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Short-term Corporate Debt Around the World*

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Abstract

Short-term corporate debt as a proportion of total debt issued by public firms varies greatly across countries, between 28% in the U.S. and 78% in China. This paper argues that the interaction between information asymmetry and legal protection of creditors is an important determinant of debt maturity. When short-term debt plays a dual role as signalling and commitment devices, a reduction in information asymmetry has a larger impact on debt maturity when creditor rights are weaker. We find empirical support for this prediction using firm-level data from 45 countries around the world.

Keywords: debt maturity, information sharing, creditor protection, law and finance.

JEL classification: G21, G32

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1. INTRODUCTION

A common problem faced by many firms around the world is the limited availability of long-term sources of funds. Exclusive reliance on short-term borrowing may expose companies to rollover risk and reduce their overall growth potential. The inability to rollover short-term debt may lead to insolvency for even positive net-present-value projects. During the period of 1991-2010, the proportion of total debt issued by public firms that has a maturity of less than one year ranges between 28% in the U.S. and 78% in China (see Table 1). This suggests that country characteristics are important determinants of variations in debt maturity structure. It also implies that the impact of debt rollover risks on the real economy varies greatly around the world. Although the negative implications of excessive short-term borrowing on growth and stability are well known (e.g. Chang and Velasco, 2001 and Demirguc-Kunt and Maksimovic, 1998), there is no consensus on its underlying determinants and hence the main priorities for reform. To address these issues, many countries have embarked on policies and institutions promoting the development of long-term loan or bond markets with mixed results.

This paper argues that the interaction between information asymmetry and legal protection of creditors is an important determinant of debt maturity. Existing models do not yield a prediction on how information asymmetry and creditor protection interact in determining debt maturity. A clear understanding of this interaction is necessary both for a meaningful empirical analysis and for policy recommendations. In this paper, we develop a simple two-period model that involves both ex-ante asymmetric information and the possibility of ex-post diversion of cash flows by entrepreneurs. The extent of diversion depends on the degree of creditor protection. In our model, short-term debt plays a dual role from an entrepreneur's perspective: i) as a signaling device to

convey favorable information to the market and, ii) as a commitment device to restrict ex-post diversion of cash flows.¹ A novel and sharp empirical prediction of our model is that a reduction in information asymmetry acts as a substitute for creditor protection in lengthening debt maturity: more specifically, the effect of information asymmetry on debt maturity is stronger when creditor rights are weaker.

A simple intuition underlies our theoretical results. When creditor rights are relatively strong, the signaling role of short-term debt prevails as the safe firms issue a small amount of short-term debt to credibly signal their type and separate themselves from the risky firms. In this case, creditor rights have little impact on debt maturity. When creditor rights become weaker, short-term debt is no longer an effective signaling device and both types of firms use some level of short-term debt to commit to restricting ex-post diversion of cash flows. Short-term debtholders can credibly threaten to liquidate a firm in case of diversion, as they have no claim to the long-term cash flows. The threat of liquidation by short-term financiers makes the entrepreneurs' commitment credible even when creditor rights are relatively weak. The weaker the creditor rights, the higher the level of short-term debt that is required to act as a commitment device. In the benchmark case of full information, long-term debt is chosen by both types of firms to minimize transaction costs. Hence a reduction in information asymmetry has a larger impact on debt maturity when creditor rights are weaker.

We test the main predictions of the model using firm-level data from 45 countries for the 1991-2010 period. Institutions facilitating sharing of credit information such as public and private credit registries reduce information asymmetry between lenders and borrowers (Jappelli and

¹ From a lender's perspective, short-term debt is used as a screening device to overcome information asymmetry, and a discipline device to cope with ex-post diversion.

Pagano, 1993; Brown, Jappelli, and Pagano, 2009; Djankov, McLiesh, and Shleifer (henceforth DMS), 2007). Therefore, we use information sharing among creditors as an empirical proxy for a reduction in information asymmetry while controlling for the impact of legal enforcement, financial development and other macro and micro factors on debt maturity structure. We also use reforms of credit reporting systems around the world as our laboratory for quasi-natural experiments. A difference-in-difference approach is employed to further exploit the within-country variations in debt maturity around the reforms.

The main empirical findings of the paper can be summarized as follows. First, a higher degree of information sharing among creditors, i.e. lower information asymmetry, is associated with a higher share of long-term debt as a proportion of total corporate debt in both developed and developing countries. The results are very robust with respect to alternative measures of information sharing, different control variables, and different estimation methodology. This suggests that information sharing helps reduce problems of adverse selection and ex-post moral hazard in the bank-firm relationship. Second, countries with weaker creditor rights or higher corruption are characterized by higher ratios of short-term debt to total debt in the corporate sector. This is consistent with short-term lending as a commitment device to restrict ex-post diversion of cash flows.

Third and most importantly, there exists an interactive effect between information sharing and creditor rights. More specifically, corporate debt maturity is less sensitive to creditor rights (information sharing) in the presence of information sharing (strong creditor protection). This supports our theory which predicts that the effect of information asymmetry on debt maturity is weaker when creditor rights are stronger.

Finally, certain aspects of credit bureaus and bankruptcy laws are particularly important for lengthening debt maturity. They include regulations requiring that both positive and negative credit information are distributed and that secured creditors are paid first in bankruptcy. In addition, some aspects of the collateral law, especially those regarding how firms' assets can be used as collateral, also seem to matter for debt maturity. This supports the view of collateral as a debt contracting device (Rajan and Winton, 1995; Vig, 2013).

Overall, our findings suggest that a reduction in information asymmetry has a stronger effect on debt maturity when creditor rights are weaker. The interaction between information asymmetry and legal protection of creditors is an important determinant of debt maturity.

The paper contributes to the literature over three important dimensions. First, our theoretical model contributes to the literature on debt maturity by bringing together ideas from asymmetric information (Flannery, 1986; Diamond, 1991) and limited contract enforcement (Hart and Moore, 1994; Diamond, 2004). The interaction between these two forces, which was not analysed in previous models, gives rise to the novel prediction that the effect of information asymmetry on debt maturity is stronger when creditor rights are weaker.² That is, our model offers the new insight that the signalling role of short-term debt is ineffective when the legal environment is relatively weak. The model also adds to the literature on the relation between legal system and financing choices of firms (La Porta, Lopez-de-Silanes, Shleifer, and Vishny, (henceforth LLSV), 1997 and 1998) by arguing that creditor rights interact with information asymmetry in influencing debt contracting.

² In two polar cases the predictions of our model are similar to previous ones: i) under asymmetric information with perfect creditor rights, our results are the same as in Flannery (1986) where short-term debt is a signaling device; and ii) when diversion (i.e. ex-post moral hazard) is a severe problem without asymmetric information, our results are similar to those in Hart and Moore (1994) and Diamond (2004) who model short-term debt as a commitment device.

Second, we extend the literature on the roles of information sharing institutions. Previous research shows that information sharing among creditors helps lenders select good borrowers and overcome moral hazard of borrowers (Pagano and Jappelli, 1993; Padilla and Pagano, 2000), and contributes to higher volumes of lending/borrowing activities (DMS, 2007), lower costs of financing (Brown, Jappelli, and Pagano, 2009), lower corruption in banking lending (Barth, Lin, Lin, and Song, 2009) and higher economic growth (Houston, Lin, Lin, and Ma, 2010). This paper analyses the maturity dimension through which information sharing influences credit markets.

Third, we contribute to the empirical literature on the determinants of corporate debt maturity across countries (e.g. Dermirguc-Kunt and Maksimovic, 1999; Giannetti, 2003, Fan, Titman, and Twite, 2012). While previous studies capture the impact of legal institutions by legal origins and corruption, our paper is the first to study the complex effects of information sharing and creditor rights, and the interaction between these institutions, on debt maturity. We also study the causal impact of information on debt maturity by employing a difference-in-difference empirical strategy.

The paper is organized as follows. Section 2 reviews the related literature. Section 3 presents our theoretical model and develops testable hypotheses on information sharing and creditor rights as determinants of debt maturity. Section 4 introduces the data, and Section 5 discusses the empirical results and robustness checks. Section 6 concludes and draws some policy implications.

2. THE RELATED LITERATURE

2.1 Debt maturity

Stiglitz (1974) extended Modigliani and Miller's (1958) irrelevance result to debt maturity in perfect markets. Since then the literature in corporate finance on debt maturity choices has identified a variety of imperfections in capital markets that can explain why the choice of maturity in fact matters.

Under various assumptions, the decision to borrow at short-term maturities has been modelled in the corporate finance literature as a solution to debt-related agency problems (Myers, 1977; Barnea, Haugen, and Senbet, 1980), driven by the fear of early project termination by uninformed investors (Von Thadden, 1995), or as the consequence of illiquidity problems and inadequate regulation and institutions (Diamond and Rajan, 2001).

A number of theoretical studies explain why risky firms with long-term projects might borrow on a short-term basis in the presence of asymmetric information. Using a signalling framework, Flannery (1986) shows that firms with favorable insider information may distinguish their quality by issuing short-term debt and roll it over, provided issuing costs are sufficiently high. The model predicts that debt maturity is shorter when there are more information asymmetries and less risk. By incorporating liquidity risk into a framework similar to that in Flannery's model, Diamond (1991) shows that debt maturity is a non-monotonic function of risk ratings: the shortest maturity for both the lowest and highest risk ratings. Rajan (1992) analyses how information asymmetries and bargaining power affect the choice between short- and long-term debts from arm's length lenders, and Diamond (1993) links the choice of maturity with the choice of seniority of debt contracts under asymmetric information.

A number of empirical studies have focused on the impact of information asymmetries on the choice of debt maturity by firms within individual countries (mainly the US).³ Using loan-level data for the US, Berger, Espinosa-Vega, Frame, and Miller (2005) investigate the importance of information asymmetries and credit risk ratings for loan maturity choices. They find that information asymmetries reduce loan maturities and, consistent with Diamond (1991), the relationship between debt maturity and risk ratings is found to be stronger when information asymmetries are higher. Furthermore, recent research also shows that managerial stock ownership and executive compensation influences corporate debt maturity (Datta, Iskendar-Datta, and Raman, 2005; Brockman, Martin, and Unlu, 2010). Custódio, Ferreira, and Laureano (2013) show that the use of short-term corporate debt has increased in the US over the past decades. The decrease in debt maturity was driven by firms with high information asymmetry.

There is also a growing literature on how institutional differences across countries influence maturity choices (see, Dermirguc-Kunt and Maksimovic, 1999; Giannetti, 2003; Fan, Titman, and Twite, 2012). In the spirit of the law and finance literature initiated by LLSV (1997), the above empirical papers capture the effects of legal systems by variables such as legal origins and corruption.

Our paper contributes to the empirical literature by investigating the inter-country variations of the structure of corporate debt maturity. We focus on the impact of institutions aiming at reducing credit information asymmetries or protecting creditor rights. To the best of our knowledge, our paper is the first to study the effects of these institutions, and the interaction between them, as fundamental determinants of debt maturity structure.

³ See, Barclay and Smith (1995), Guedes and Opler (1996), Stoh and Mauer (1996), Barclay, Marx and Smith (2003), Johnson (2003), and Billett, King and Mauer (2007) for the US studies.

2.2 Information sharing and creditor rights

When banks consider loan applications, they can gather credit information from applicants and engage in direct screening. Alternatively, they can acquire this information from an information sharing institution who record borrowers' characteristics, credit history (positive and/or negative), and current debt exposure to other lenders. The institution can be either public (government-owned) or private credit bureaus.

Previous studies show that these information sharing institutions help the development of private credit markets (Jappelli and Pagano, 2002; DMS, 2007; Brown, Jappelli, and Pagano, 2009). They contribute to less severe financial constraints faced by firms in developing countries (Galindo and Miller, 2001), better access to credit (Barron and Staten, 2003) and better firm performance (Kallberg and Udell, 2003). In addition, the literature finds that information sharing helps lenders to select good borrowers (Pagano and Jappelli, 1993), overcome moral hazard of borrowers (Padilla and Pagano, 2000), reduce non-performing loans and the costs of firm financing (Brown, Jappelli, and Pagano, 2009), reduce corruption in bank lending (Barth, Lin, Lin, and Song, 2009), decrease bank risk-taking and lead to higher economic growth (Houston, Lin, Lin, and Ma, 2010). Experimental evidence by Brown and Zehnder (2010) confirms that a credit registry motivates borrowers to repay loans. Our paper adds to this literature by analyzing the maturity dimension upon which information sharing influences credit markets.

Economic theory suggests that limited enforcement influences the contracting environment (Hart and Moore, 1994). The seminal papers by LLSV (1997 and 1998) relate creditor rights to countries' financial development. Diamond (2004) argues that in legal systems with ineffective contract enforcement, debt maturity becomes shorter. In a model of multiple-bank lending, Bennardo, Pagano, and Piccolo (2015) analyse the role of information sharing and creditor rights

for credit market efficiency. Empirical evidence suggests that creditor rights and the enforceability of contracts matter to debt contracting (Qian and Strahan, 2007; Bae and Goyal, 2009).

Creditor rights may also influence debt maturity. Stronger creditor protection gives creditors more power in bankruptcy: creditors are more likely to force repayment, take collateral, and gain control of borrowers in case of financial distress of borrowers. This limits the extent of ex-post diversion of cash flows by other stakeholders, including managers, shareholders, and governments. Hence creditors are more willing to face the higher risk of diversion associated with longer-term finance.

Creditor rights may also interact with information sharing in affecting debt maturity. For example, the impact of information sharing on debt maturity may be weaker in countries with stronger creditor rights: when creditors have strong power ex-post to limit the possibility of diversion cash flows, e.g. by replacing firms' management in bankruptcy, they may be willing to lend long-term even in the absence of information sharing.

We formalize the above ideas in a theoretical model to isolate different forces in action. Our model involves both ex-ante asymmetric information and the possibility of ex-post diversion of cash flows by entrepreneurs. The extent of diversion depends on the degree of creditor protection. We bring together two strands of the literature: i) the signalling role of debt maturity under asymmetric information (Flannery, 1986; Diamond, 1991), and ii) the effects of limited contract enforcement on debt contracting (Hart and Moore, 1994; Diamond, 2004). We also contribute to the law and finance literature by arguing that creditor rights interact with information asymmetry in influencing debt contracting. Our paper is the first to study, both theoretically and empirically, the complex effects of the interaction between these frictions on debt maturity.

3. THEORY

3.1 The Model

We consider a simple, stylized two-period model of financing under asymmetric information. The time line and key aspects of the model are summarized in Figure 1. There are three dates, $t = 0, 1,$ and $2,$ and two groups of agents, i.e. entrepreneurs and financiers. Entrepreneurs have no initial wealth. At date 0, each entrepreneur needs to make an investment of amount I to undertake an indivisible project that generates cash flows over two periods. The entrepreneur chooses the optimal maturity structure of debt to fund this investment: he does so by issuing short-term debt, long-term debt, or a mix between the two types of debt. Short-term debt matures at date 1 whereas long-term debt matures at date 2. Each issuance of short-term or long-term debt implies a fixed transaction cost, $C.$ Both entrepreneurs and financiers are risk neutral. The risk-free interest rate is zero. For simplicity, we assume that there are two financiers who are involved in Bertrand competition. Our focus is the entrepreneur's choice of short-term debt as a fraction of total debt issued.

There are two types of projects, S (safe) and R (risky). Their proportions in the project population are λ and $1 - \lambda$ (where $0 < \lambda < 1$), respectively. The project type is private information of the entrepreneur at date 0. The S-type project generates cash-flow X_S with certainty at both dates 1 and 2. At date 1, the R-type project yields cash-flow X_R with probability p (where $0 < p < 1$) or 0 with probability $1 - p.$ At date 2, the R-type project yields X_R with certainty. The cash flows generated at date 1 can be reinvested at the risk-free interest rate of zero. Both types of projects have positive net present-value. They also have the same expected return

(i.e. mean-preserving spreads): $NPV=(1+p)X_R - I = 2X_S - I > 0$. We assume $0 < X_S < X_R < I$

At both dates 1 and 2, the entrepreneur may divert a fraction θ of the cash flows, where $0 \leq \theta < 1$.⁴ The fraction θ is inversely related to the degree of creditor protection. Debt repayment is not fully enforced, i.e. cash flows diverted by the entrepreneur at any given θ cannot be claimed by financiers. If cash flows at date 1 are inadequate to meet debt service requirements because of diversion, short-term debtholders may liquidate the project. However, if the project yields zero cash-flow at date 1, short-term debtholders allow the project to continue and the debt is due at date 2. In this case, the entrepreneur incurs a non-monetary cost of financial distress, C . In the benchmark case of full information, the type of the project is known to all agents and the entrepreneurs can be costlessly forced to use the cash flows generated by the firm to repay debt (i.e. debt repayment is enforced at zero cost).⁵

3.2 The main result

We consider two different cases: i) The benchmark case of full information, and ii) the presence of asymmetric information. Our main results are summarized in the following proposition:

⁴ The literature has considered two forms of moral hazard: i) ex-ante (effort) moral hazard and ii) diversion of cash flow which is an ex-post moral hazard problem. These two forms of moral hazard problems could generate the same predictions, only under certain conditions.

⁵ Alternative approaches to allowing for diversion include costly diversion (Shleifer and Wolfenzon, 2002), or costly debt enforcement (Diamond, 2004). In these cases, the cost of diversion (debt enforcement) increases (decreases) with the amount of available information. For example, better information on credit history makes earnings manipulation more difficult, which increases (decreases) the cost of diversion (debt enforcement). This would capture the notion that ex-post moral hazard is less severe as the degree of information asymmetry is lower. Such models would give the same result as our simple model if the cost of diversion is prohibitively high (or the cost of debt enforcement is sufficiently low) under full information.

PROPOSITION:

i) In the benchmark case of full information:

For any θ , both types of projects are financed by only long-term debt.

ii) Under asymmetric information:

a) For $0 \leq \theta \leq \underline{\theta}$, under certain conditions, there exists a separating equilibrium: the S-type project is financed by a mix of long-term debt and a small amount of short-term debt, whereas the R-type project is financed by long-term debt only.

b) For $\underline{\theta} < \theta \leq \bar{\theta}_p$, there exists a pooling equilibrium where both types of projects are financed by a mix of short-term debt and long-term debt. The ratio of the amount of short-term debt over the total amount of funds raised, I , increases with θ .

Proof: See Internet Appendix.

The main results of the model are summarized in Figure 2. The intuition of our results is summarized as follows. In the benchmark case of full information, long-term debt is chosen by both types of firms to minimize transaction costs. Under asymmetric information, when the fraction of cash flows that can be diverted (θ) is low, the R-type project can fund investment, I , by issuing only long-term debt. S-type projects issue a minimal amount of short-term debt to credibly signal their type.

When the fraction θ becomes higher than a threshold ($\underline{\theta}$), financiers cannot recover their investments, I , if the R-type project is financed by only long-term debt. Therefore the R-type project reluctantly issues some short-term debt, in addition to long-term debt, and the separating equilibrium collapses. In the resulting pooling equilibrium, both types of firms issue some level of

short-term debt to commit to limiting diversion of the intermediate cash flows on date 1. Borrowing short-term is a credible commitment even when creditor rights are relatively weak, as short-term financiers can threaten to liquidate a firm in case of diversion. More specifically, if liquidation happens entrepreneurs lose the opportunity to capture future cash flows that can be diverted. Hence entrepreneurs prefer repaying short-term debt than diverting intermediate profits and being liquidated. As long as the fraction θ is lower than a threshold ($\bar{\theta}_p$), both types of firms are financed and financiers *in expectation* recover their funds. The higher is the fraction θ , the more short-term debt is used as a commitment device.

3.3 Empirical Implications

This section derives three empirically testable hypotheses from our model, which are labelled as the signalling hypothesis, the commitment hypothesis, and the substitution hypothesis. Figure 3 illustrates our theoretical model with a numerical example. Suppose that $\lambda = 0.5$, $p = 0.8$, $NPV / I = 0.3$. Note that the choice of parameters does not affect our main results. In the internet appendix, we derive the thresholds of θ (i.e. $\underline{\theta}$ and $\bar{\theta}_p$). Panel A plots the average short-term debt to total debt ratio as a function of θ . We assume that the ratio in the separating equilibrium is minimal at 2%. Panel B plots the interest rates of long-term debt, short-term debt, and total debt as a function of θ . We note that in the pooling equilibrium, the yield of short-term debt does not depend on θ , whereas the average yield of total debt issued increases with θ due to the higher ratio of short-term to total debt.

Panel A of Figure 3 shows that entrepreneurs use a higher level of short-term debt under asymmetric information than under full information. This confirms the simple intuition that short-

term debt acts as a signalling device to overcome adverse selection. Our testable Hypothesis 1 is the following:

- ***Signalling hypothesis:*** *A reduction in information asymmetry is associated with a lower ratio of short-term debt to total debt.*

In the pooling equilibrium under asymmetric information, a higher fraction of cash flows that can be diverted is associated with a higher level of short-term debt (see Panel A of Figure 3). Therefore, the higher the fraction θ , the more short-term debt is employed as a commitment device. As mentioned before, the fraction of diversion is inversely related to the degree of creditor protection: the lower the degree of creditor protection, the higher the fraction of output entrepreneurs can divert. This leads to the following testable Hypothesis 2:

- ***Commitment hypothesis:*** *Better creditor protection is associated with a lower ratio of short-term debt to total debt.*

Panel A of Figure 3 also shows that the *difference* in levels of short-term debt under asymmetric information and those under full information depends on the fraction of cash flows that entrepreneurs can divert. This difference captures the effect of the degree of information asymmetry on debt maturity at any given θ . When creditor protection is relatively strong (i. e. θ is relatively low), the difference is small and does not depend on creditor rights. Hence the signaling role of short-term debt prevails in a strong legal system where a separating equilibrium exists. When creditor rights are relatively weak (i. e. θ is relatively high), the difference in short-term debt becomes larger. Hence, the higher the fraction θ , the higher the effect of information asymmetry on debt maturity. This implies that when creditor protection becomes weaker, a

reduction in information asymmetry reduces the use of short-term debt as a commitment device. In this case, information sharing among creditors facilitates debt enforcement and acts as a substitute for creditor protection in lengthening debt maturity. This leads to our key empirical prediction (Hypothesis 3):

- *Substitution hypothesis: The effect of a reduction in information asymmetry on debt maturity decreases with the level of creditor protection.*

It has been argued that information sharing among creditors leads to lower information asymmetry (Jappelli and Pagano, 1993; Djankov, McLiesh, and Shleifer, 2007). Therefore, in our empirical analysis we use credit information sharing as a proxy for a reduction in information asymmetry while controlling for legal enforcement, financial development and other macro and micro factors that may affect debt maturity structure.⁶

In sum, our model combines elements of two different types of models, i.e. ex-ante asymmetric information and ex-post moral hazard models. The predictions of our model are similar to the existing ones in the two polar cases: i) Asymmetric information with perfect creditor rights ($\theta=0$) where the results are the same as in Flannery (1986), and ii) Diversion (i.e. ex-post moral hazard) is a severe problem (θ is very high) without asymmetric information, in which case the results are similar to those in Hart and Moore (1994) and Diamond (2004). However, the interaction between these two forces, which was not analysed before, gives rise to the novel

⁶ Based on our model, information sharing among creditors affects debt maturity through two distinct channels. First, information sharing helps reduce the information asymmetry when a lending decision is made. This leads to longer debt maturities as firms are less willing to engage in costly signalling through short-term debt. Second, information sharing facilitates debt enforcement. This enhances borrowers' incentive to repay loans and reduces the need for short-term debt as a commitment device. Our simple, stylized theory abstains from modelling the incentives for creditors to share information and the impact on borrower base and competition, which has been extensively discussed in the literature (e.g. Pagano and Jappelli, 1993; Bouckaert and Degryse, 2004).

prediction that the effect of information asymmetry on debt maturity is stronger when creditor rights are weaker.

4. DATA AND SUMMARY STATISTICS

In order to examine the determinants of the debt maturity structure of firms in countries at different levels of development, we construct a novel database including a number of institutional, macro- and micro-economic variables, as briefly illustrated below.

We measure the debt maturity structure of a firm by the ratio of short-term interest-bearing debt (i.e. debt obligations with maturity less than one year) to total interest-bearing debt in the firm's balance sheet using the WorldScope. We calculate this ratio across firms for all countries for which we have data for at least 50 firms, and these firms represent more than 30 percent of the stock market capitalization in that country. We exclude banks, insurance, and other financial firms. This leads to our sample of a total of 40,474 publicly listed firms in 45 countries over the period 1991-2010. Although we only have data for publicly listed firms, which tend to be relatively large firms, we expect that the effects of credit information and creditor rights on debt maturity would be stronger for smaller unlisted firms. Table 1 presents a description of the cross sectional characteristics of the sample.

4.1 Measuring information asymmetry

As postulated in Section 3, a reduction in information asymmetry is likely to increase the maturity horizon at which financial institutions feel safe to lend. As information sharing among creditors reduces information asymmetry between borrowers and lenders, we employ several measures of information sharing among lenders. The main sources for our data are the World Bank/IFC `Doing Business_ database as well as the World Bank Public and Private Credit Registries Surveys. In addition, we obtain the credit registries establishment dates from Miller (2003), Love and Mylenko (2003), and Djankov, McLiesh, and Shleifer (2007).

Following DMS (2007), our first measure *D Information Sharing* is an indicator variable regarding the existence of an information sharing institution (i.e. a public registry or private bureau). The second variable *Depth of Credit Information* is an index measuring the rules affecting the scope, accessibility, and quality of credit information available through either public or private credit registries. The data are collected from the World Bank/IFC `Doing Business_ database. A value of one is added to the index for each of the following six aspects of a public or private credit registry (or both): (i) both positive credit information (e.g., loan amounts and pattern of on-time repayments) and negative information (e.g., late payments, number and amount of defaults and bankruptcies) are distributed; (ii) data on both firms and individuals are distributed; (iii) data from retailers, trade creditors and utility companies are distributed to financial institutions; (iv) more than two years of historical data are distributed; (v) data on loans below 1% of income per capita are distributed; and (vi) regulations are provided to guarantee borrowers the right to access their data in the largest registry in the economy. The index ranges from zero to six, with higher values indicating the better availability of credit information, from either a public registry or a private bureau, to facilitate lending decisions. The index is set to zero for countries without a credit registry.

In addition, we employ two more detailed measures of information sharing: (i) *Private Credit Bureau Coverage and Public Credit Registry Coverage* measure the extent of coverage of individuals and companies by private or public registries as a percentage of the adult population; and (ii) six indicator variables capture the above mentioned six features of public or private registries: *Positive/Negative Information, Firms/Individuals Covered, Trade/ Retailers Information, Historical Data, Small Loans Covered, and Borrowers' Rights*.⁷

4.2 Measuring legal rights of creditors and borrowers

LLSV (1998) develop a creditor rights index to measure the powers of secured creditors in bankruptcy. The creditor rights index is obtained by adding a score of one for each of the following provisions of creditor protections: (i) there are restrictions, such as creditor consent or minimum dividends, for a debtor to file for reorganization; (ii) the bankruptcy laws prohibit an automatic stay on assets; (iii) secured creditors are paid first out of the proceeds of liquidating a bankrupt firm; and (iv) creditors can dismiss managers and replace them with administrators when a firm becomes bankrupt. We use the *Creditor Rights* variable reported in DMS (2007), who introduce time-variations in the index due to reforms of bankruptcy laws. The index ranges from zero (weak creditor rights) to four (strong creditor rights).

Legal rights of creditors as well as borrowers are likely to influence the maturity horizon at which lending and borrowing activities take place. For example, collateral of borrowers can be

⁷ Each of these proxies for the quality of credit information has its own advantages and disadvantages. The credit bureau coverage variables have more cross-country and time-series variation than indicator variables, but they may be predominantly driven by the coverage of retail borrowers rather than corporate loans. This problem is less pronounced for public credit registries, as most of them have loan cut-off minimum amounts, usually excluding retail or small business loans. Additionally, we find that countries with higher coverage of private credit bureaus also have higher percentage of firms rated by either S&P or Moody's (the correlation coefficient is 0.38 and statistically significant).

motivated as a contractual device to increase lenders' incentive to monitor (Rajan and Winton, 1995). This may reduce the use of short-term debt as a commitment device. As robustness checks, we use the *Legal Rights* index, as reported in the World Bank/IFC Doing Business database, to measure the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders. The legal rights index includes eight aspects related to legal rights in collateral law and two aspects in bankruptcy law. A score of one is added for each of the following features of the laws: (i) any business may use movable assets as collateral while keeping possession of the assets, and any financial institution may accept such assets as collateral; (ii) the law allows a business to grant a non-possessory security right in a single category of revolving movable assets (such as accounts receivable or inventory), without requiring a specific description of the secured assets; (iii) the law allows a business to grant a non-possessory security right in substantially all of its assets, without requiring a specific description of the secured assets; (iv) a security right may extend to future or after-acquired assets and may extend automatically to the products, proceeds or replacements of the original assets; (v) general description of debts and obligations is permitted in collateral agreements and in registration documents; (vi) a collateral registry is in operation that is unified geographically and by asset type and that is indexed by the name of the grantor of a security right; (vii) secured creditors are paid first (e.g., before general tax claims and employee claims) when a debtor defaults outside an insolvency procedure; (viii) secured creditors are paid first when a business is liquidated; (ix) secured creditors are not subject to an automatic stay or moratorium on enforcement procedures when a debtor enters a court supervised reorganization procedure; and (x) the law allows parties to agree in a collateral agreement that the lender may enforce its security right out of court. The index ranges from zero to ten, with higher scores indicating that collateral and bankruptcy laws are better designed to facilitate lending. In addition

to using the aggregate index, we also use ten indicator variables to capture the individual components of the index: *Movable Assets*, *Revolving Movable Assets*, *All Assets*, *Future Assets*, *General Description of Debt*, *Collateral Registry*, *Secured Creditors Paid First (Outside Procedure)*, *Secured Creditors Paid First (In Liquidation)*, *No Automatic Stay*, and *Enforcement Out of Court*. Note that *Movable Assets* will be dropped from the regressions due to the lack of variability.

4.3 Country controls and firm characteristics

The differences in corporate debt maturity structures across countries may reflect varying quality of legal institutions and contracting environments (see Demirguc-Kunt and Maksimovic, 1998). Both laws and the actual enforcement of laws matter for debt contracting. We control for the level of enforcement and corruption in the legal system by using the (reverse of) *Corruption* perception indices provided by Transparency International. In addition, the enforcement procedure of debt contracts varies across countries. Based on Djankov, Hart, McLiesh, and Shleifer (2008), we include an indicator variable *Bankruptcy Code* that equals one if an insolvent firm is mostly likely to undergo a liquidation or reorganization proceeding. It equals zero if the firm is mostly likely to undergo foreclosure.

Macroeconomic variables may also influence firms' choices of debt maturity. In particular, GDP growth rate is a proxy for the growth opportunity faced by firms (Smith and Watts, 1992), and the inflation rate provides evidence for firms and banks on whether the local currency is a stable or risky measure of value to be used in long-term contracting. Hence we include among our controls the growth rate of GDP per capita as well as indices of consumer price inflation. A dummy

variable is also added to control for any structural differences between developed and developing economies not already captured by other explanatory variables.

In order to control for characteristics of the local banking sector and the degree of domestic financial development, we use the ratio of total deposits in the financial system to GDP, the coverage ratio of deposit insurance to deposits per capita as reported in Demirguc-Kunt, Kane and Laeven (2014) and whether or not a country experiences a systemic banking crisis in a given year as defined in Laeven and Valencia (2010).

Finally, we use a set of micro-level variables to control for the differences in firm characteristics across countries. The choice of these variables is based on the prior literature. First, larger firms may face lower information asymmetries and reduced financial constraints. Therefore we control for firm size by using the natural logarithm of firms' total assets. Second, the ratio of fixed assets to total assets is included to reflect the maturity structure of firms' assets. Firms with more fixed assets have higher collateral value but lower asset liquidity (Grudes and Opler, 1996) and tend to raise more long-term debt in order to match the maturity of their assets and liabilities (Stohs and Mauer, 1996). Third, we use the return on assets to capture profitability and liquidity of firms. Fourth, the debt to value ratio is included to control for firms' leverage (Barclay, Marx, and Smith, 2003). The ratio is defined as total debt (short-term and long-term debt) divided by market value of a firm, which is the sum of market value of equity, and book value of preferred stocks and total debt. Fifth, we include the market to book ratio to control for the growth prospect and the potential collateral value of assets. All of firm-characteristics variables are winsorized at the 1% each tail to ensure that our results are not driven by outliers.

4.4 Summary Statistics

We start with a brief summary of the key variables that will enter into our analysis. As reported in Table 1, China has the highest average short-term debt ratio (78%), whereas the United States has the lowest (28%), at about one-third of China's. There is a clustering of developing countries at the top of the range, such as Turkey and Thailand, indicating that firms in lower-income countries use more short-term debt as a proportion of total debt. Table 2 presents summary statistics for the variables used in our regression analysis. The average short-term debt to total debt ratio is 51% for firms across 45 countries over the 1991-2010 period. The average Depth of Credit Information across countries is 5 out of the maximum value of 6, whereas the average Creditor Rights index is 2 out of 4. More details on variable definitions and data sources are provided in the Appendix.

5. EMPIRICAL RESULTS

5.1 *Information sharing and creditor rights as determinants of corporate debt maturity*

We attempt to disentangle the impact of better credit information and stronger creditor rights by estimating the following pooled regression:

$$STD/TD = f(\text{Information Sharing, Creditor Rights, Information Sharing} * \text{Creditor Rights, Country Controls, Firm Characteristics, Industry Dummies, Year Dummies})$$

where the dependent variable *STD/TD* is the short-term debt to total debt ratio of a firm in each year. The interaction term between Information Sharing and Creditor Rights is included to test the substitution hypothesis. Our estimation sample contains firm-year observations for 45

countries over 20 years. In all of the regressions we use standard errors two-way clustered by year and by firm to allow for dependence across firms over time.⁸

Country Controls consist of variables on Legal Environment, Macroeconomic Environment, and Financial Development. We include a Corruption index and a Bankruptcy Code indicator as measures of the *Legal Environment*. In addition, GDP Growth, Inflation, and a Developed Country dummy are included to control for the *Macroeconomic Environment*. Furthermore, we use three variables to capture the degree of domestic *Financial Development* which may influence firms' debt maturity choices, namely the Deposit to GDP ratio, the coverage ratio of Deposit Insurance and a Banking Crisis indicator.

As discussed earlier, it is important to control for firm-level factors which may influence firms' debt maturity choices. Therefore we also include five variables to account for specific *Firm Characteristics*: Log of Total Assets, the Fixed Assets to Total Assets ratio, Return on Assets, the Debt to Value ratio and the Market to Book ratio. All regressions include industry indicator variables based on two-digit SIC code and year indicators to control for economic cycles.⁹

Table 3 presents the baseline results. We find that higher levels of information sharing in a country are associated with lower short-term to total debt ratios in the corporate sector. This holds for each of the information sharing measures (i.e. the presence of Information Sharing institutions and the Depth of credit information). The presence of a credit registry reduces the

⁸ We take the conservative approach by estimating two-way clustered standard errors: if we remove the time clustering, the statistical significance of our results is stronger.

⁹ We also test whether firm heterogeneity or country heterogeneity is a more important driver of corporate debt maturity, by comparing the R^2 of two regressions: one in which the firm-level regressors (including industry fixed effects) are removed, and another in which the country-level variables (including information and legal environment) are removed. Results suggest that both firm heterogeneity and country heterogeneity are of similar levels of importance in explaining corporate debt maturity, i.e. each of them explains 12% of variations of corporate debt maturity measured by adjusted R^2 .

average short-term to total debt ratio by 19% for a country with zero creditor rights. The reduction is approximately 4% for a country at the mean value of the creditor rights index ($-0.188 + 0.073 * 2.08 = -3.6\%$). The results are statistically significant as well as economically significant given the average short-term to total debt ratio of 51% in our sample. The results support our theory that information sharing helps mitigate the problems of adverse selection and ex-post moral hazard. Information sharing makes firms resort less to costly signalling of borrowing short term. We also find that weaker protection of creditor rights is associated with higher levels of short-term debt. This supports the hypothesis that short-term debt acts as a commitment device to limit ex-post diversion of cash flows.

As explained in Section 3, ex ante better credit information may be a substitute for ex post stronger protection for creditor rights. Consistent with this hypothesis, we find an important interactive effect between information sharing and creditor rights. The presence of information sharing appears to attenuate the positive effects of creditor rights on debt maturity. Put it differently, corporate debt maturity is less sensitive to creditor rights (information sharing) in the presence of information sharing (strong creditor protection). For example, the negative effects of creditor rights on short-term debt are virtually cancelled in the presence of information sharing (the marginal effects of creditor rights = $-0.054 + 0.073 * D \text{ Information Sharing} = 1.9\%$). Similarly, the negative effects of information sharing on short-term debt are largely eliminated for a mean level of creditor rights index of 2.08 (the marginal effects of depth of credit information = $-0.031 + 0.014 * 2.08 = -0.2\%$). This suggests that when creditors have strong power ex post, e.g. to replace firms' management in bankruptcy, they may be willing to lend long-term even in the absence of information sharing.

In a theory of financial structure based on the degree of legal protection of creditor rights and on legal enforcement costs, Diamond (2004) predicts that firms' debt will be short-term when legal enforcement is costly or corrupt. In line with the theory, we find that a higher level of corruption is associated with higher ratios of short-term to total corporate debt. Furthermore, we find that debt enforcement with a bankruptcy procedure (i.e. liquidation or reorganization) increases the use of short-term debt relative debt enforcement with foreclosure. This finding is in contrast to that of Fan, Titman, and Twite (2012) who show that the existence of an explicit bankruptcy code is associated with greater use of long-term debt.

As for macroeconomic fundamentals, firms in developed countries use on average 16% less short-term debt than firms in developing countries. We also find that corporate debt maturity is influenced by the development of the domestic financial sector. On average, countries with a larger amount of (short-term) deposits in the banking sector, compared to the size of the economy, are characterized by a higher share of short-term corporate debt. This result is similar to the finding by Fan, Titman, and Twite (2012) who argue that banks as suppliers of capital with short-term liabilities have a comparative advantage of holding short-term debt. We also find that firms use more long-term debt in countries with better coverage of deposit insurance schemes.

Furthermore, several firm characteristics appear important in explaining corporate debt maturity structures across countries. In line with our expectations, larger, more profitable firms, and firms with more tangible assets or better growth prospects obtain easier access to long-term finance. In addition, leverage is positively associated with debt maturity, consistent with the prior literature (Barclay, Marx, and Smith, 2003; Johnson, 2003).

Columns 3 and 4 of Table 3 present results of the first and second half of our sample periods, respectively. Results are similar with the following exceptions. First, inflation increases

the use of short-term debt in 1990s, but not in the post 2000 period. Second, firms use more short-term debt in countries with a systemic banking crisis in 1990s. However, this does not hold in more recent banking crises in 2001-2010.

We also employ alternative measures of information sharing and creditor rights in our analysis. Results are shown in Table 4. In line with previous results, we find that improvements in the coverage of private and public credit registries increase firms' access to long-term finance. Among the components of the depth of credit information index, two aspects of credit registries seem to matter significantly: whether both positive and negative credit information are reported, and whether credit information from a wide range of sources (e.g. trade creditors, retailers, and utility companies) are included.

Column 3 of Table 4 also report results with alternative measures of legal rights of creditors and borrowers. Laws allowing secured creditors to be paid first in bankruptcy or right of enforcement out of court have a significant impact on corporate debt maturity. In addition, certain aspects of the collateral law, especially those regarding the extent to which firms can use their assets as collateral, also seem to matter. This is consistent with the use of collateral as a contractual device to increase lenders' incentive to monitor (Rajan and Winton, 1995; Vig, 2013). This reduces the use of short-term debt as a commitment device. The interaction between credit information and legal rights remains significant.

The overall conclusion of the above empirical analysis is that – controlling for other macro and micro characteristics – information sharing among creditors and legal protection of creditor rights are crucial determinants of firms' debt maturity choices around the world. Information sharing acts as a substitute for creditor protection in lengthening debt maturity.

5.2 Alternative dependant variables and estimation methods

We use different measures of debt maturity structure. First, following Demirguc-Kunt and Maksimovic (1999), we use the ratio of short-term debt to total assets (STD/TA). Second, trade credit is an important source of financing for firms around the world (Fisman and Love, 2003). Therefore we use the ratio of accounts payable to total assets to capture trade credit. Third, we include trade credit in our measure of short-term debt by using $(STD + Payables) / TA$. We drop observations if the short-term debt to total debt ratio (STD/TD) is missing, to make our sample size similar to that in the previous section. We drop the leverage ratio in our regressions as the short-term debt to total asset ratio is mechanically correlated with the total debt ratio.

The results as reported in Table 5 confirm our previous results. Several interesting findings emerge. First, while firms in developed countries rely less on short-term debt, they use more trade credit than firms in developing countries. Second, a systemic banking crisis is associated with more short-term debt but less trade credit in a firm's balance sheet.

We examine the extent to which our results are driven by the cross-sectional variation in our explanatory variables. Following Fama-MacBeth's (1973) approach, we run cross-sectional regressions for each of the 20 years in our sample and then average coefficient estimates across the 20 years. Newey and West's standard errors are calculated with three lags to adjust for time-series correlation. The results are very similar to those reported for pooled regressions (see the internet appendix).

5.3 Endogeneity issues: instrumental variables and difference-in-difference estimations

This section investigates potential endogeneity issues in our regressions. First, we investigate the reverse causality between the maturity structure of corporate debt and credit information-sharing institutions. Based on available evidence it also appears that the establishment of credit bureaus across countries has been driven by exogenous factors other than the availability of long-term corporate debt markets, including the growth of retail credit markets (Vietnam), a minimum size of the economy (Central America), the existence of a regulatory framework for information sharing (Egypt), the adoption of standardized formats for credit data reporting (South Africa) and the development of information technology (IFC, 2006). Hence the potential for reverse causality in our regression is very limited. However, to be conservative, we use an instrumental variable (IV) approach to instrument information sharing and creditor rights by exogenous variations across countries.

The selection of instrumental variables is based on the law and finance literature. As legal origins of a country are determined exogenously e.g. by colonial power and history (LLSV, 1999; Acemoglu and Johnson, 2005), we use legal origins (English, French, German, Nordic and Socialist) as instruments for measures of information sharing and creditor rights. In addition, political and financial institutions are also shaped by a country's culture heritage and religious composition (Stulz and Williamson, 2003). They should not have a direct impact on debt maturity. Therefore we include the composition of religions of a country (Buddhist, Catholic, Muslim, Orthodox Christian, and Protestant) as additional instruments.

Table 6 presents the empirical results of two-stage least squares regressions when variables of information sharing and creditor rights (and their interactions) are instrumented. The coefficients of variables on information sharing and creditor rights remain negative and significant. This confirms our finding that information sharing and creditor protection help lengthen corporate

debt maturity. The interaction term between creditor rights and information sharing institutions is positive and significant. Other controls at the country and the firm levels yield similar results to those reported before.

Second, we turn to investigate the potential omitted variables problem in our regressions. Many countries started their public or private credit bureaus during our sample period. We use them as our laboratory for quasi-natural experiments. For instance, Thailand established her first credit bureau in 1999. Afterwards the average short-term to total debt ratios for firms in the country dropped by 9% compared to the years prior to the establishment of credit bureaus. In addition, according to the Loanware/Bondware Capital Markets database, the average maturity of loans and bonds for borrowers in Thailand increases by 40% after the establishment of credit bureaus than before. Panel A of Table 7 presents the list of 12 countries that established credit registries (either public or private) during our sample period. We employ a difference-in-difference approach to exploit the time-series and cross-sectional variations in corporate debt maturities around these institutional reforms in credit reporting systems. Regressions are estimated over either a 7-year window (i.e. from 3 years prior to the establishment year to 3 years after the establishment) or an 11-year window (i.e. from 5 years prior to the establishment year to 5 years after the establishment). The dependent variable is the short-term debt to total debt of firms (STD/TD).

Reforms in credit reporting systems affect all firms in the country. There is no natural candidate for the control set of firms that are not affected by the reform. But smaller firms, who suffer from higher information asymmetry, are likely to be more affected by the reform than larger ones. Following Vig (2013), we use larger firms in a country as the control group and the smaller firms in the country as the treatment group. Specifically, *D Treatment* is a dummy variable that equals one if a firm's size is below that of the median firm in the country in a given year, and zero

otherwise. It captures the cross-sectional differences in debt maturity between the treatment and control groups before reforms. $D PostCR$ is a dummy variable that equals one if a country has established a credit registry (either public or private), and zero otherwise. Hence the interaction term is our difference-in-difference estimator. We include country fixed effects to control for cross-country differences in legal, institutional, and macroeconomic conditions. All regressions also include industry and year dummies. Firm characteristics include the same set of firm-level control variables as in other regressions, i.e. Log of Total Assets, the Fixed Assets to Total Assets ratio, Return on Assets, the Debt to Value ratio and the Market to Book ratio. Standard errors are two-way clustered by year and by firm.

Panel B reports the regression results. Regressions in the first two columns are run without $D Treatment$ and the interaction term. Hence the coefficient on $D PostCR$ captures the time-series difference in debt maturity. We find that short-term debt is reduced by 1% following the establishment of credit bureaus in a country. This is statistically significant for a 7-year estimation window around the reform. The last two columns report results for difference-in-difference estimations. The interaction term $D PostCR * Treatment$ is negative and statistically significant. It suggests that the net effect of establishing information-sharing institutions is a 5% reduction in the short-term debt to total debt ratio. This supports a causal effect from information sharing to debt maturity.

5.4 Other robustness checks

We have performed a number of further robustness checks for our results. First, additional control variables are included. As the term structure of interest rates are important for debt maturity choices, we include the term spread proxied as the difference between 10-year government bond

yields and 3-months rates of treasury bills (see e.g., Brick and Ravid, 1985). We also calculate Altman's (1968) Z-score to measure the credit risk of a firm. Alternative macro- and micro-economic variables are such as bank concentration and non-performing loans (see Brown, Jappelli, and Pagano, 2009). The corruption index is replaced by the Rule of Law variable obtained from International Country Risk Guide. Furthermore, to ensure that firms from a small number of countries do not overly drive our results, we include a dummy variable for China and the U.S. in our regressions to absorb their effects on short-term debt, and hence remove their potential influence on other coefficients. Our main results are robust to these alternative specifications of the model. Tables are available upon requests.

Second, firms' debt maturity and leverage may be simultaneously determined by the contracting environment (Myers, 1977; Barclay, Marx, and Smith, 2003; Johnson, 2003). To address the potential endogeneity in firms' leverage, we use the IV analysis where a firm's leverage ratio is instrumented by that of the industry median (excluding the firm). Our main results regarding information sharing and creditor rights remain the same as those reported before (Tables are available upon request). The only difference compared with the previous results is that using this IV analysis, debt maturity is negatively associated with leverage.¹⁰

Third, we test if our results are different for developed and developing countries. We interact a dummy variable for developing countries with our key variables of interest, i.e. credit information, creditor rights, and their interactions. While our results work in the same direction as

¹⁰ Our theoretical model on debt maturity does not generate a clear prediction on how the debt maturity decision interacts with the leverage decision, as the use of equity is not justified in the model. In particular, equityholders do not incur cost of financial distress and cannot liquidate a firm if dividends are not paid. Therefore, in our model, equity does not deal with the two frictions of asymmetric information and diversion. More broadly speaking, short-term debt is a better instrument in dealing with these frictions than long-term debt and equity. Thus, if the information and legal environment prevents firms from issuing long-term debt or equity, the firms rely on short term debt, or raise no capital at all.

before for both sets of economies, the results are significantly stronger, both economically and statistically, in developed countries than developing countries. The difference may come from the empirical proxy of the developing country dummy picking up factors that are not yet modelled in our theoretical framework.¹¹ A possible explanation is that developing countries have relatively weak enforcement of rules that are not captured by our control variable corruption: e.g. if better nominal rules on credit information and creditor rights are not fully enforced in practice, they have a smaller real effect on debt maturity in developing countries than developed countries.

Fourth, we examine whether the development of domestic financial sectors, as well as firms' characteristics, may be co-determined with firms' debt maturity choices. To address this issue, we use one-year lagged values of financial development variables and firm characteristics variables as instruments. This approach assumes that past values of these variables are correlated with their current values but not with the current error terms. The results confirm our main results reported in Section 5.1.

6. CONCLUSION AND POLICY IMPLICATIONS

The limited availability of long-term funds is a common problem faced by many firms around the world. Although the negative implications of excessive short-term borrowing on growth and stability are well known, there is no consensus on its underlying determinants and hence the main priorities for reform. The key feature of this paper is that the interaction between asymmetric

¹¹ In our theoretical framework, we have assumed that the diversion problem proxied by δ is negatively related to creditor rights. If the relation is less negative in developing countries than developed countries, e.g. due to differences in rule enforcement, the effects of better rules on credit information and creditor rights will generate a smaller effect on debt maturity in developing countries.

information and creditor rights is an important determinant of debt maturity. More specifically, a reduction in information asymmetry has a stronger effect on debt maturity when creditor rights are weaker.

From a theoretical standpoint, short-term debt plays a dual role in our model: i) as a signalling device to overcome ex-ante information asymmetry, and ii) as a commitment device to restrict ex-post diversion of cash flows. The relative importance of the two roles depends on the degree of creditor protection. In particular, the commitment role of short-term debt is more important than the signalling role when creditor rights are relatively weak. As information sharing among creditors facilitates debt enforcement, it reduces the use of short-term debt as a commitment device in relatively weak legal environments.

Using panel data from 45 developed and developing countries, we find that better credit information (as proxied by the existence and quality of private and public credit registries) and stronger creditor rights are associated with a higher share of long-term debt as a proportion of total corporate debt. Most importantly, information sharing acts as a substitute for creditor protection in lengthening debt maturity: the presence of information sharing (strong creditor protection) attenuates the influence of creditor rights (information sharing) on debt maturity. This suggests that when creditors have better information about borrowers ex ante, they may be willing to lend long-term even in the absence of strong legal protection ex post.

The empirical results are robust to a number of estimation strategies. Reforms of credit reporting systems around the world are used as our laboratory for quasi-natural experiments. Results from the difference-in-difference estimations support a causal relation from information sharing to debt maturity.

The result does not imply that, in and of itself, better credit information or stronger creditor rights is a sufficient condition for developing long-term corporate debt markets. Countries, especially less developed, face challenges in developing strong institutions and rule enforcement. Our results do suggest, however, that an improvement in credit reporting systems acts as a substitute for relatively weak creditor protection and increases the maturity horizon at which financial institutions feel safe to lend. Better credit information would contribute to lengthening the maturity of corporate debt thus placing firms on a more solid footing to avoid rollover risks and exploit their full growth potential.

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Table 1: The sample

This table presents a description of the sample. Average STD/TD is the average short-term debt (i.e. less than one year maturity) divided by total debt across firms in a country. Definitions of other variables are in the Appendix.

Country	Number of Firm-years	Average STD/TD	Average Credit Info Index	Average Creditor Rights
Argentina	1,218	54%	6	1
Australia	7,786	45%	5	3
Austria	1,529	52%	6	3
Belgium	2,093	45%	4	2
Brazil	4,777	51%	5	1
Canada	26,990	42%	6	1
Chile	2,596	42%	5	2
China, PRC	21,712	78%	3.7	2
Czech Republic	558	55%	2.0	3
Denmark	3,105	43%	4	3
Finland	2,434	34%	5	1.2
France	13,185	49%	4	0
Germany	13,190	49%	6	3
Greece	4,046	65%	4.6	1
Hong Kong SAR	10,930	62%	4.5	4
Hungary	514	61%	4.6	1
India	15,842	42%	2.6	2
Indonesia	3,957	59%	3.6	2.2
Ireland	1,331	39%	5	1
Israel	3,526	49%	5	3
Italy	4,162	53%	5.1	2
Japan	61,082	58%	6	2.2
Korea, Rep.	15,261	62%	5.5	3
Luxembourg	484	29%	0	
Malaysia	12,026	63%	6	3
Mexico	2,100	42%	6	0
Netherlands	3,514	43%	5	3
New Zealand	1,712	36%	5	4
Norway	3,224	29%	4	2
Pakistan	2,257	59%	3.9	1
Peru	1,252	56%	6	0
Philippines	2,466	58%	2.5	1
Poland	2,969	60%	3.6	1
Portugal	1,170	49%	5	1
Russia	3,036	63%	2.3	2
Singapore	7,475	62%	2.8	3
South Africa	5,308	49%	5.9	3
Spain	2,538	48%	5	2
Sweden	6,128	36%	4	1.1
Switzerland	3,667	36%	5	1
Taiwan, China	15,041	67%	5	2
Thailand	6,333	64%	3.8	2.2
Turkey	2,888	67%	5	2
United Kingdom	30,985	48%	6	4
United States	53,054	28%	6	1

Table 2: Summary statistics

This table presents the summary statistics for our data. STD/TD is the short-term debt (i.e. less than one year maturity) divided by total debt of a firm. Definitions of other variables are in the Appendix. Variables with a prefix `D_` are binary dummies.

Variables	Mean	St.Dev	25th Perc.	Median	75th Perc.	Min	Max
STD/TD	0.51	0.34	0.20	0.49	0.84	0.00	1.00
Size	11.85	2.13	10.51	11.81	13.18	5.94	17.18
Fixed Assets	0.32	0.24	0.12	0.28	0.48	0.00	0.93
ROA	-0.03	0.27	-0.01	0.03	0.07	-1.85	0.32
Leverage	0.27	0.26	0.03	0.20	0.44	0.00	0.92
Market to Book	2.38	3.66	0.79	1.46	2.68	-6.16	25.46
Depth of Credit Info	5.15	1.29	5.00	6.00	6.00	0.00	6.00
Creditor Rights	2.08	1.08	1.00	2.00	3.00	0.00	4.00
D Developed Country	0.73	0.45	0.00	1.00	1.00	0.00	1.00
Corruption	3.86	2.07	2.00	3.40	5.70	0.00	9.43
D Bankruptcy Code	0.77	0.42	1.00	1.00	1.00	0.00	1.00
GDP growth	2.80	3.44	1.19	2.45	4.29	-16.30	23.26
Inflation	2.91	4.99	1.03	2.14	3.32	-5.03	55.00
Deposit /GDP	88.54	42.58	59.19	80.24	110.45	17.37	319.02
Deposit Insurance coverage	1.42	0.99	1.04	1.31	2.12	0.00	5.28
D Banking Crisis	0.14	0.35	0.00	0.00	0.00	0.00	1.00

Table 3: Determinants of debt maturity structure

The dependent variable is the short-term debt to total debt of firms (STD/TD). Definitions of other variables are in Appendix. The absolute values of t-statistics are in brackets, calculated with standard errors two-way clustered by year and by firm. All regressions include industry dummies and year dummies. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	1	2	3 (1991-2000)	4 (2001-2010)
D Info Share	-0.188 [3.56]***			
Depth of Credit Info		-0.031 [5.31]***	-0.041 [5.28]***	-0.025 [3.24]***
Creditor Rights	-0.054 [2.97]***	-0.055 [5.24]***	-0.063 [5.97]***	-0.044 [2.93]***
D Info Share * Creditor Rights	0.073 [4.26]***			
Depth of Credit Info * Creditor Rights		0.014 [7.11]***	0.016 [6.84]***	0.011 [4.08]***
Corruption	0.034 [30.04]***	0.034 [27.22]***	0.029 [11.95]***	0.033 [14.72]***
D Bankruptcy Code	0.06 [5.84]***	0.064 [6.82]***	0.029 [2.45]**	0.082 [13.50]***
D Developed Country	-0.161 [23.53]***	-0.154 [20.47]***	-0.145 [14.73]***	-0.152 [11.40]***
GDP growth	-0.001 [1.56]	-0.001 [0.87]	0.000 [0.23]	0.001 [0.25]
Inflation	0.001 [1.32]	0.001 [1.98]**	0.002 [6.39]***	0.000 [0.01]
Deposits /GDP	0.001 [9.12]***	0.001 [9.59]***	0.001 [8.20]***	0.001 [7.89]***
Deposit Insurance Coverage	-0.034 [11.47]***	-0.033 [9.68]***	-0.018 [3.69]***	-0.039 [9.02]***
D Banking Crisis	-0.007 [0.61]	-0.006 [0.54]	0.035 [2.96]***	-0.016 [0.91]
Size	-0.040 [27.10]***	-0.039 [26.62]***	-0.031 [23.54]***	-0.043 [32.36]***
Fixed Assets	-0.243 [13.17]***	-0.235 [13.08]***	-0.328 [36.09]***	-0.196 [12.14]***
ROA	-0.037 [5.89]***	-0.041 [6.06]***	-0.086 [5.99]***	-0.027 [5.36]***
Leverage	-0.071 [7.65]***	-0.074 [7.90]***	-0.052 [4.08]***	-0.092 [10.04]***
Market to Book	-0.003 [6.26]***	-0.003 [6.53]***	-0.001 [2.71]***	-0.003 [8.98]***
Constant	1.172 [17.58]***	1.117 [34.04]***	1.077 [28.14]***	1.145 [23.97]***
Observations	263,152	263,152	93,390	169,762
R-squared	0.25	0.25	0.24	0.25

Table 4: More detailed measures of information sharing and creditor rights

The dependent variable is the short-term debt to total debt of firms (STD/TD). Definitions of other variables are in Appendix. The absolute values of t-statistics are in brackets, calculated with standard errors two-way clustered by year and by firm. All regressions include industry dummies and year dummies. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	1	2	3
Private CB Coverage	-0.001 [6.23]***		
Public CR Coverage	-0.002 [4.01]***		
Positive/Negative Information		-0.025 [3.19]***	
Firms/Individuals Covered		-0.011 [1.45]	
Trade/Retailers Information		-0.044 [6.93]***	
Historical Data		0.007 [0.86]	
Small Loans Covered		0.024 [1.75]*	
Borrowers' Rights		-0.01 [0.54]	
Depth of Credit Info			-0.009 [1.51]
Creditor Rights	-0.017 [2.93]***	-0.015 [1.23]	
Revolving Movable Assets			-0.005 [0.77]
All Assets			-0.025 [3.83]***
Future Assets			-0.017 [2.34]**
General Description of Debt			0.09 [3.48]***
Collateral Registry			0.000 [0.00]
Secured Creditors Paid First (outside procedure)			-0.007 [1.08]
Secured Creditors Paid First (in liquidation)			-0.08 [8.74]***
No Automatic Stay			0.010 [1.45]
Enforcement Out of Court			-0.027 [3.78]***
Private Credit Bureau Cov. * Creditor Rights	0.000 [1.92]*		
Public Credit Registry Cov. * Creditor Rights	0.001 [4.12]***		
Depth of Credit Information * Creditor Rights		0.007 [3.34]***	
Depth of Credit Information * Legal Rights			0.002

			[2.55]**
Corruption	0.032 [24.99]***	0.035 [27.93]***	0.025 [10.53]***
D Bankruptcy Code	0.071 [6.99]***	0.069 [6.29]***	-0.011 [1.41]
D Developed Country	-0.126 [12.82]***	-0.158 [18.71]***	-0.158 [22.02]***
GDP growth	-0.001 [0.72]	-0.001 [1.35]	0.000 [0.20]
Inflation	0.000 [0.91]	0.001 [1.69]*	0.000 [0.34]
Deposits /GDP	0.001 [6.59]***	0.001 [4.32]***	0.001 [9.11]***
Deposit Insurance Coverage	-0.03 [7.81]***	-0.039 [10.93]***	-0.035 [10.55]***
D Banking Crisis	0.002 [0.15]	-0.005 [0.40]	0.001 [0.18]
Size	-0.039 [24.51]***	-0.039 [25.69]***	-0.039 [24.57]***
Fixed Assets	-0.237 [13.24]***	-0.235 [13.17]***	-0.241 [14.60]***
ROA	-0.045 [5.95]***	-0.042 [6.15]***	-0.036 [5.10]***
Leverage	-0.077 [8.61]***	-0.075 [8.23]***	-0.072 [7.88]***
Market to Book	-0.002 [6.17]***	-0.003 [6.47]***	-0.002 [6.27]***
Constant	0.987 [37.21]***	1.012 [26.75]***	1.112 [29.46]***
Observations	255,724	263,152	263,152
R-squared	0.25	0.25	0.25

Table 5: Alternative measures of debt maturity structure

The dependent variables are STD/TA, Payables/TA, and (STD + Payables)/TA, respectively. STD/TA is short-term debt divided by total asset of a firm. Payables/TA is account payables divided by total asset of a firm. (STD + Payables)/TA is the sum of short-term debt and account payables divided by total asset of a firm. Definitions of other variables are in Appendix. The absolute values of t-statistics are in brackets, calculated with standard errors two-way clustered by year and by firm. All regressions include industry dummies and year dummies. *,**,*** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	1	2	3
	STD/TA	Payables/TA	(STD + Payables)/TA
Depth of Credit Info	-0.012 [6.14]***	-0.013 [9.50]***	-0.028 [12.04]***
Creditor Rights	-0.010 [2.35]**	-0.040 [13.77]***	-0.053 [9.80]***
Depth of Credit Info *Creditor Rights	0.004 [6.16]***	0.007 [11.80]***	0.012 [13.44]***
Corruption	0.012 [18.37]***	0.006 [11.77]***	0.018 [22.28]***
D Bankruptcy Code	0.046 [13.24]***	0.003 [1.27]	0.050 [11.41]***
D Developed Country	-0.052 [15.45]***	0.014 [3.28]***	-0.039 [9.43]***
GDP growth	0.001 [1.31]	-0.003 [7.45]***	-0.002 [3.12]***
Inflation	0.000 [0.10]	-0.000 [2.29]**	-0.000 [0.80]
Deposits /GDP	0.000 [5.50]***	0.000 [2.31]**	0.000 [4.69]***
Deposit Insurance Coverage	-0.009 [4.13]***	-0.002 [2.03]**	-0.010 [3.53]***
D Banking Crisis	0.013 [2.57]**	-0.013 [2.71]***	-0.001 [0.09]
Size	-0.003 [5.16]***	-0.004 [9.11]***	-0.006 [9.80]***
Fixed Assets	0.005 [0.83]	-0.105 [16.18]***	-0.100 [7.72]***
ROA	-0.150 [19.10]***	-0.073 [14.95]***	-0.220 [22.96]***
Market to Book	-0.001 [3.75]***	-0.000 [2.78]***	-0.001 [3.71]***
Constant	0.117 [5.27]***	0.243 [24.30]***	0.371 [13.58]***
Observations	265,910	248,591	248,591
R-squared	0.18	0.17	0.22

Table 6: Instrumental variables estimations

The dependent variables are STD/TA, Payables/TA, and (STD + Payables)/TA, respectively. STD/TA is short-term debt divided by total asset of a firm. Payables/TA is account payables divided by total asset of a firm. (STD + Payables)/TA is the sum of short-term debt and account payables divided by total asset of a firm. Definitions of other variables are in Appendix. The absolute values of z-statistics are in brackets, calculated with standard errors two-way clustered by year and by firm. All regressions include industry dummies and year dummies. *,**,*** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	1	2	3
	STD/TD	STD/TA	(STD + Payables)/TA
Depth of Credit Info	-0.097 [10.45]***	-0.030 [7.89]***	-0.061 [9.54]***
Creditor Rights	-0.191 [11.02]***	-0.043 [4.87]***	-0.117 [8.40]***
Depth of Credit Info *Creditor Rights	0.043 [11.61]***	0.012 [7.34]***	0.025 [10.06]***
Corruption	0.035 [22.19]***	0.012 [16.87]***	0.018 [19.76]***
D Bankruptcy Code	0.097 [6.35]***	0.058 [11.43]***	0.066 [10.92]***
D Developed Country	-0.137 [13.89]***	-0.047 [12.34]***	-0.029 [7.13]***
GDP growth	0.002 [0.88]	0.002 [2.55]**	-0.001 [0.88]
Inflation	0.001 [2.26]**	0.000 [0.23]	-0.000 [0.55]
Deposits /GDP	0.001 [6.72]***	0.000 [5.36]***	0.000 [4.93]***
Deposit Insurance Coverage	-0.029 [7.77]***	-0.008 [3.32]***	-0.008 [2.52]**
D Banking Crisis	-0.003 [0.22]	0.015 [2.55]**	-0.000 [0.04]
Size	-0.037 [31.81]***	-0.002 [4.64]***	-0.006 [9.43]***
Fixed Assets	-0.217 [11.94]***	0.009 [1.46]	-0.092 [7.04]***
ROA	-0.052 [8.01]***	-0.152 [20.23]***	-0.225 [24.38]***
Leverage	-0.086 [7.10]***		
Market to Book	-0.003 [7.14]***	-0.001 [3.54]***	-0.001 [3.64]***
Constant	1.322 [34.31]***	0.164 [6.11]***	0.477 [11.80]***
Observations	263,152	265,910	248,591
R-squared	0.24	0.18	0.21

Table 7: Difference-in-Difference estimations

Panel A presents the list of countries that established credit registries (either public or private) during our sample period. Panel B reports the regression results for time-series difference and difference-in-difference estimations. Regressions are estimated over either a 7-year window (-3,3) or a 11-year window (-5,5) around the establishment year. The dependent variable is the short-term debt to total debt of firms (STD/TD). D PostCR is a dummy variable that equals one if a country has established a credit registry (either public or private), and zero otherwise. D Treatment is a dummy variable that equals one if a firm's size is below that of the median firm in the country in a given year, and zero otherwise. The interaction term is the difference-in-difference estimator. Firm characteristics include the same set of firm-level control variables as in other regressions. The absolute values of t-statistics are in brackets, calculated with standard errors two-way clustered by year and by firm. All regressions include country, industry dummies and year dummies. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: List of countries

China	Czech	Greece	Hungary	India	Korea
Pakistan	Philippines	Poland	Russia	Singapore	Thailand

Panel B: Estimation results

	Time-series difference		Difference-in-Difference	
	(-3,3)	(-5,5)	(-3,3)	(-5,5)
D PostCR	-0.012 [2.32]**	-0.010 [0.90]	0.011 [1.05]	0.015 [1.01]
D Treatment			0.041 [1.85]*	0.051 [2.91]***
D PostCR*Treatment			-0.048 [2.16]**	-0.052 [2.90]***
Country dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes
Observations	18,098	29,890	18,098	29,890
R-squared	0.27	0.28	0.27	0.28

Figure 1: Timeline of the model

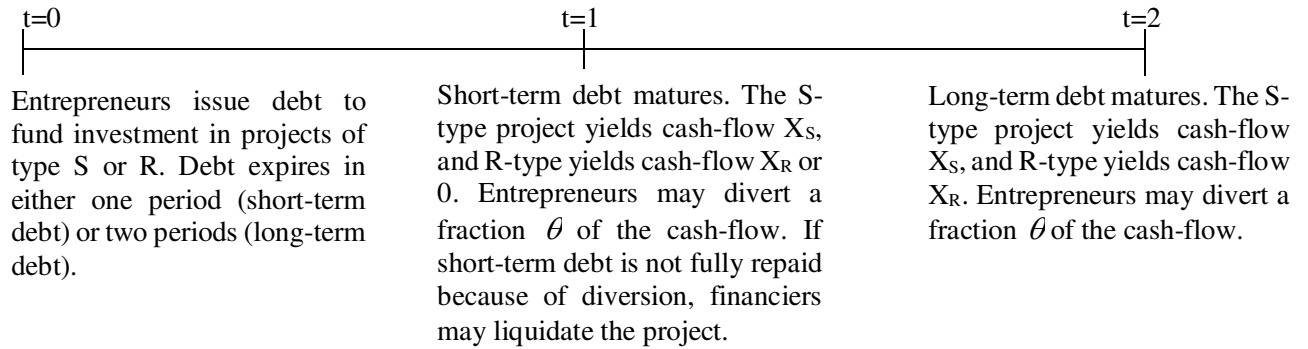


Figure 2: Results of the model

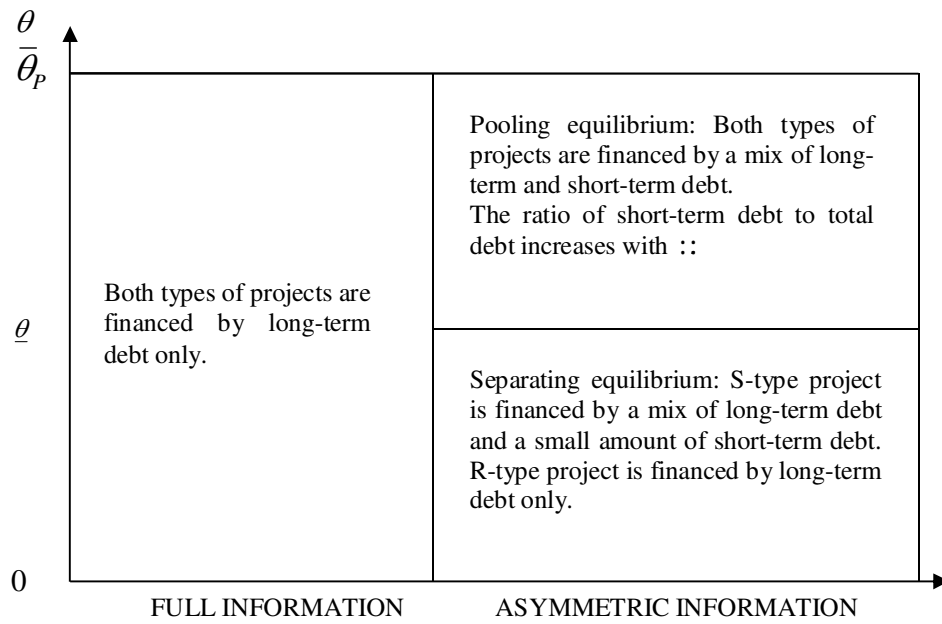
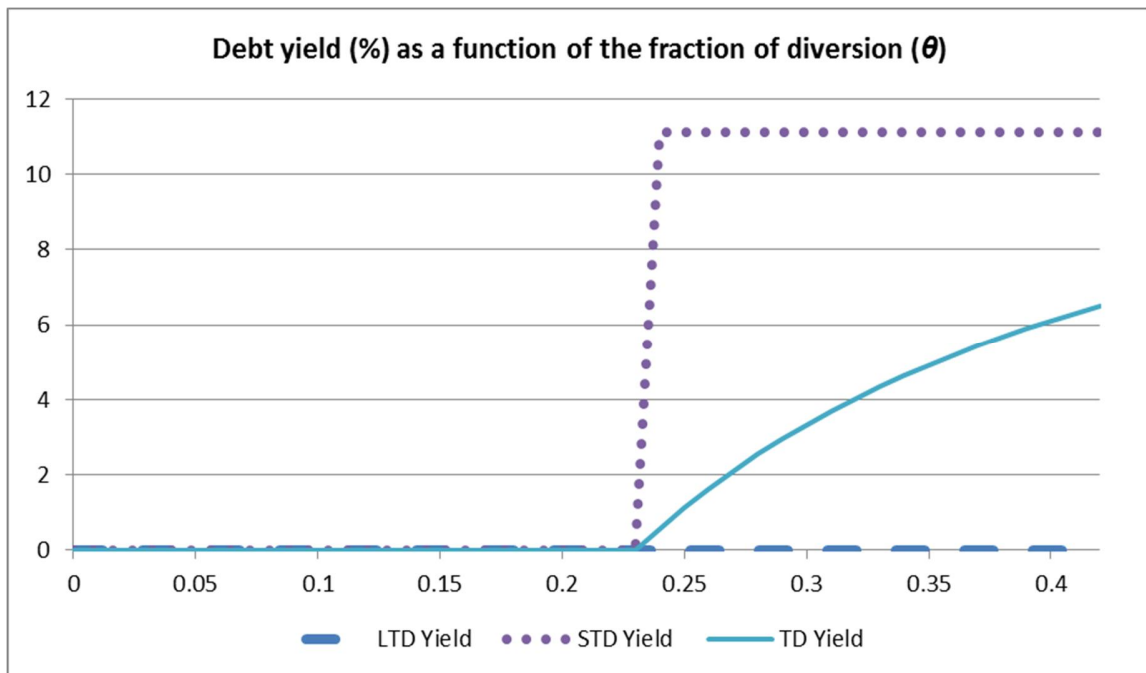
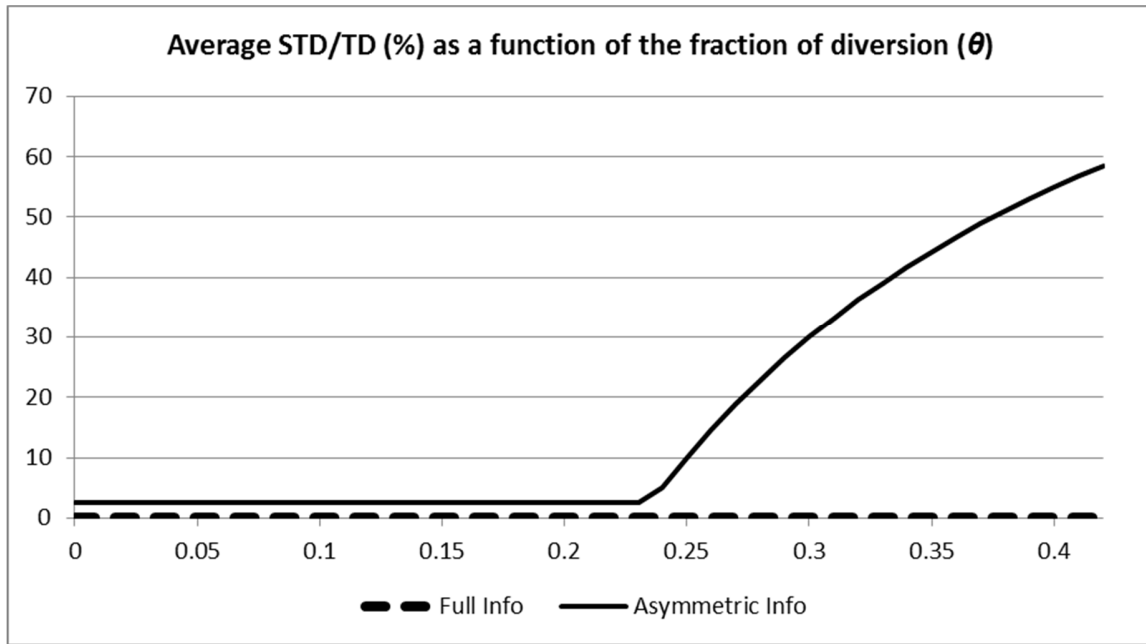


Figure 3: Numerical illustration of the model

Suppose $\lambda = 0.5$, $p = 0.8$, $NPV / I = 0.3$. Panel A plots the average short-term debt to total debt ratio, V_p^1 / I (see Eq. A12). Panel B plots the interest rates of long-term debt, short-term debt r_p^1 (see Eq. A13), and total debt r_p (see Eq. A14).



APPENDIX: VARIABLE DEFINITIONS AND SOURCES

	Variables	Descriptions and Data Source
Share of Short-Term Debt	STD/TD	Short-term debt (i.e. less than one year maturity) divided by total debt of a firm. Average across firms in each country. Source: Worldscope.
Information Sharing	D Information Sharing	Dummy =1 if a private or public credit bureau exists. Source: Doing Business (2006), Miller (2003), Love and Mylenko (2003), Djankov, McLiesh, and Shleifer (2007) and World Development Indicators.
	Depth of Credit Information	The index ranges from 0 to 6, with a score of 1 assigned for each of the following 6 features of the credit information system: <ul style="list-style-type: none"> . Both positive and negative credit information is distributed. . Data on both firms and individuals are distributed. . Data from retailers, trade creditors or utilities as well as financial institutions are distributed. . More than 2 years of historical data are distributed. . Data on loans above 1% of income per capita are distributed. . By law, borrowers have the right to access their data. The index is set to zero for countries without a credit registry. Source: World Development Indicators (WDI)
	Private Credit Bureau (D- / -Cov.)	Variable with a prefix `D_`: Dummy =1 if a private credit bureaus exists; Variable with a postfix `Cov._`: Private credit bureaus coverage as a % of the adult population. Source: Doing Business (2006), Miller (2003), Love and Mylenko (2003), Djankov, McLiesh, and Shleifer (2007) and WDI.
	Public Credit Registry (D- / -Cov.)	Variable with a prefix `D_`: Dummy =1 if a public credit registry exists; Variable with a postfix `Cov._`: Public credit registries coverage as a % of the adult population. Source: Doing Business (2006), Miller (2003), Love and Mylenko (2003), Djankov, McLiesh, and Shleifer (2007) and WDI.
Creditor rights	Creditor Rights	Creditor right index (0 least - 4 most rights). Source: LLSV (1998) and Djankov, McLiesh and Shleifer (2006)
	Legal Rights	Index of legal rights of borrowers and lenders (0 least - 10 most rights). Source: Doing Business (2010)
Legal Environment	Corruption	Corruption perception index (reversed: 0 least - 10 most corrupted). Source: Transparency International
	Bankruptcy code	Dummy = 1 if an insolvent firm is mostly likely to undergo a liquidation or reorganization proceeding, and = 0 it is mostly likely to undergo foreclosure. Source: Djankov, Hart, McLiesh, and Shleifer(2008).
Financial Development	Deposit /GDP	Demand, time and saving deposits in deposit money banks and other financial institutions as a share of GDP. Source: IMF
	Deposit insurance coverage	Log of one plus ratio of deposit insurance coverage to deposits per capita. Source: Demircuc-Kunt, Kane and Laeven (2014)
	D Banking Crisis	Dummy =1 if there is a systemic banking crises, and =0 otherwise. Source: Laeven and Valencia (2010)
Macro Environment	GDP Growth	Growth rate of GDP per capita. Source: WDI
	Inflation	Consumer Price Inflation. Source: WDI
	D Developed Country	Dummy =1 if the country is a developed country, and =0 if it is a developing country. The classification is based on Gross National Income per capita. Source: World Bank
Firm Characteristics	Log of Total Assets	Natural logarithm of average total assets (in thousand US\$). Source: Worldscope
	Return on Assets	Return of assets (net income before interest divided by total assets of a firm). Source: Worldscope
	Fixed Assets /Total Assets	Fixed assets (net property, plant and equipment) divided by total assets of a firm. Source: Worldscope
	Market to Book ratio	Market value of equity divided by book value of equity. Source: Worldscope
	Leverage	Total debt (short-term and long-term debt) divided by market value of a firm. Market value of a firm is the sum of market value of equity, and book value of preferred stocks and total debt. Source: Worldscope.