81)				
Domestic credit * Maturity * Resolving insolvency		0.000301			
		(0.41)			
Domestic credit * Maturity		-0.0690			
		(-1.01)			
Capitalization * Maturity * Resolving insolvency			0.0000883		
			(0.25)		
Capitalization * Maturity			-0.0159		
			(-0.57)		
Bonds * Maturity * Resolving insolvency				0.00891	
				(1.60)	
Bonds * Maturity				-0.782	
				(-1.64)	

Total capitalization * Maturity * Resolving insolvency					0.000117
					(0.32)
Total capitalization * Maturity					-0.0187
					(-0.66)
Maturity * Resolving insolvency	-0.000549	-0.000504	-0.000653	-0.00120**	-0.000673
	(-0.78)	(-0.78)	(-0.95)	(-2.32)	(-0.92)
Observations	24718	24718	24718	24718	24718
Adjusted R-squared	0.141	0.141	0.141	0.141	0.141

Panel B: The dependent variable in all regressions is Asset volatility (stock) which is the volatility of the value of a firm's assets calculated based on Merton's model averaged over the period 1995-2013. Maturity is the sectoral median of the average firm level ratio of long-term debt to total debt in the US over the period 1995-2013. Resolving insolvency is an index measuring the time, cost and outcome of insolvency proceedings involving domestic entities as well as the strength of the legal framework applicable to liquidation and reorganization proceedings in 2006, with higher values indicating more efficient bankruptcy resolution. Private credit is domestic credit to private sector by banks (% of GDP) as of year-end 1995. Domestic credit is domestic credit provided by financial sector (% of GDP) as of year-end 1995. Capitalization is the sum of Domestic credit and the market capitalization of listed companies (% of GDP) as of year-end 1995. Bonds is debt securities (% of GDP) as of year-end 1995. Total capitalization is the sum of Capitalization and Bonds. Country and industry fixed effects are included. Sample includes all firms except financial firms and firms in the public sector. Standard errors are clustered at the country-industry level. *, **, and *** denote significance at 10%, 5%, and 1%.

	(1)	(2)	(3)	(4)	(5)
	Asset volatility (stock)				
Private credit * Maturity * Resolving insolvency	0.0000520				
	(1.11)				
Private credit * Maturity	-0.00436				
	(-1.14)				
Domestic credit * Maturity * Resolving insolvency		0.0000239			
		(0.67)			
Domestic credit * Maturity		-0.00399			
		(-1.21)			
Capitalization * Maturity * Resolving insolvency			0.0000374*		
			(1.94)		
Capitalization * Maturity			-0.00262*		
			(-1.83)		
Bonds * Maturity * Resolving insolvency				0.000308	
				(1.23)	
Bonds * Maturity				-0.0306	
				(-1.41)	
Total capitalization * Maturity * Resolving insolvency					0.0000387**
					(2.00)

Total capitalization * Maturity					-0.00273*
					(-1.90)
Maturity * Resolving insolvency	-0.000106***	-0.0000704**	-0.000131***	-0.0000808***	-0.000136***
	(-2.69)	(-2.03)	(-3.53)	(-3.14)	(-3.47)
Observations	22683	22683	22683	22683	22683
Adjusted R-squared	0.270	0.270	0.270	0.270	0.270

Table 11: Firm volatility, long-term finance, and government effectiveness

Panel A: The dependent variable in all regressions is Asset volatility (book) which is the standard deviation of the growth rate of the book value of total assets over the period 1995-2013. Maturity is the sectoral median of the average firm level ratio of long-term debt to total debt in the US over the period 1995-2013. Government effectiveness is an index capturing perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures in 1996, with higher values indicating more effective government policies. Private credit is domestic credit to private sector by banks (% of GDP) as of year-end 1995. Domestic credit is domestic credit provided by financial sector (% of GDP) as of year-end 1995. Capitalization is the sum of Domestic credit and the market capitalization of listed companies (% of GDP) as of year-end 1995. Bonds is debt securities (% of GDP) as of year-end 1995. Total capitalization is the sum of Capitalization and Bonds. Country and industry fixed effects are included. Sample includes all firms except financial firms and firms in the public sector. Standard errors are clustered at the country-industry level. *, **, and *** denote significance at 10%, 5%, and 1%.

	(1)	(2)	(3)	(4)	(5)
	Asset volatility (book)				
Private credit * Maturity * Government effectiveness	-0.00438				
	(-0.11)				
Private credit * Maturity	-0.0319				
	(-0.73)				
Domestic credit * Maturity * Government effectiveness		-0.0609			
		(-1.34)			
Domestic credit * Maturity		0.0142			
		(0.33)			
Capitalization * Maturity * Government effectiveness			0.0256		
			(1.16)		
Capitalization * Maturity			-0.0298		
			(-1.33)		
Bonds * Maturity * Government effectiveness				0.169**	
				(2.15)	
Bonds * Maturity				-0.255**	
				(-2.41)	

Total capitalization * Maturity * Government effectiveness					0.0281
					(1.44)
Total capitalization * Maturity					-0.0315
					(-1.53)
Maturity * Government effectiveness	-0.0225	0.0247	-0.0629*	-0.0453***	-0.0694**
	(-0.74)	(0.64)	(-1.89)	(-2.87)	(-2.10)
Observations	24763	24763	24763	24801	24763
Adjusted R-squared	0.141	0.141	0.141	0.141	0.141

Panel B: The dependent variable in all regressions is Asset volatility (stock) which is the volatility of the value of a firm's assets calculated based on Merton's model averaged over the period 1995-2013. Maturity is the sectoral median of the average firm level ratio of long-term debt to total debt in the US over the period 1995-2013. Government effectiveness is an index capturing perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures in 1996, with higher values indicating more effective government policies. Private credit is domestic credit to private sector by banks (% of GDP) as of year-end 1995. Domestic credit is domestic credit provided by financial sector (% of GDP) as of year-end 1995. Capitalization is the sum of Domestic credit and the market capitalization of listed companies (% of GDP) as of year-end 1995. Bonds is debt securities (% of GDP) as of year-end 1995. Total capitalization is the sum of Capitalization and Bonds. Country and industry fixed effects are included. Sample includes all firms except financial firms and firms in the public sector. Standard errors are clustered at the country-industry level. *, **, and *** denote significance at 10%, 5%, and 1%.

	(1)	(2)	(3)	(4)	(5)
	Asset volatility (stock)				
Private credit * Maturity * Government effectiveness	0.00381**				
	(2.10)				
Private credit * Maturity	-0.00417*				
	(-1.93)				
Domestic credit * Maturity * Government effectiveness		0.000542			
		(0.28)			
Domestic credit * Maturity		-0.00256			
		(-1.30)			
Capitalization * Maturity * Government effectiveness			0.00296***		
			(3.06)		
Capitalization * Maturity			-0.00263**		
			(-2.42)		
Bonds * Maturity * Government effectiveness				0.00310	
				(0.87)	
Bonds * Maturity				-0.00534	
				(-1.01)	
Total capitalization * Maturity * Government effectiveness					0.00260***
					(2.99)

Total capitalization * Maturity					-0.00225**
					(-2.21)
Maturity * Government effectiveness	-0.00558***	-0.00299*	-0.00699***	-0.00311***	-0.00685***
	(-3.84)	(-1.69)	(-4.80)	(-4.35)	(-4.76)
Observations	22713	22713	22713	22747	22713
Adjusted R-squared	0.271	0.271	0.271	0.270	0.271