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Abstract

We investigate if and when the leading theories of debt maturity are useful in understanding the maturity choices of nonfinancial firms in a major developing economy, Turkey. Unlike most research, we use a dataset that provides financial information on not only large, publicly-traded firms but also small, privately-held firms across a wide variety of industries. Our strongest finding is that firms that have high leverage also have long debt maturity. Size, asset maturity, and credit quality are also important, although results depend on the type of firm group considered. The stability of the economic environment as measured by inflation and interest rate volatility also influences debt maturity decisions. Our findings are broadly consistent with the liquidity risk theory. The agency theory is also partially useful in understanding firms' maturity decisions, particularly for medium- and large-sized, publicly-traded firms. The signaling theory is most useful when the sample consists of large, publicly-traded firms. We find little evidence that taxes matter for maturity decisions. Our findings also provide some evidence that borrower-lender relationships matter for debt maturity structures.

Keywords: debt maturity structure, nonfinancial firms, Turkey
JEL Classification Numbers: G3, G32.

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1 Introduction

The theories of debt maturity structure have been developed mainly with publicly-traded firms in developed economies in mind. However, the typical firm in most economies is a privately-held firm. Privately-held firms differ from publicly-traded firms in many respects, including size, expected life, taxability, ownership, flexibility, industry, economies of scale, financial market access, and level of information asymmetry (see, for example, Ang, 1991, 1992; Scherr and Hulburt, 2001). In addition, given the immense cultural, institutional, and financial differences across borders, the nature and extent of these differences are likely to vary considerably between developed and developing economies (see, for example, LaPorta, Lopez-de Silanes, Shleifer, and Vishny, 1997; Booth, Aivazian, Demirguc-Kunt, and Maksimovic, 2001; De Jong, Kabir, and Nguyen, 2008). Therefore, the question of whether and to what extent debt maturity theories apply to the typical privately-held firm in developing economies is an important research question. The fact that the structure of debt maturity has serious implications for macroeconomic and financial stability in developing economies (see, for example, Schmukler and Vesperoni, 2006; BCBS, 2011) makes this question all the more interesting.

Despite the importance of this question, there is a dearth of papers that study privately-held firms in developing economies. To our knowledge, the only exceptions are Stephan, Talavera, and Tsapin (2011) who examine Ukraine and Bas (2012) who examines 24 developing economies. The present paper contributes to this literature by studying the case of a major developing economy, Turkey. We use a comprehensive dataset compiled by the Central Bank of the Republic of Turkey (CBRT) that provides financial information on a wide variety of firms in Turkey. The fact that our dataset is quite comprehensive enables us to provide a more accurate analysis of the typical firm's debt maturity structure than most previous studies, including those on developed economies. Our dataset also allows us to systematically investigate the debt maturity structure differences between publicly-traded and privately-held firms, large and small firms, and manufacturing and non-manufacturing firms.

Our empirical analyses build on the major theories of debt maturity (agency theory, tax-based theory, signaling and liquidity risk theories, and maturity-matching theory). Our strongest and most robust finding is that firms that have high leverage also have long debt maturity. Leverage is also the most economically significant determinant. These findings indicate that the typical firm is concerned about the risk of bankruptcy and/or premature liquidation by lenders as suggested by debt maturity theories. In addition, we find relatively strong evidence of a non-monotonic relationship between

debt maturity and indicators of firm credit quality. Hence, firms that rely heavily on shorter-term debt appear to be a mix of the high- and low-quality firms, with the middle-quality firms using more longer-term debt.

Firm size and asset maturity also play important roles in the determination of firms' debt maturity structures. However, results seem to depend on the type of firm group considered. While important for medium-to-large, publicly-traded firms, size does not impact on the maturity structures of privately-held, micro and small enterprises. Moreover, size matters more for firms considering issuing long-term debt for the first time than for firms that want to reoptimize the amount of existing long-term debt in their capital structure. Therefore, creditor-shareholder conflicts appear to be a more relevant concern for larger, publicly-traded firms and for firms issuing long-term debt for the first time. The latter finding, in turn, suggests that adverse selection problems are a more serious agency problem than moral hazard problems in the provision of long-term debt financing for our sample firms.

The evidence for maturity-matching is strongest in the case of medium-to-large privately-held firms in the non-manufacturing sector. We also find that when firms do not match maturities, they do so in different ways. While privately-held micro and small enterprises tend to issue debts of shorter maturity than their assets, large, publicly-traded companies tend to issue debts of longer maturity than their assets. Since maturity-mismatches of the former sort are more risky and since privately-held micro and small enterprises tend to have low credit quality, maturity-mismatches present a substantially more serious risk for this group of firms.

We also find some evidence that the level of asymmetric information might play a role in determining the debt maturity structures of large, publicly-traded firms. Macroeconomic variables also appear to exert some impact on firms' debt maturity decisions. Specifically, we find that increases in inflation and interest rate volatility generally reduce debt maturity, particularly for privately-held small- and medium-sized enterprises (SMEs). Given that SMEs are an important part of any economy, these findings underscore the importance of maintaining a stable and predictable economic environment that facilitates long-term contracting among businesses. Finally, we find little consistent evidence for the importance of firms' taxability or growth opportunities.

Overall, our results are probably best understood within the context of the liquidity risk theory. It is important to emphasize, however, that neither individually nor jointly, can the leading theories of debt maturity entirely account for the observed maturity structures. Indeed, we find some tentative

evidence that relationships between borrowers and lenders might also be playing an important role in shaping firm' maturity structures. For example, our findings suggest that only sufficiently creditworthy firms can form long-term credit relationships with lenders. Moreover, for firms with existing credit relationships, the relevance of the leading debt maturity theories appear to decline considerably. Instead, findings appear to be more consistent with the view that lenders insure their clients against idiosyncratic as well as aggregate financial risks.

The rest of the paper is organized as follows. Section 2 reviews the theories of debt maturity, develops empirical hypotheses, and provides a summary of the relevant empirical literature. Section 3 describes the data and variables. Section 4 describes the empirical methodology and presents the main results. Section 5 conducts a battery of robustness checks. Section 6 examines the debt maturity structure differences across firms of various types. Section 7 provides an overall assessment of our result. Section 8 provides concluding remarks.

2 Hypotheses and empirical evidence

In this section, we develop the various debt maturity structure hypotheses to be investigated and review the existing empirical evidence.

2.1 Hypotheses

The theoretical literature provides a number of non-mutually exclusive hypotheses about the determinants of firm debt maturity structure. These are: agency hypotheses, tax hypotheses, signaling and liquidity risk hypotheses, and maturity matching hypothesis. We now consider each in turn.

2.1.1 Agency hypotheses

Growth opportunities: Myers (1977) argues that a firm's future investment opportunities are akin to growth options. Accordingly, the value of a firm depends on whether the firm's managers optimally exercise these options. If the firm is financed entirely by equity, managers (acting on behalf of shareholders) optimally exercise all profitable growth options. With debt in the firm's capital structure, however, managers may fail to exercise some of the profitable options if creditors stand to capture a large enough fraction of the expected earnings. Myers (1977) shows that this *underinvestment problem*

can be solved by issuing debt that matures before the growth options are to be exercised.[1] Therefore, a firm's debt maturity should decrease with its growth options.

Firm size: Smith and Warner (1979) argue that creditor-shareholder conflicts faced by smaller firms are likely to be greater in variety as well as in severity than large firms (see, also, Pettit and Singer, 1985; Ang, 1992). As noted above, shortening debt maturity can help mitigate these agency problems. Therefore, a firm's debt maturity should increase with its size.

2.1.2 Tax hypotheses

Tax rates: Kane, Marcus, and McDonald (1985) develop a multi-period model in which the choice of debt maturity involves a trade-off between the per-period tax-advantage of debt and the costs of debt issuance and possible bankruptcy. Their model implies that the firm lengthens debt maturity as the tax advantage of debt decreases to ensure that the remaining tax advantage of debt is not less than expected floatation and bankruptcy costs. Thus, a firm's debt maturity should decrease with its effective tax rate.

Term structure of interest rates: Brick and Ravid (1985) also present a multi-period tax-based framework to analyze debt maturity choice. In their model, a firm optimally chooses long debt maturity when there is a tax advantage of debt and the term structure of interest rates is increasing. This is because an increasing term structure accelerates the tax advantage into the early periods of the debt obligation, thereby increasing the total tax advantage in present value terms. Hence, a firm's debt maturity should increase with slope of the term structure of interest rates.

Volatility of interest rates: Kim, Mauer, and Stohs (1995) develop a multi-period model to analyze how corporate debt maturity affects investor tax-timing options to tax-trade corporate securities. They show that a more volatile interest rate process produces more volatile bond prices, which in turn leads to a larger tax-timing option value. Since the value of the tax-timing option, like standard options, increases with maturity, it becomes optimal for the firm to issue long-term debt when interest rate volatility is high. Thus, a firm's debt maturity should increase with the volatility of interest rates.

Volatility of firm value: Another implication of the Kane, Marcus, and McDonald (1985) model concerns the impact of firm value volatility on debt maturity. The authors show that debt maturity increases when the volatility of firm value decreases, as the firm does not have to rebalance its capital

[1] Other creditor-shareholder conflicts including asset-substitution, claim-dilution, and overinvestment can also be mitigated by using shorter-term debt (see, for example, Barnea, Haugen, and Senbet, 1980; Leland and Toft, 1996; Childs, Mauer, and Ott, 2005). Note that overinvestment problems can also arise when there is a conflict of interest between shareholders and managers. Hart and Moore (1995) show that when a firm with new investment opportunities has little or no long-term debt, the management will have a tendency to finance unprofitable investments by borrowing against future earnings. This view would imply that a firm's debt maturity would increase with its growth options.

structure as often to moderate expected bankruptcy costs. Hence, a firm's debt maturity should decrease with the volatility of firm value.

A common feature of the above tax-based models is that they analyze the debt maturity decision taking the firm's capital structure (leverage) decision as given. However, Wiggins (1990) and Lewis (1990) argue that theoretical predictions can be altered substantially when capital structure and debt maturity structure decisions are modeled simultaneously. For instance, Wiggins (1990)'s model predicts a positive relation between volatility of firm value and debt maturity, which is in direct contrast to Kane, Marcus, and McDonald (1985). Lewis (1990) seems to go even further, arguing that taxes may in fact be completely irrelevant for debt maturity decisions. It is not clear, however, that it is the difference in the treatment of capital structure and maturity structure decisions that is the driver of the discrepancies between the implications of the two types of models.[2]

2.1.3 Signaling and liquidity risk hypotheses

Signaling: Flannery (1986) explores the signaling implications of a firm's debt maturity choice when a firm's insiders are better informed than outside investors about the firm's quality. If debt issuance is costless, high-quality firms cannot signal their type by their choice of maturity since low-quality firms can mimic this choice. In the resulting pooling equilibrium, high-quality firms are under-valued and low-quality firms are over-valued by the market. When issuing debt is sufficiently costly, however, low-quality firms may be forced to issuing long-term debt to minimize issuance costs. This allows high-quality firms to distinguish themselves from low-quality firms by issuing short-term debt. In the resulting separating equilibrium, firms of different quality are accurately valued by the market.[3] Thus, the signaling hypothesis predicts an inverse relation between a firm's debt maturity and its quality.

Liquidity risk: Diamond (1991) also explores the choice of debt maturity when a firm has private information about its future credit-standing. A firm expecting favorable news about its credit-standing (i.e. a high-quality firm) can reduce the cost of capital by issuing short-term debt and refinancing at better terms following the arrival of good news. However, even high-quality firms may sometimes receive unfavorable news, which may make it difficult for the firm to repay its debt. In that case, the lender can sell the firm's assets or remove the borrower from control (termed liquidation). Lenders,

[2]Wiggins (1990) and Ravid (1996) note that different assumptions concerning the tax shelters in default state are behind the opposite implications of the Wiggins (1990) and Kane, Marcus, and McDonald (1985) models. In addition, as noted by Stohs and Mauer (1996), Wiggins (1990) does not endogenously derive the optimal maturity structure, making it impossible to know whether his result holds at the optimum. On the other hand, Brick and Ravid (1991) argue that the conflicting predictions of the Brick and Ravid (1985) and Lewis (1990) models stem from the different assumptions concerning the priority of different types of claims in default state.

[3]Kale and Noe (1990) show that issuance costs are not a necessary condition for the existence of a separating equilibrium in which high-quality firms signal their type by issuing short-term debt.

however, have a tendency to liquidate too often from the borrower's point of view because they do not internalize the part of future benefits that may accrue only to the borrower (the control rent). A greater proportion of short-term debt in the firm's capital structure makes liquidation more likely.

This theoretical framework has a number of interesting implications regarding the choice of debt maturity in the cross-section of firms. Firms with high quality can issue short-term debt because the risk of liquidation is minimal. Firms with medium quality issue long-term debt to reduce the risk of liquidation. Finally, firms with low quality have no choice but to issue short-term debt because their liquidation value is too low to entice creditors to lend long-term. As a result, there are two types of short-term borrowers: Firms with high quality and firms with low quality, with medium-quality firms borrowing longer-term. Thus, the liquidity risk model predicts that a firm's debt maturity first increases and then decreases with the firm's quality.

2.1.4 Maturity-matching hypothesis

An age-old maxim in the finance profession is that a firm should match the maturity of its assets and liabilities. As explained by Morris (1976), when debt is too short-term, the asset may not generate sufficient cash flows by the maturity date to service the debt. Although this possibility exists for longer maturities as well, it is less likely and has the advantage of pushing the possible liquidity crisis further into the future. Debt of maturity longer than the asset life can also be risky because of the uncertainty regarding the source and volume of the cash flows necessary to service the debt after the asset is retired. Matching maturities can help a firm manage its expected costs of financial distress by reducing these risks.[4] Thus, a firm's debt maturity should increase with the maturity of its assets.

2.2 Empirical evidence

A large number of empirical studies have been carried out in the past twenty years to test whether the predictions of various debt maturity theories hold up in the data. This literature can be broken down into two broad categories: Studies that use a sample of publicly-traded firms and those that use a sample of privately-held firms. While studies generally find evidence in support of maturity-matching, the findings concerning the rest of the debt maturity hypotheses are mixed at best.

[4]The agency and liquidity risk perspectives also suggest that matching maturities can be beneficial for firms. In particular, Myers (1977) argues that maturity-matching can mitigate creditor-shareholder conflicts by scheduling debt repayments to correspond to the decline in future value of assets currently in place. Diamond (1991) argues that liquidity risk can be reduced by financing long-term assets with long-term debt.

2.2.1 Publicly-traded firm studies

Most empirical work falls into this category. Using data on a sample of U.S. firms, Barclay and Smith (1995), Barclay, Marx, and Smith (2003), and Johnson (2003) find that debt maturity varies inversely with growth opportunities and directly with firm size as predicted by the agency perspective. Guedes and Opler (1996), however, find that maturity is negatively associated with both growth opportunities and firm size, again using data on U.S. firms. Stohs and Mauer (1996), on the other hand, report a positive association between maturity and both growth opportunities and firm size. The evidence for the agency perspective is therefore rather mixed. The signaling and tax hypotheses receive even less support in these studies as the estimated coefficients on relevant proxy independent variables often have the wrong sign and/or are economically insignificant. Goyal and Wang (2013) and Newberry and Novack (1999) are notable exceptions that provide evidence that strongly supports, respectively, the signaling hypothesis and some of the tax-related hypotheses.[5] Finally, Diamond (1991)'s liquidity risk model finds strong support in many of these studies, as they uncover a non-monotonic relationship between debt maturity and the proxies for firm (credit) quality.

Empirical studies on developed economies other than the U.S. also reveal mixed results. Using data on U.K. firms, Ozkan (2000, 2002) provide evidence that firms with more growth opportunities in their investment sets use shorter-term debt, as predicted by the agency perspective. However, the estimated coefficients on the firm size variable attain opposite signs across the two studies. The tax-related and signaling hypotheses receive little or no support in both studies. Cunat (1999) reports findings similar to those in Ozkan (2000, 2002) for Spanish firms. Antoniou, Guney, and Paudyal (2006) focus on U.K., France, and Germany. They find evidence in support of the agency perspective in the U.K. and but not in Germany or France. The Brick and Ravid (1985) term structure hypothesis receives reasonable support in all three economies. No strong support is found, however, for the remaining tax hypotheses as well as for the signaling and liquidity risk hypotheses in any of the three economies. The signaling view finds strong support, however, in the case of Australian firms (Alcock, Finn, and Tan, 2012).

The results of developing economy studies are probably even more diverse. In their study of 30 developing and developed economies, Demirguc-Kunt and Maksimovic (1999) find that debt maturity varies directly with size and inversely with growth opportunities as predicted by the agency perspective.

[5] Goyal and Wang (2013) test the signaling prediction by tracing the evolution of debt issuers' default risk. They find that issuing short-term debt reduces borrowers' asset volatility and increases their distance-to-default. Newberry and Novack (1999), on the other hand, find evidence of an interest rate term structure effect on debt maturity as predicted by Brick and Ravid (1985). On the other hand, their finding on the impact of effective tax rates on debt maturity is the opposite of what is suggested by Kane, Marcus, and McDonald (1985). The finding is nevertheless consistent with a "tax clientele" argument where long-term debt is used more intensively by firms with high marginal tax rates that can use interest tax shields more cost-effectively (Scholes and Wolfson, 1992).

By contrast, the agency perspective receives little or no support in Cai, Fairchild, and Guney (2008) and Deesomsak, Paudyal, and Pescetto (2009), who focus instead on China and the Asia-Pacific region (Australia, Malaysia, Thailand, and Singapore), respectively. In fact, Cai, Fairchild, and Guney (2008) find that debt maturity is positively related with growth opportunities as predicted by Hart and Moore (1995), suggesting that overinvestment problems are more important in China than underinvestment problems. Another view that finds little support in both studies is the signaling view. The authors attribute the lack of support for the agency and signaling views to the existence of close relationships between firms and their banks, which renders information and agency considerations much less relevant. The tax and liquidity risk hypotheses, on the other hand, receive somewhat greater support in these studies. Kirch, Renato, and Terra (2012) focus on five South American economies (Argentina, Brazil, Chile, Peru, and Venezuela) and report results that lend partial support for each of the four major groups of debt maturity hypotheses. Most closely related to ours is perhaps the study by Arslan and Karan (2006) who, like us, focus on Turkey. Differently from us, however, these authors focus on publicly-traded industrial firms and explore the corporate governance implications of debt maturity structure. Their findings are generally consistent with the agency and signaling hypotheses but not with the tax hypotheses, whereas the relevance of the liquidity risk hypothesis is not investigated.

2.2.2 Privately-held firm studies

Privately-held firms differ from publicly-traded firms in many respects. Due to the lack of pertinent data, however, empirical debt maturity studies of such firms are much fewer in number. In an early study, Scherr and Hulburt (2001) find that some determinants of debt maturity for privately-held firms are similar to those for publicly-traded firms while others are not in the U.S.. Their findings lend considerable support for default risk, maturity of assets, and capital structure as determinants of privately-held firms' debt maturity. The authors also find that firms with either high or low default risk use debt of shorter maturities than do firms with intermediate default risk as predicted by Diamond (1991). However, almost no evidence is found for the importance of firms' growth options, taxability, or level of asymmetric information in determining debt maturity. Taking a slightly different approach, Ortiz-Molina and Penas (2008) analyze the maturity of loans to U.S. privately-held businesses. Although the authors do not attempt to test all major debt maturity hypotheses, their evidence is generally consistent with the agency perspective.

In the context of developed European economies, Heyman, Deloof, and Ooghe (2008) bring evidence from Belgian firms that supports the signaling perspective but not the agency or liquidity risk perspectives. Like Ortiz-Molina and Penas (2008), these authors do not investigate the tax hypothe-

ses of debt maturity. The relevance of the tax hypotheses is explored, however, by Lopez-Gracia and Mestre-Barbera (2011) and Gonzalez-Mendez (2013) in the context of Spanish firms. While the former study provides relatively strong evidence that taxes matter for maturity decisions, the latter study reports only weak evidence in favor the tax hypotheses. The latter study also finds evidence that is consistent with the predictions of the agency and maturity-matching hypotheses. Finally, Magri (2010) aims at sorting out supply and demand explanations of the maturity choice in the context of Italian firms. She argues that lenders (i.e. the supply-side of the market) are likely to have a greater say in maturity decisions than borrowers and to exert control over borrowers by choosing shorter maturities when informational asymmetries and default risk are more important.

We are aware of only two privately-held firm studies on developing economies. Using data on 24 developing economies, Bas (2012) finds that in economies with higher tax rates firms have shorter debt maturity as predicted by Kane, Marcus, and McDonald (1985). She also shows that larger firms have longer maturity but finds no evidence that growth opportunities are related with maturity. Stephan, Talavera, and Tsapin (2011) focus instead on Ukraine and report evidence that is relatively more consistent with the agency and signaling perspectives.

3 Data and variables

We next describe our data, construct proxy variables for the different debt maturity hypotheses, and present key descriptive statistics.

3.1 Data

Our firm-level data come from the survey-based Sectoral Balance Sheets (SBS) dataset of the CBRT.[6] Launched in 1989, this dataset contains by far the most comprehensive and representative annual balance sheet and income statement data on Turkish non-agricultural non-financial firms. At the end of the period under analysis, the firms in the SBS dataset account for about 60 percent of the non-financial sector value added.

Even though our dataset goes back to 1989, we start our sample at 2004 for two reasons. First, we want to understand the recent situation about firms' maturity structure of debt in Turkey rather than perform a historical analysis. Second, starting the sample at 2004 allows us to focus on the period after the 2000-2001 economic crisis following which ambitious economic reforms were adopted

[6]The SBS data can be accessed at the CBRT's webpage. Note, however, that due to confidentiality considerations, the data are made available to the general public only at the sectoral level.

and an attendant structural transformation took place in Turkey.[7] This choice also helps to rule out the period of heightened macroeconomic volatility as well as the period of strong disinflation of the beginning of the 2000s. Our sample ends at 2013 as this is the last year for which data is available.

There are on average nearly 9400 firms in our dataset each year. These firms are legally either corporations (59.6 percent) or limited companies (40.4 percent). According to Turkish law, only corporations are allowed to issue publicly-tradable equity. As such, our sample corporations are either privately-held (96.9 percent) or publicly-traded (3.1 percent).[8] With possibly few exceptions, all publicly-traded Turkish non-financial firms are included in the dataset. Our sample privately-held firms, on the other hand, consist of (private) limited companies (41.1 percent) and privately-held corporations (58.9 percent).

In our analyses, we restrict attention to firms with NACE Rev. 2 codes from C to J (except D and E) to focus on the manufacturing and selected non-manufacturing sectors.[9] We include all thirteen NACE Rev. 2 manufacturing sub-sectors in our sample, which comprises nearly 46.9 percent of all firms on average. The non-manufacturing sector, on the other hand, consists of five selected sub-sectors and comprises roughly 53.1 percent of all firms.[10]

The dataset is quite diverse in terms of firm size. It includes most large firms in Turkey as well as a large number of SMEs and microenterprises. Of the 9400 firms each year in the dataset, roughly 18 percent are microenterprises, 70.5 percent are SMEs, and 11.5 percent are large firms.[11] Despite the inclusion of small, privately-held firms in the data set, such firms are inevitably under-sampled, as they constitute a relatively small part of the relevant population of firms in Turkey. This is especially true for the smallest firms.[12] The dataset nevertheless provides us with a unique opportunity to study the financial decisions of small, privately-held firms in a developing economy context.

[7] See, for example, Turhan (2008) and Aysan, Güler, and Orman (2013).

[8] Publicly-traded corporations, while 3.1 percent of corporations, are only 1.8 percent of all firms in the dataset.

[9] NACE (Statistical Classification of Economic Activities in the European Community) has been created based on ISIC (International Standard Industrial Classification) of the United Nations. NACE Rev. 2 corresponds to ISIC Rev. 4 and is organized in a way that is suitable to the structures of the European economies.

[10] The non-manufacturing industries we include are: i) construction (F), ii) wholesale and retail trade, repair of motor vehicles and motorcycles (G), iii) transport and storage (H), iv) accommodation and food service activities (I), and v) information and communication (J). On the other hand, we exclude some of the non-manufacturing industries such as those related to education, public administration, real estate, health, energy (D), water and waste management (E) etc. These industries are generally under the influence of various sorts of government intervention that distort the operation of market forces. Note also that since most of our sample non-manufacturing firms are service firms, we will use the terms "service" and "non-manufacturing" interchangeably in the sequel.

[11] This classification is based on European Union's firm size classification that uses annual balance sheet totals (assets). Microenterprises, SMEs, and large-sized firms are, respectively, firms with balance sheet totals less than EUR 2 million, between EUR 2 million and EUR 43 million, and more than EUR 43 million.

[12] Given available data, it is not possible to compute exact statistics. However, we estimate that the ratios of value added by sample microenterprises, SMEs, and large firms to their population counterparts are roughly about 10 percent, 60 percent, and 90 percent, respectively.

We perform some basic filtering on our firm-level data. Specifically, we drop firms with negative assets, negative sales, negative equity, and negative debt. In addition, we include only those firms that have at least three years of consecutive data as the calculation of some of our variables (for example, earnings volatility) requires observations from multiple years. Moreover, to reduce the impact of outliers on our results, we winsorize both tails of the data at 1 percent. The final sample is an unbalanced panel of 11687 firms with 56231 firm-year observations.

Our macroeconomic data, on the other hand, are collected from a variety of sources including the CBRT, Borsa Istanbul, Turkish Statistical Institute, Undersecretariat of Treasury of the Republic of Turkey, and World Development Indicators.

3.2 Proxy variables

In this sub-section, we define the proxy variables to be used in our analyses. We begin with the dependent variable, debt maturity, and then consider, in turn, each of the independent variables which serve as proxies for various debt maturity hypotheses. Finally, we introduce a number of control variables. Given that the overwhelming majority of our sample firms are privately-held, all proxy variables we develop are based on book values. In Section 5, we investigate the robustness of our results to alternative variable definitions.

3.2.1 Proxy for debt maturity

Our dependent variable, denoted *DebtMat*, is a measure of the maturity structure of debt calculated at the firm level. Following convention, we define *DebtMat* as the share of long-term debt to total debt, where long-term debt is any debt maturing in more than one year. The measure of long-term debt consists of financial debt (76 percent) and loans from shareholders and affiliated firms (parent, sister, and subsidiary) (24 percent) but excludes trade debt, whose determinants are likely quite different from that of straight debt. 91.2 percent of our firms' financial debt, in turn, is made up of bank debt.

3.2.2 Proxies for agency hypotheses

Growth opportunities: Our proxy for a firm's available growth opportunities, denoted *Growth*, is defined as the percent change in a firm's assets. This definition assumes that a firm's recent growth is a good measure of its future growth potential. Versions of this definition have been used in many studies including Scherr and Hulburt (2001) and Heyman, Deloof, and Ooghe (2008). We expect a negative association between *Growth* and *DebtMat*.

Firm size: Firm size, denoted *Size*, is defined as the natural logarithm of (inflation-adjusted) assets as in, among others, Guney and Ozkan (2005) and Heyman, Deloof, and Ooghe (2008). We expect a positive association between *Size* and *DebtMat*.

3.2.3 Proxies for tax hypotheses

Tax rates: Following convention, the firm's effective tax rate, denoted *Tax*, is defined as the ratio of a firm's tax payments to pre-tax income. We expect a negative relation between *Tax* and *DebtMat*.

Term structure of interest rates: Developed economy debt maturity studies typically use yields on 10-year and 6-month government bonds as proxies for long-term and short-term interest rates, respectively (see, for example, Barclay and Smith, 1995; Stohs and Mauer, 1996). However, government bond markets are not as advanced in less developed economies. For instance, the Turkish government started to issue 10-year bonds only in 2010 and 5-year bonds did not exist prior to late 2004. Even the 2-year government bonds were not consistently issued before late 2002. Historically, there has also been a tendency of longer-term government bond markets to dry up during times of economic distress, as exemplified by the disappearance of the 1-year and 2-year government bond markets during the second half of 2001. In light of these facts, we define the slope of the yield curve, denoted *Term*, as the 12-month average for the fiscal year of the yield differential between the 2-year and 3-month government bonds. We expect a positive relation between *Term* and *DebtMat*.[13]

Volatility of interest rates: To measure interest rate volatility, *IntVolat*, we compute the standard deviation of the monthly short-term (3 months) government bond yields over the current year as in Antoniou, Guney, and Paudyal (2006). We expect a positive relation between *IntVolat* and *DebtMat*.

Volatility of firm value: In the absence of market values, we measure the volatility of firm value, *EarnVolat*, by the standard deviation of operating income over total assets over the current and past two years. Stohs and Mauer (1996) and Antoniou, Guney, and Paudyal (2006) use a similar definition. We expect a negative relation between *EarnVolat* and *DebtMat*.

3.2.4 Proxies for signaling and liquidity risk hypotheses

Signaling: It is notoriously difficult to determine what would constitute a good proxy for a firm's quality. Different studies have used different measures as proxies including a firm's abnormal future earnings (e.g. Barclay and Smith, 1995; Stohs and Mauer, 1996), Altman's Z-score (e.g. Jun and Jen, 2003; Arslan and Karan, 2006), and (inverse of) the volatility of the firm's earnings (e.g. Antoniou,

[13] We are grateful to Zeynel Harun Alioğulları for his help in constructing the term structure series that goes back to the early 2000s.

Guney, and Paudyal, 2006; Cai, Fairchild, and Guney, 2008). To test Flannery (1986)'s signaling hypothesis, we use an updated version of Altman (1968)'s Z-score as in Jun and Jen (2003) and Arslan and Karan (2006), which is defined as

$$Z - score = \frac{10.6EBIT + 0.169Sales + 101RE + 10.4WC}{Assets} + \frac{0.3Equity}{Debt},$$

where *EBIT* is earnings before interest and taxes, *RE* is retained earnings, and *WC* is working capital (current assets minus current debt). Higher levels of *Z-score* indicate lower default risk and hence higher firm quality. We expect a negative relation between *Z-score* and *DebtMat*.

Liquidity risk: Testing Diamond (1991)'s hypothesis of a non-monotonic relation between firm (credit) quality and debt maturity is slightly more involved. Again, different studies have used different approaches to do this. Barclay and Smith (1995) use bond and commercial paper ratings, Stohs and Mauer (1996) use bond ratings and their square, Scherr and Hulburt (2001) use Altman (1968)'s Z-score and its square, and Johnson (2003) uses firm size and its square. In this paper, we use an approach similar to Jun and Jen (2003) in that we divide our sample firms into three groups based on their financial condition as summarized by the *Z-score* statistic: the weakest 25 percent, the strongest 25 percent, and those in between. Diamond (1991)'s increasing, then decreasing relation predicts that *DebtMat* should be positively related to *Z-score* for firms with weak financial condition (low quality) and negatively related to *Z-score* for firms with strong financial condition (high quality). Including the medium quality firms in our analyses helps us explore the point at which the relationship between debt maturity and firm quality switches from being positively related to negatively related.

3.2.5 Proxy for maturity-matching hypothesis

Following Stohs and Mauer (1996), we define a firm's asset maturity, denoted *AssetMat*, as the weighted average of the maturities of current assets and fixed assets (net property, plant, and equipment). The maturity of current assets is computed as the ratio of current asset to cost of goods sold. Stohs and Mauer (1996) argue that current assets (e.g. inventory) support production, which can be measured by the cost of goods sold. As such, this ratio can be viewed as reflecting the speed of consuming current assets (Cai, Fairchild, and Guney, 2008). The maturity of fixed assets, on the other hand, is calculated as the ratio of fixed assets to annual depreciation expense. The idea behind this measure is that slower depreciation means longer maturity (Hart and Moore, 1994). Maturity-matching would suggest a positive relation between *AssetMat* and *DebtMat*.

3.2.6 Control variables

We employ a number of additional variables to control for effects not captured by our proxy variables. These are: i) firms' leverage ratios, ii) macroeconomic variables, and iii) crisis year dummies.

Leverage: As discussed earlier, researchers debated whether capital structure and debt maturity decisions are sequential or simultaneous. Like the early theoretical studies, empirical studies initially analyzed debt maturity decisions in isolation from capital structure decisions. For instance, Barclay and Smith (1995) did not control for leverage in their maturity regressions. Stohs and Mauer (1996) did control for leverage but without considering its nature as an endogenous variable. Most subsequent work including Barclay, Marx, and Smith (2003) and Johnson (2003) have modeled capital structure and debt maturity decisions simultaneously. These studies generally have found that firms that choose high leverage also choose long maturity.[14] Theoretically, firms that have high leverage might choose long maturity in order to avoid liquidity risk (Diamond, 1991) or to delay exposure to bankruptcy risk in (Leland and Toft, 1996). Therefore, we model capital structure and debt maturity decisions as joint decisions. However, to highlight the implications of this modeling choice, we also present results from the case where leverage is excluded from estimations and show how the two sets of results differ. We define leverage, *Leverage*, as the ratio of a firm's total debt to its total assets. We expect *Leverage* to be positively associated with *DebtMat*.

Macroeconomic variables: Economy-wide variables also potentially influence firms' debt maturity decisions. In particular, the growth rate of the overall economy can be viewed as an indicator of the investment opportunities available to firms (Myers, 1977; Smith and Watts, 1992). The inflation rate, on the other hand, provides evidence on whether the local currency provides a stable measure of value to be used in long-term contracting (e.g. Demirguc-Kunt and Maksimovic, 1999; Fan, Titman, and Twite, 2012). Accordingly, we include the annual rates of real GDP growth, denoted *GDPGrowth*, and inflation, denoted *Inflation*, in our regression equations. We expect *Inflation* and *DebtMat* to be negatively associated. *GDPGrowth* may be either negatively or positively related with *DebtMat* depending on whether the underinvestment hypothesis or the overinvestment hypothesis is more relevant.

Crisis year dummies: The Turkish economy contracted sharply during 2008 and 2009 due to the global financial crisis. In order to control for crisis effects, we include year dummies for 2008 and 2009 denoted by *D2008* and *D2009*.

[14] See Dennis, Nandy, and Sharpe (2000) for a finding to the contrary. These authors argue that leverage and maturity should be negatively related as agency costs can be mitigated by reducing leverage as well as by shortening maturity.

3.3 Descriptive statistics

Table 1 presents the descriptive statistics for all of our variables during 2004-2013. Consider first our measures of debt maturity and leverage. The table shows that while the average firm financed 25 percent of its assets with debt in 2004, this figure increased to 39 percent in 2013, with an average of 32 percent during our sample period. Firms (on average) not only used more debt in their capital structure over time but also increased the share of long-term debt in their total debt, going from about 21 percent in 2004 to 37 percent in 2013. Thus, firms' usage of long-term debt increased slightly more rapidly than their use of total debt during 2004-2013. However, the fact that the median long-term debt is considerably below the mean suggests that many firms use little or no long-term debt. In fact, roughly 40 percent of our firms have exactly zero long maturity debt during our sample period on average, falling from about 56 percent in 2004 to 28 percent in 2013.

Consider next the remaining firm-level variables. As the firm growth numbers indicate, the average firm grew by about 19 percent from 2004 to 2013. Moreover, the fact that the median growth is considerably below the mean growth indicates that there was a relatively small number of firms that grew fairly rapidly during the sample period. The maturity of the average firm's assets increased from nearly 1.5 years to 6.3 years, with an average of 3.5 years. Except for a temporary increase during 2007 and 2008, the average firm's volatility of earnings was on a downward trajectory. The tax burden faced by the average firm fell slightly from 16 percent to 15 percent between 2004 and 2013, with an average of 15 percent. As the firm quality numbers indicate, the average firm in 2013 was in worse financial condition than in 2004. Moreover, the fact that the median is substantially lower than the mean suggests that the majority of firms have relatively weak financial condition.

Turning to macro-level variables, Table 1 indicates that our sample period was a period with a relatively high average GDP growth rate of about 4.6 percent a year. There was substantial variation in growth rates, however, mainly due to the global financial crisis. Inflation fell from 10.6 percent in 2004 to 7.5 percent in 2013, with an average of 8.5 percent during 2004-2013. Interest rate differentials fell from 3.5 percent to below 2 percent by 2005 and remained between 0 and 2 percent afterwards, except for a small cross-over to the negative territory in 2012. Interest rates were fairly volatile thanks in part to the global financial crisis.

[Insert Table 1 about here]

4 Methodology and results

We now describe our empirical methodology and present the results from applying our methodology to our full sample.

4.1 Methodology

We model debt maturity as a function of various proxies discussed in the previous section. Specifically, we estimate the following fixed effects panel data model:

$$DebtMat_{it} = \beta_0 + \alpha_i Leverage_{it} + \sum_j \beta_j X_{j,it} + \sum_k \theta_k Y_{kt} + \mu_i + \epsilon_{it} \quad (1)$$

where $DebtMat_{it}$ is our measure of the maturity structure of debt calculated as the share of long-term debt to total debt for firm i in year t, $Leverage_{it}$, which is endogenous, is the leverage of the firm defined as the ratio of a firm's total debt to its total assets, X_j is the vector of debt maturity proxies as discussed in the previous section, Y_{kt} are the macro variables used to control for the state of the economy; μ_i are the time-invariant unobservable firm-specific effects; and ϵ_{it} is the error term. We estimate Equation (1) with and without *Leverage* using Newey and West (1987)'s variance estimator which produces consistent estimates when there is heteroskedasticity and autocorrelation in standard errors. When *Leverage* is included, we control for the simultaneity between *DebtMat* and *Leverage* by instrumenting the latter using its first lag and the first lag of firm profitability (ratio of operating income to total assets). The instruments pass Hansen (1982)'s test of instrument validity in all of our regression analyses.[15]

4.2 Full sample results

Table 3 reports our results from estimating Equation (1). The first and second columns, respectively, display the results from estimating Equation (1) without and with the fitted value of *Leverage*. The third and fourth columns, in turn, display the results that are obtained by standardizing all variables in the second column and those obtained by ranking statistically significant standardized coefficients based on their absolute magnitude. The magnitudes are comparable across standardized coefficients as each shows the impact of a one standard deviation change in the associated independent variable on the dependent variable. In what follows, we elaborate on our findings with reference to various maturity hypotheses.

[15] See Hansen (1982). In two of the firm quality regressions discussed in Section 4.2.3, we use real total asset growth and the volatility of earnings as additional instruments to obtain a valid instrument set.

[Insert Table 3 about here]

4.2.1 Agency hypotheses

Growth opportunities: Regardless of whether the regression includes *Leverage* or not, the coefficient estimates on *Growth* are not significant. Thus, we find no support for both the underinvestment and overinvestment agency hypotheses. Similar findings are reported in, among others, Stohs and Mauer (1996) and Scherr and Hulburt (2001) for the U.S., Magri (2010) for Italy, and Kirch, Renato, and Terra (2012) for five Latin American economies.

Firm Size: The coefficient estimates on *Size* are positive and highly significant in both regression specifications, suggesting that larger firms have longer debt maturity as predicted by the agency perspective. However, the economic significance of this variable is debatable. This is because the coefficient estimate in the regression with *Leverage* implies that a one standard deviation increase in *Size* increases debt maturity only by about 0.12 standard deviations. These results are consistent with the findings reported in the majority of empirical studies.

Therefore, our results provide mixed support for the agency perspective.

4.2.2 Tax hypotheses

Tax rates: While the coefficient estimate on *Tax* is negative and significant in the equation without *Leverage*, it does not achieve significance in the equation with *Leverage*. This result is consistent with Lewis (1990) who argues that if leverage and debt maturity are chosen simultaneously, then taxes have no effect on the maturity structure of debt.[16] This result is also in line with the empirical findings reported in Dennis, Nandy, and Sharpe (2000) and Scherr and Hulburt (2001) for the U.S. and Antoniou, Guney, and Paudyal (2006) for Britain and France.

Interest rates and volatility: Although the coefficient estimate on *EarnVolat* is not significant in the equation without *Leverage*, it is marginally significant and positive in the equation that includes *Leverage*. However, neither of these results is consistent with the tax perspective. Nevertheless, a positive estimate might indicate that firms extend the maturity of their debt to avoid possible liquidation as also found by Antoniou, Guney, and Paudyal (2006) for France, Cai, Fairchild, and Guney (2008) for high-growth firms in China, and Kirch, Renato, and Terra (2012) for five Latin American economies. Second, the estimate on *IntVolat* is negative and significant at the 5 percent

[16] Alternatively, this result could be due to the fact that effective tax rates (hence the tax advantage) are simply too low (15 percent for the average firm) to have any significant influence on firms' maturity choices, especially after accounting for the key maturity determinants such as leverage.

level in the equation that includes *Leverage*. Although this is inconsistent with the tax perspective as well, it might indicate that firms avoid entering into long-term debt contracts when macroeconomic uncertainty is high. A similar finding is reported by Antoniou, Guney, and Paudyal (2006) for British firms. Finally, even though the coefficient estimate on *Term* is marginally significant in the equation without *Leverage*, it has the wrong sign from a tax perspective. In the equation that includes *Leverage*, *Term*'s coefficient estimate is not significant, in line with the empirical findings reported in Barclay and Smith (1995) and Stohs and Mauer (1996).

Overall, we find no evidence in support of the tax perspective.

4.2.3 Signaling and liquidity risk hypotheses

Signaling: Although the coefficient estimate on *Z-score* is negative and significant in the regression equation without *Leverage*, it turns insignificant when *Leverage* is included in the equation. An insignificant coefficient estimate on the firm quality variable is also reported by Dennis, Nandy, and Sharpe (2000) for the U.S. and Antoniou, Guney, and Paudyal (2006) for Britain, France, and Germany. Note, however, that the coefficient on *EarnVolat* is marginally significant. To the extent that *EarnVolat* proxies for firm quality, this finding is consistent with Flannery (1986)'s signaling hypothesis where low quality firms (firms with high earnings volatility) borrow longer-term. Alternatively, the positive relation between *DebtMat* and *EarnVolat* might be indicative of a "close relationship" between firms and their lenders. Specifically, in a close borrower-lender relationship, lenders might want to ease their clients' financial stress by extending the maturity of credit (see, for example, Petersen and Rajan (1994) for a general statement of this possibility). Given that our sample firms borrow on average about 25 percent of their debt from shareholders and related firms each year, this is a genuine possibility.[17]

Liquidity risk: To investigate the relevance of the liquidity risk perspective, we digress briefly and consider the results reported in Table 3. This table displays the coefficients on *Z-score* from estimating Equation (1) with and without *Leverage* separately for different *Z-score* quartiles. We find that, in the equations without *Leverage*, the sign of the coefficient estimate on *Z-score* is positive and significant for low- and medium-quality firms and negative and significant for high-quality firms. Even though this pattern of estimated coefficients is consistent with Diamond (1991)'s hypothesis of a non-monotonic relation between firm (credit) quality and debt maturity, the support for this hypothesis is somewhat weakened by our finding of an insignificant estimate on *Z-score* for high-quality firms in the equation that includes *Leverage*. Support for Diamond (1991) can also be found in Barclay and Smith (1995), Stohs and Mauer (1996), and Johnson (2003) for U.S. firms. Figure 1 shows visually the

[17] We provide additional evidence on this type of relationship-lending in Section 5.8.

non-monotonic relationship between maturity and firm quality for our sample firms. In addition to firms' debt maturity structures, the figure also includes their leverage ratios in view of the importance of this variable in the determination of maturity structures.

Overall, our results provide moderate support for the liquidity risk perspective while providing only weak support for the signaling perspective.

[Insert Table 3 about here]

[Insert Figure 1 about here]

4.2.4 Maturity-matching hypothesis

Returning to Table 2, the estimated coefficients indicate that *DebtMat* and *AssetMat* are positively and significantly associated, suggesting that firms with higher proportion of longer-term assets in their balance sheet also choose longer debt maturity structures. This is true regardless of whether *Leverage* is included in the regression equation or not. However, the economic significance of this result is questionable as the coefficient estimates imply that a one standard deviation increase in *AssetMat* increases *DebtMat* only by about 0.02 standard deviations. Therefore, consistent with most empirical studies, our results provide moderate support for the maturity-matching hypothesis.

4.2.5 Control variables

Leverage: The coefficient estimate in the regression equation with *Leverage* suggests a strong positive association between *DebtMat* and *Leverage*. A one standard deviation increase in *Leverage* increases *DebtMat* by about 0.41 standard deviations. Thus, the economic significance of *Leverage* is orders of magnitude greater than that of other independent variables. Qualitatively, these results are consistent with Diamond (1991) and Leland and Toft (1996) who argue that firms that choose high leverage also choose long maturity to avoid premature liquidation or to delay their exposure to bankruptcy risk. A positive and significant coefficient estimate is also reported by empirical studies such as Stohs and Mauer (1996) and Johnson (2003) for the U.S., Antoniou, Guney, and Paudyal (2006) for Britain, France, and Germany, and Cai, Fairchild, and Guney (2008) for China.

More generally, our results underscore the importance of accounting for the simultaneity between debt maturity structure and capital structure in understanding firms' financial management decisions. For one, failing to include *Leverage* in the regression equation could lead one to incorrectly conclude that *Z-score* and *Tax* have significantly negative effects on *DebtMat* for the entire sample of firms. Excluding *Leverage* also causes the economic significance of remaining variables to appear higher or

lower than what they actually are. For example, while a one standard deviation increase in *Size* increases *DebtMat* by about 0.12 standard deviations in the equation with *Leverage*, it increases *DebtMat* by about 0.28 standard deviations in the equation without *Leverage*, thus substantially overstating the impact of firm size on maturity.

Economy-wide variables: Our results do not provide evidence that *GDPGrowth* or crisis year dummies have a significant impact on *DebtMat*, especially when *Leverage* is included in the regression. We find, however, that *Inflation* is negatively associated with *DebtMat* in both regressions, indicating that higher levels of inflation are associated with lower levels of debt maturity. Viewed as an indicator of whether the local currency provides a stable measure of value to be used in long-term contracting, *Inflation* thus has an impact on *DebtMat* similar to that of *IntVolat* discussed earlier. A significant, negative coefficient estimate on *Inflation* is also reported by Demirguc-Kunt and Maksimovic (1999).

5 Robustness analyses and additional considerations

We perform a number empirical checks to ensure that our main results are robust.[18] We also consider a number of interesting variations in our baseline model.

5.1 Variable definitions

Dependent variable: Recall that our measure of debt includes financial debt (roughly 91 percent of which, in turn, is bank debt) as well as loans from shareholders and affiliated firms. It might also be interesting to see how our results would change if we used narrower definitions such as financial debt or bank debt as alternative measures of debt. The second and third columns of Table 4 report the results from estimating Equation (1) when *DebtMat* is defined either as the share of long-term financial debt in total financial debt or as the share of long-term bank debt in total bank debt.[19] The first column is reproduced from Table 2 to ease comparison.

Although the results are by and large the same as before, there are a few small differences, especially between the first and third debt maturity specifications. First, the coefficient on *Growth* turns significant (albeit at the 10 percent level) in the bank debt maturity equation. One explanation might be that agency conflicts between shareholders and creditors are more severe when funds are borrowed entirely from external sources rather than (at least partly) from shareholders and related firms.

[18] To save on space, we do not report all of these results. But, they are available upon request from the authors.

[19] Note that we also must make a corresponding adjustment in the definition of the leverage variable. Accordingly, Leverage is defined as the ratio of a firm's total financial debt to its total assets in the second column and as the ratio of a firm's total bank debt to its total assets in the third column. Financial debt differs from bank debt by the inclusion of financial leasing payables, deferred financial leasing payable costs (-), and other financial debt.

Second, the coefficient estimate on *EarnVolat* turns insignificant. As discussed earlier, a significantly positive relation between maturity and earnings volatility might be due to a close relationship between borrowers and lenders whereby lenders reduce their clients' financial stress by extending the maturity of their lending. In this case, an insignificant coefficient estimate on *EarnVolat* in the bank debt maturity equation would suggest the absence of a close relationship between firms and their banks. Third, the coefficient estimate on *Tax* turns marginally significant in the new regression specifications, implying that firms with low effective tax rates increase the maturity of their debt when debt is either financial debt or bank debt. From the lens of the Kane, Marcus, and McDonald (1985) model, this result likely reflects the fact that expected floatation and bankruptcy costs are higher in arm's length financial transactions, which in turn necessitates lengthening the maturity of debt to ensure that the remaining tax advantage is not less than these higher costs.

[Insert Table 4 about here]

Independent variables: For convenience, we begin with the economy-wide variables. We only consider robustness to the choice of the term structure proxy as its definition is potentially less standard than the others. We find that defining term structure as the difference between 2-year and 6-month rather than between 2-year and 3-month government bond yields does not affect our results.[20]

Regarding the firm-level variables, however, our findings are more mixed. On the one hand, replacing our version of *Z-score* with Altman (1968)'s original *Z-score* or replacing operating earnings with EBIT or EBITDA in the calculation of earnings volatility does not affect our results. On the other, when we use an unweighted measure of asset maturity (such as the ratio of fixed assets to annual depreciation expenses) rather than the weighted measure we use, the coefficient estimate on the asset maturity proxy ceases to be significant.[21] However, as noted by Guedes and Opler (1996), a drawback of unweighted measures is that they implicitly assume that other balance sheet items have a zero maturity. Finally, when the investment opportunity set faced by a firm is instead proxied by capital expenditures to total assets, the estimate on firm growth becomes positive and significant.[22] A positive association between a firm's debt maturity and its investment opportunity set is consistent with Hart and Moore (1995)'s overinvestment hypothesis, according to which sufficient amounts of long-term debt prevent self-interested managers from making unprofitable but empire-building investments.

[20] We also considered a term structure measure based on the difference between the available longest and shortest maturity government bonds. The results were similar.

[21] We should note, however, that the coefficient is still positive and highly significant if we restrict the sample to the group of firms that consists of corporations. See Section 6.3 for more on this.

[22] We also tried using the ratio of research and development expenses to total assets as an alternative proxy, but its coefficient estimate was not statistically significant.

5.2 Choice of the sample start year

We also consider the sensitivity of our main results to the choice of the sample start year. Table 5 presents the results from estimating Equation (1) for samples that start in 2003, 2004, and 2005, where the 2004 results are our baseline results reported in Section 4. Results show that the majority of our qualitative findings are unaffected by this choice. However, there appears to be a break in the data in 2003 after which the estimated coefficients on *Growth* and *Z-score* turn insignificant while those on *IntVolat* and *Inflation* turn significant. These results might be interpreted as indicating that, during times of economy-wide distress, firm-specific features play a more critical role in shaping firms' financing decisions than aggregate variables which are common for all firms.

[Insert Table 5 about here]

5.3 Survivorship bias

The fact that some firms enter or exit the sample might potentially cause our estimated coefficients to be biased. To see if this is the case, we re-estimate Equation (1) only for those firms that have complete data during our sample period. On average, such firms are likely to be more established and institutional firms with built-up reputations than the average firm in the full sample. Unreported results show that while most of our qualitative results remain intact, there are also a few differences that appear to reflect the differences in the types of firms across the two samples. In particular, the estimated coefficients on the volatility indicators *EarnVolat* and *IntVolat* as well as *Inflation* turn insignificant, implying that uncertainties at both the firm and aggregate levels are less relevant for this group of firms. We also find that the coefficient estimates on *Z-score* and *Tax* turn significant at the 5 and 10 percent levels, respectively. A significant and negative estimate on *Z-score* could be expected from a signaling and liquidity risk perspective as these firms are likely to be of relatively higher quality. A significant and negative estimate on *Tax*, on the other hand, could be explained by the observation that the influence of taxes is likely to be stronger for institutional firms which are less likely to evade taxes and hence face higher effective tax rates.

5.4 Capital markets

The domestic supply of capital might influence firms' debt maturity structures.[23] To explore this possibility, we also include as independent variables the size of debt markets (domestic credit to the

[23]For example, Claudia, Ferreira, and Laureano (2013) show that corporate use of long-term debt has decreased in the U.S. over the past three decades and that capital markets have played an important role in this change. See also Gonzalez and Gonzalez (2014) and Khanga and King (2015).

private sector over GDP), the size of equity markets (stock market capitalization over GDP), and the size of government debt (total government debt over total domestic non-financial debt) in Equation (1). Our qualitative results remain intact except that the coefficient on *IntVolat* loses significance whereas the coefficient on *GDPGrowth* turns marginally significant. Moreover, we find that the coefficient on the equity market variable is positive and highly significant whereas the coefficients on the debt market and government debt variables do not attain significance. The former finding could be interpreted as indicating that as firms join the stock market they not only find it easier to acquire (external) equity, and hence potentially reduce their dependence on debt, but also to extend the maturity of debt in their capital structures. We provide further evidence on this finding in Section 6.3.

5.5 Tangibility and profitability

Although we are not aware of any theoretical studies that explicitly link firm debt maturity to factors such as tangibility or profitability, empirical studies have occasionally used these variables in their debt maturity analyses. For instance, Demirguc-Kunt and Maksimovic (1999) and Fan, Titman, and Twite (2012) find a statistically significant and positive association between maturity and both of tangibility and profitability. The idea is that tangible assets play a more important role than intangible assets in reducing the risk of default as they suffer a smaller loss of value when a firm goes into distress (see, for example, Köksal and Orman, 2015). In addition, tangible assets are easier to collateralize and collateral, in turn, might have a more relevant role (in reducing risk) in long-term lending than in short-term lending (Kirch, Renato, and Terra, 2012). Finally, if firms match the maturities of assets and liabilities, tangible assets should be better able to support long-term debt as they are more lasting than intangible assets (Stohs and Mauer, 1996). Profitability, on the other hand, could be positively associated with debt maturity because profitable firms have lower default risk and interest tax shields of debt are more valuable for profitable firms (see, for example, Frank and Goyal, 2008).

To explore the maturity effects of tangibility and profitability factors, we include them in our baseline regression equation, both individually and jointly. Consistent with earlier studies, we find that the coefficient estimates on both tangibility and profitability variables are positive and highly significant, implying that profitable firms and firms with a greater proportion of tangible assets in their asset base choose longer-term debt. In addition, while most of our remaining results go unaffected by the inclusion of these factors, the estimated coefficient on *AssetMat* turns insignificant, likely reflecting the fact that tangibility also serves as a proxy for the maturity of a firm's assets.

5.6 Demand versus supply considerations

Recall that on average nearly 40 percent of our sample firms have no long term debt in their capital structure each year. Data also shows that some firms never issue long-term debt while others adjust the fraction of existing long-term debt in their total debt over time. The non-issuance of long-term debt by some firms might potentially reflect the fact that long-term debt is typically more expensive than short-term debt. However, it might also be due to the unwillingness of creditors to lend long-term to firms that are not sufficiently creditworthy (Diamond, 1991). If the supply side forces dominate, then it becomes meaningless to talk about a borrowing firm's "choice" of debt maturity.

To consider this possibility, we investigate the maturity choices of only those firms that have positive amounts of long-term debt in their capital structure. Results reported in Table 6 reveal interesting findings. In particular, the coefficient estimate on *Leverage* in the new equation is roughly half of that in the full sample equation. Hence, even though firms that issue long-term debt also worry about liquidity risk, it appears to be less of a concern for such firms. This likely reflects the loosened credit-lending standards applied to these firms by their lenders with whom they might have an ongoing credit relationship. Also, the estimate on *Size* turns insignificant, implying that size has no effect on debt maturity for firms with ongoing long-term credit relationships. This result is not due to firms having similar size as this group of firms includes microenterprises as well as large firms. Rather, it might reflect the possibility that only those firms with sufficiently high quality are allowed to enter the long-term credit market, and once they are in, they can issue long-term debt independently of their size. Moreover, among such firms, those with better quality can lengthen debt maturity further, as indicated by the positive and significant coefficient estimate on *Z-score*.

The drops in the significance levels of the estimated coefficients on *AssetMat* and *IntVolat* also appear to be suggestive of the existence of relationships between lenders and sufficiently creditworthy borrowers. Specifically, if lenders are willing to supply long-term credit to client firms, then maturity-mismatches or uncertainties in the macroeconomy might be less of a problem for these firms. In addition, we find that the coefficient estimate on *EarnVolat* turns significant, indicating that, unlike other firms, firms that carry long-term debt in their capital structure increase their maturity in response to increases in their earnings volatility. This might happen if, for example, lenders have a tendency to ease the financing of their clients by extending longer-term credit during times of financial distress. This sort of lender-provided insurance is quite common in economies where there is a lack of transparency and proper legal enforcement (see, for example, Rajan and Zingales, 2003a,b).

Finally, consistent with the tax perspective, we find some evidence that firms lengthen the maturity

of their debt when the term structure of interest rates is increasing, as indicated by the positive and significant coefficient estimate on *Term*. This suggests that the insignificance of the coefficient estimate in the full sample case was probably generated by the inclusion of lower quality firms in the regression equation. This is most likely because low quality firms are unable to extend their debt maturity and this makes the detection of term structure effects difficult in the regression that includes such firms.

[Insert Table 6 about here]

6 Debt maturity across firm types

Myers (2003) argued that different factors might affect different types of firms in fundamentally different ways. We now explore this possibility by systematically investigating the debt maturity structure differences of three main types of firms: manufacturing versus service firms, large versus small firms, and publicly-traded versus privately-held firms. In investigating the latter distinction, we also highlight the maturity structure differences across sharper firm type classifications according to their legal form of organization. Specifically, we also explore the differences between publicly-traded and privately-held corporations as well as between privately-held corporations and private limited companies. These exercises can also be viewed as further robustness checks on our main results in Section 4.

Figure 2 displays firms' debt maturity structures by industry membership, firm size, and legal form averaged over the entire sample period. The figure also displays firms' leverage ratios. Panel A of Figure 2 shows that manufacturing firms have both lower leverage and shorter maturity, although the difference is more pronounced in maturity structures. Panel B shows that larger firms use less debt in their capital structure and that their debt is of longer maturity. Panel C shows that publicly-traded firms are considerably less levered than privately-held firms but that the two types of firms have roughly similar maturity of debt. Panel D presents the results from breaking down the privately-held firms into its constituents, namely privately-held corporations and private limited companies. The panel also shows the results for all corporations (publicly-traded and privately-held together). Results suggest that while the maturity structures are quite similar, there are large differences in the leverage ratios of different classes of firms, the most significant being between those of publicly-traded corporations and private limited companies. In what follows, we take a more systematic look at the differences in debt maturity determinants across various classes of firms.

[Insert Figure 2 about here]

6.1 Manufacturing versus service firms

To investigate the debt maturity implications of industry affiliation, we rerun regressions separately for manufacturing and service firms. The results presented in Table 7 suggest that the debt maturity structures are determined largely by the same factors. For example, the two most economically important factors, *Leverage* and *Size*, are the main determinants of maturity for both groups of firms. In addition, factors such as *Growth*, *Z-score*, *Tax*, and *Term* appear to be unrelated with the debt maturity structures of neither group of firms.

The most significant difference between these two groups is that the coefficient estimate on *AssetMat* is insignificant for manufacturing firms, implying that these firms do not engage in maturity-matching to reduce the expected costs of financial distress associated with possible liquidity crises (as suggested by Morris, 1976; Diamond, 1991) or to mitigate the conflicts of interests between creditors and shareholders (as suggested by Myers, 1977). One possible explanation of this result is that manufacturing firms have closer relationships with their lenders, as a result of which they do not have to follow a maturity-matching policy to hedge liquidity risks. Our finding of a positive coefficient estimate on *EarnVolat* and a negative estimate on *IntVolat* in the manufacturing firm regression but not in the service firm regression is also consistent with this interpretation wherein lenders insure their clients against idiosyncratic as well as aggregate risks. Finally, the estimated coefficient on *Inflation* is significant only in the service firm equation, implying that the stability of domestic currency (lower inflation) leads service firms to lengthen their debt maturity.

[Insert Table 7 about here]

6.2 Large versus small firms

Table 8 reports the results from running our regressions separately for microenterprises, SMEs, and large firms. Coefficient estimates suggest that firm growth rates, volatility of earnings, effective tax rates, and the term structure of interest rates are unimportant for debt maturity in all firm size class. In fact, the only factor that has a significant coefficient estimate in all size classes is *Leverage*, which confirms the overriding role played by leverage in firms' maturity choices. Therefore, regardless of their size, firms that choose high leverage also choose long maturity, possibly to delay their exposure to bankruptcy risk (Leland and Toft, 1996) and/or to avoid liquidity risk (Diamond, 1991).

Leverage is also the only factor that appears to have any relation with the maturity choices of microenterprises. Note, however, that the coefficient estimates on *Leverage* are considerably higher for SMEs than both microenterprises and large firms, indicating that lengthening debt maturity to control

for the risk of liquidation is particularly important for SMEs.[24] To the extent that size proxies for quality, this result can be interpreted as being in line with Diamond (1991)'s liquidity risk hypothesis in which both high-quality and low-quality firms borrow short-term while intermediate-quality firms borrow longer-term. This intuition is also broadly consistent with the patterns of estimated coefficients on the firm quality proxy *Z-score* across size groups. Note that while the estimated coefficients on *Z-score* are insignificant in the microenterprise and SME regressions, the coefficient on *Z-score* is negative in the large firm regression. Therefore, the low liquidation risk of large, high-quality firms might be allowing them to reduce financing costs by borrowing on the shorter-term.

Results also indicate that microenterprises and SMEs do not engage in maturity-matching.[25] This result, while consistent with the results reported in Stephan, Talavera, and Tsapin (2011) for Ukraine, contrasts sharply with the developed economy small firm studies such as Scherr and Hulburt (2001) and Heyman, Deloof, and Ooghe (2008).[26] However, it is quite likely that the small firms in our sample are smaller than the firms in their sample, implying that the results are not directly comparable. Our results probably reflect the fact that smaller firms are much less sophisticated than larger firms in terms of financial management; they just follow a simple rule-of-thumb policy of choosing debt maturity in a way that is consistent with their leverage.

Finally, coefficient estimates on *IntVolat* and *Inflation* are significant only in the SME equation, indicating that only the debt maturity structures of SMEs are influenced by the uncertainties in the economic environment.[27] Although this result might be caused by the substantial reduction in the number of firm-year observations, it might also suggest that factors other than *IntVolat* and *Inflation* are more important in the maturity choices both the smallest and the largest firms.

[Insert Table 8 about here]

6.3 Publicly-traded versus privately-held firms

Finally, we consider debt maturity structure differences according to firms' legal form of organization. Results reported in Table 9 demonstrate once again the importance of firms' leverage ratios and size in

[24] Controlling for the risk of liquidation might be a lesser concern for both large firms and microenterprises. This is because large firms are generally highly diversified, have substantial capital, and suffer less from asymmetric information problems, suggesting that liquidation risk is minimal for such firms. By contrast, creditors are not highly willing to lend long-term to microenterprises in the first place as these firms are typically characterized by low liquidation values.

[25] We also considered small- and medium-sized firms separately. The coefficient estimate on *AssetMat* was significant only in the medium-sized firm equation. Thus, while medium- and large-sized firms match maturities, microenterprises and small firms do not.

[26] In their survey of American CFOs, Graham and Harvey (2001) also find that maturity-matching is particularly pervasive among small firms.

[27] When we ran regressions separately for small- and medium-sized firms, we found that the coefficient estimates on *IntVolat* and *Inflation* were significant only in the small-sized firm regression.

the determination of debt maturity structures. Regardless of their legal form, firms that are larger or have high leverage ratios have significantly longer maturity of debt. In addition, results again provide no evidence that firm growth rates, effective tax rates, or the term structure of interest rates have any relation with firms' maturity structures.

On the other hand, while the coefficient estimates on *AssetMat* are significant in the privately-held firm, privately-held corporation, and corporation regressions, they are insignificant in the publicly-traded corporation and private limited company regressions. Thus, matching maturities to mitigate liquidity risk and/or creditor-shareholder conflicts appears to be most important for privately-held corporations. If publicly-traded corporations are generally of higher quality than privately-held corporations and that privately-held corporations, in turn, are generally of higher quality than private limited companies,[28] this finding can be understood within Diamond (1991)'s liquidity risk model where medium-quality firms borrow longer-term while both high-quality and low-quality firms borrow shorter-term. This intuition is further confirmed by the pattern of estimated coefficients on *Z-score* across legal forms, as the estimate in the private limited company regression is positive and that in the publicly-traded corporation regression is negative.

Our finding that publicly-traded firms do not match maturities is rather interesting as it directly contrasts with the majority of large firm studies, including Arslan and Karan (2006) who studied the debt maturity decisions of publicly-traded Turkish firms. To understand this result, note that our sample publicly-traded firms have both the shortest asset maturity and the longest debt maturity (relative to leverage) among all types of firms. That is, publicly-traded firms' debt appears to be of longer maturity than the life of their assets. According to Morris (1976), this type of maturity-mismatch might be risky due to the uncertainty of the source and volume of the cash flows which are necessary to service the debt after the asset is retired. Given that publicly-traded firms are among the highest quality firms, however, they are unlikely to face serious difficulties in servicing debt.[29]

Finally, the pattern of estimated coefficients on *IntVolat* and *Inflation* is not easy to interpret. However, it seems rather clear that interest rate volatility and inflation are unrelated with the maturity decisions of publicly-traded firms. One possible interpretation of this result is that debt maturity decisions of publicly-traded firms are not affected materially by macroeconomic uncertainties since they have substantial internal funds, have diversified their external sources of finance, and are viewed by

[28] The *Z-score* values (30.48, 13.78, and 7.08, respectively) suggest that this is indeed the case.

[29] The opposite appears to hold for private limited companies as their debt appears to be of shorter maturity than the life of their assets. As explained by Morris (1976), this sort of mismatch can be more risky since the asset may not generate sufficient cash flows by the maturity date to retire the debt. In addition, in the Diamond (1991) model, liquidity risk arises from debt that is shorter maturity than assets and not vice versa. The low quality of private limited companies only exacerbates this risk.

lenders as being much more creditworthy than privately-held firms. The pattern of coefficient estimates on *EarnVolat* does not paint a clear picture either. Results suggest, however, that corporations increase their debt maturity when earnings are more volatile. This likely reflects relationship-lending effects where lenders protect their clients during difficult times by extending the maturity of credit.

[Insert Table 9 about here]

7 Overall assessment of results

Our strongest and most unambiguous finding is that firms that have high leverage also have longer debt maturity. This finding holds regardless of how leverage is defined and across a wide spectrum of firm types that includes manufacturing, service, small, large, publicly-traded, and privately-held firms. In addition, the economic significance of leverage dwarfs that of all other determinants of debt maturity, including *Size* which is a rather distant second. These findings underscore the importance of modeling firms' debt maturity and capital structure decisions simultaneously as suggested by theoretical studies such as Lewis (1990) and Wiggins (1990) as well as by empirical studies such as Barclay, Marx, and Smith (2003) and Johnson (2003).

Size is another major determinant of firm debt maturity, except for two types of firms. First, size does not appear to be related with the maturity structures of micro and small enterprises. Previous small firm studies did not reach a unanimous decision on the relation between debt maturity and firm size. While Scherr and Hulburt (2001) and Heyman, Deloof, and Ooghe (2008) report a negative association between the two variables, Ortiz-Molina and Penas (2008) and Magri (2010) report a positive association. Our finding falls in between the two sets of findings. As noted by Scherr and Hulburt (2001), this mixed evidence on size could be due to the fact that size proxies for several factors such as default risk, agency conflicts, and information asymmetry. Second, size does not seem to matter for the maturity structures of firms that already carry long-term debt in their capital structures. Therefore, once a firm obtains long-term financing, its size has no bearing on its maturity of debt. This holds despite the fact that firms that carry long-term debt are on average larger than firms that have no long-term debt in their capital structures. Taken together, these two findings suggest that firm size might play a more important when issuing long-term debt for the first time than in the choice of how much debt to issue once some long-term debt has already been issued. This might indicate in turn that adverse selection problems are a more serious problem than moral hazard problems in long-term contracting.

Asset maturity appears to also play some role in the determination of firms' debt maturity structures, although results depend on how asset maturity is defined and on the type of firm group considered. The evidence for maturity-matching is strongest when either tangibility or weighted measures are used as indicators of asset maturity. We find relatively weak evidence for maturity-matching when an unweighted measure of asset maturity is used. Following Stohs and Mauer (1996) and others, we have chosen to use a weighted measure in our analyses. Our results show that while asset maturity is positively associated with debt maturity for most firm groups including the full sample, it is unrelated with debt maturity in the manufacturing, microenterprise, small firm, private limited company, and publicly-traded firm samples. Our results also suggest that while not matching maturities may be harmless for publicly-traded firms, it may be highly risky for small, privately-held firms.

Macroeconomic variables appear to influence firms' debt maturity choices as well. Increases in inflation and interest rate volatility appear to reduce debt maturity, particularly for privately-held SMEs. Given that SMEs are an important part of any economy in terms output and employment, these findings underscore the importance of maintaining a stable and predictable economic environment to facilitate long-term contracting among businesses.

We find little evidence that the remaining independent variables affect debt maturity decisions. Interestingly, the insignificance of *Growth* occurs despite the fact that our sample includes a wide spectrum of firms that differ in their growth opportunities.[30] The only instance where *Growth* is significantly (and negatively) related with maturity is the bank debt maturity equation. Since our baseline debt definition includes debts from shareholders and related firms, this finding might be explained by more severe creditor-shareholder conflicts when debt is acquired entirely from external sources. Also, when we use capital expenditures as a proxy for growth opportunities, we find a positive association with debt maturity.

On the other hand, the coefficient estimates on the tax proxies *EarnVolat*, *Tax*, *Term*, and *IntVolat* are either insignificant or have the wrong sign in the vast majority of our regressions. Therefore, consistent with the theoretical work of Lewis (1990) and most prior empirical studies, our findings provide little evidence that tax considerations matter for debt maturity decisions.[31] We do, nevertheless, find some evidence that taxes might matter for firms that acquire the majority of their debt from external

[30] Our inability to detect such influences, however, might be due to the rough way in which we measure growth opportunities. Since the overwhelming majority of our sample firms are privately-held, we use accounting measures rather than the more preferable market measures used in large public firm studies. Similar results are reported by other small firm studies such as Scherr and Hulburt (2001), Heyman, Deloof, and Ooghe (2008), and Magri (2010).

[31] The insignificance of taxes might also potentially reflect the low level of effective taxes faced by our sample firms. One reason for the low level of effective taxes might be a lack of proper enforcement and transparency, which in turn facilitates tax evasion. Indeed, Fan, Titman, and Twite (2012) find that taxes do influence debt maturity structures in developed economies but not in developing economies, where taxes are easier to evade.

sources rather than from shareholders and related firms.

Finally, the coefficient estimate on the firm quality proxy, *Z-score*, is not significant in the majority of our regressions. This result is consistent with the results reported by Antoniou, Guney, and Paudyal (2006) and Cai, Fairchild, and Guney (2008). One possible explanation for this result is that our *Z-score* measure, which was developed in the context of an advanced economy like the U.S., is not well-suited for a developing economy like Turkey. It might also be due to the fact that we include leverage in our regressions. If leverage is also a strong proxy for quality, this might drive the results. Note, however, that the coefficient estimate on *Z-score* is significantly negative in the corporation (public as well as private) and large firm regressions. This result suggests that credit quality might be important for debt maturity choices of some firms but not others.

8 Summary and conclusion

This paper tests the leading theories of debt maturity choice of non-financial firms in a major developing economy, Turkey, between 2004 and 2013. Our analyses reveal several results. Our findings on size and growth opportunities indicate that the agency perspective is not likely to be useful in understanding the overall debt maturity choices of micro and small firms and firms with existing long-term credit relationships with lenders. However, consistent with most large firm studies, we find evidence that size (but still not growth opportunities) matters for the debt maturity choices of larger firms, indicating that creditor-shareholder conflicts are a more relevant concern for such firms.

Our findings on asset maturity, on the other hand, provide moderate support for the maturity-matching hypothesis. The evidence for maturity-matching is strongest in the case of medium-to-large privately-held service firms. Our analyses also indicate that when firms do not match maturities, they do so in different ways. In particular, while firms that are smaller and/or have low credit quality (such as privately-held micro and small enterprises) tend to issue debts of shorter maturity than their assets, larger and/or high credit quality firms (such as large publicly-traded companies) tend to issue debts of longer maturity than their assets. Thus, maturity-mismatches appear to be a more serious concern in the case of privately-held micro and small enterprises.

In our analyses, we have considered maturity-matching as an independent hypothesis. However, as discussed in our literature review, maturity-matching can also be rationalized within the contexts of both the agency and liquidity risk perspectives. Viewed this way, our findings on maturity-matching can be viewed as further evidence in support of both of these debt maturity perspectives.

Overall, our results are probably best understood within the context of Diamond (1991)'s liquidity

risk theory. Several of our findings seem to point in this direction, but the clearest evidence is perhaps our finding of a positive association between firm quality and debt maturity for private limited companies and a negative association for publicly-traded companies. Since these two groups of firms are at the opposite ends of the quality spectrum, the relation between firm quality and debt maturity must be non-monotonic as suggested by the theory. Moreover, although we have not necessarily associated leverage with any of the maturity perspectives in our analyses, it probably is most closely related with the liquidity risk perspective. This is because this perspective argues a theoretical link between debt maturity and firm credit quality and credit quality is a decreasing function of leverage (Diamond, 1991). Viewed this way, our results provide additional support for the liquidity risk perspective.

By contrast, our results provide only weak support for Flannery (1986)'s signaling model. However, we do find that the signaling perspective can be potentially useful if viewed as a conditional theory about the maturity choices of large, publicly-traded firms. Also, we find little evidence that tax theories are useful in understanding firms' debt maturity choices.

Finally, it should be noted that none of these theories was developed with the developing economies in mind. The vast cultural, institutional, and financial differences across economies might plausibly have important ramifications for debt maturity structures. In the context of the present paper, such differences might be partly responsible for the apparent weakness of some of the debt maturity theories as well as for some of our unexpected findings. Our results suggest that it would be particularly worthwhile to investigate more fully the nature of borrower-lender relationships and how they impact on debt maturity decisions in developing economies.

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Table 1: Descriptive statistics

	Value in 2004	Value in 2013	First quartile	Mean	Median	Third quartile	Standard deviation
DebtMat	0.21	0.37	0.00	0.29	0.14	0.56	0.34
Leverage	0.25	0.39	0.14	0.32	0.31	0.47	0.22
AssetMat	1.45	6.33	0.39	3.50	0.79	1.83	16.55
Size (log)	4.81	4.90	3.88	4.93	4.27	4.67	5.69
Growth	0.48	0.26	-0.06	0.19	0.08	0.29	0.52
Z-score	11.96	6.29	1.53	11.68	3.43	6.07	52.54
Tax	0.16	0.15	0.00	0.15	0.20	0.22	0.15
EarnVolat	0.07	0.04	0.02	0.05	0.04	0.06	0.05
IntVolat	2.13	1.01	1.01	1.40	1.13	2.13	0.70
Term	3.54	0.82	0.82	1.26	1.24	1.61	0.81
Inflation	10.58	7.49	7.49	8.52	8.76	10.14	1.50
GDPGrowth	9.36	4.12	2.13	4.55	5.67	8.77	4.58

This table presents the descriptive statistics for the dependent and independent variables described. The sample is an unbalanced panel of 11687 non-financial firms with 56231 firm-year observations between 2004 and 2013. The dependent variable, *DebtMat*, is the ratio of long-term debt to total debt, where long-term debt is any debt maturing in more than one year. *Leverage* is the ratio of total debt to its total assets. *AssetMat* is the weighted average of the maturities of current assets and fixed assets (net property, plant, and equipment). *Size* is the natural logarithm of real total assets. *Growth* is the annual percent change in total assets. *Z-score* is defined as $Z - score = \frac{10.6EBIT+0.169Sales+101RE+10.4WC}{Assets} + \frac{0.3Equity}{Debt}$, where *EBIT* is earnings before interest and taxes, *RE* is retained earnings, and *WC* is working capital (current assets minus current debt). *Tax* is the ratio of tax payments to pre-tax income. *EarnVolat* is the standard deviation of operating income over total assets over the current and past two years. *IntVolat* is the standard deviation of the monthly short-term (3 months) government bond yields over the current year. *Term* is the 12-month average for the fiscal year of the yield differential between the 2-year and 3-month government bonds. *Inflation* is the annual percent change in the CPI. *GDPGrowth* is the annual percent change in the real GDP. All variables (except macroeconomic variables) are winsorized at 1% level in both tails of the distribution.

Table 2: Determinants of debt maturity: Full sample results

	Leverage excluded	Full sample	Standardized coefficients	Ranking
Leverage	-	0.6336***	0.4126	1
		(0.0339)		
AssetMat	0.0005***	0.0004***	0.0210	3
	(0.0001)	(0.0001)		
Size	0.0663***	0.0327***	0.1168	2
	(0.0041)	(0.0045)		
Growth	-0.0015	-0.0023	-	-
	(0.0029)	(0.0028)		
EarnVolat	0.0406	0.0576*	0.0077	6
	(0.0339)	(0.0341)		
Z-score	-0.0002***	-0.0000	-	-
	(0.0000)	(0.0000)		
Tax	-0.0465***	-0.0091	-	-
	(0.0087)	(0.0090)		
Term	-0.0048*	-0.0036	-	-
	(0.0027)	(0.0027)		
IntVolat	-0.0029	-0.0046**	-0,0095	5
	(0.0021)	(0.0021)		
Inflation	-0.0082***	-0.0034**	-0,0165	4
	(0.0014)	(0.0014)		
GDPGrowth	0.0002	0.0007	-	-
	(0.0008)	(0.0008)		
D2008	0.0189***	0.0053	-	-
	(0.0059)	(0.0060)		
D2009	-0.0006	0.0193	-	-
	(0.0129)	(0.0130)		
Observations	56,231	56,223		
Number of firms	11,687	11,687		

This table presents the results from estimating our fixed effects panel regression Equation (1): $DebtMat_{it} = \beta_0 + \alpha Leverage_{it} + \sum_j \beta_j F_{j,it} + \sum_k \theta_k Macro_{kt} + \mu_i + \epsilon_{it}$, where $DebtMat_{it}$ is our measure of the maturity structure of debt for firm i in year t; $Leverage_{it}$ is our measure of leverage for firm i in year t; F_j is the vector of debt maturity determinants, $Macro_{kt}$ is the vector of macroeconomic variables used to control for the state of the economy; μ_i is the time-invariant unobservable firm-specific effect; and ϵ_{it} is the firm- and year-specific error term. Column 1 displays results from the case where leverage is excluded from the regression. Column 3 displays the results from estimating Equation (1) using the standardized versions of variables. Column 4 sorts the results according to their economic significance, where the ordering is based on the absolute value of the standardized coefficients. Only statistically significant estimated coefficients are ranked. The variables are as defined in Table 1. Heteroskedasticity and serial correlation robust standard errors are reported in parentheses. ***, **, and * denote significance at the 1, 5, and 10% levels, respectively.

Table 3: Estimated coefficients on *Z-score* for different quality subsamples

	Leverage excluded	Full sample
1^{st} quartile	0.0406***	0.0487***
	(0.0023)	(0.0032)
2^{nd}&3^{rd} quartiles	0.0437***	0.0565***
	(0.0016)	(0.0020)
4^{th} quartile	-0.0002***	-0.0000
	(0.0000)	(0.0000)

This table presents the estimated coefficients on *Z-score* from the estimation of Equation (1) for different firm quality subsamples. Firms are divided into quartiles according to their *Z-score* values. The 2^{nd} and 3^{rd} quartiles are pooled together. The variable *Z-score* is as defined in Table 1. Heteroskedasticity and serial correlation robust standard errors are reported in parentheses. ***, **, and * denote significance at the 1, 5, and 10% levels, respectively.

Table 4: Total debt versus financial debt versus bank debt

	Total debt maturity (Full sample)	Financial debt maturity	Bank debt maturity
Leverage	0.6336***	0.6074***	0.6543***
	(0.0339)	(0.0420)	(0.0466)
AssetMat	0.0004***	0.0003**	0.0005***
	(0.0001)	(0.0002)	(0.0002)
Size	0.0327***	0.0283***	0.0331***
	(0.0045)	(0.0055)	(0.0058)
Growth	-0.0023	-0.0018	-0.0060*
	(0.0028)	(0.0032)	(0.0033)
EarnVolat	0.0576*	0.0764*	0.0663
	(0.0341)	(0.0407)	(0.0424)
Z-score	-0.0000	0.0001	-0.0000
	(0.0000)	(0.0001)	(0.0001)
Tax	-0.0091	-0.0190*	-0.0191*
	(0.0090)	(0.0100)	(0.0104)
Term	-0.0036	0.0026	0.0024
	(0.0027)	(0.0032)	(0.0033)
IntVolat	-0.0046**	-0.0051**	-0.0076***
	(0.0021)	(0.0024)	(0.0024)
Inflation	-0.0034**	-0.0046***	-0.0066***
	(0.0014)	(0.0017)	(0.0017)
GDPGrowth	0.0007	-0.0006	-0.0000
	(0.0008)	(0.0010)	(0.0010)
D2008	0.0053	-0.0096	-0.0087
	(0.0060)	(0.0068)	(0.0071)
D2009	0.0193	-0.0009	0.0048
	(0.0130)	(0.0150)	(0.0155)
Observations	56,223	49,402	48,471
Number of firms	11,687	11,014	10,887

This table presents the findings from estimating Equation (1) for different definitions of debt maturity and leverage. Results reported in Column 1 are our baseline results reported in Table 2. Columns 2 and 3 report the results from estimating Equation (1) when *DebtMat* is defined either as the share of long-term financial debt in total financial debt or as the share of long-term bank debt in total bank debt, respectively. A corresponding adjustment in the definition of leverage is also made. The measure of total debt differs from financial debt by also including loans from related firms and employees. Financial debt, in turn, differs from bank debt by the inclusion of financial leasing payables, deferred financial leasing payable costs (-), and other financial debt. The variables are as defined in Table 1. Heteroskedasticity and serial correlation robust standard errors are reported in parentheses. ***, **, and * denote significance at the 1, 5, and 10% levels, respectively.

Table 5: Different sample start years

	2003	2004 (Full sample)	2005
Leverage	0.5980***	0.6336***	0.6287***
	(0.0292)	(0.0339)	(0.0376)
AssetMat	0.0005***	0.0004***	0.0004***
	(0.0001)	(0.0001)	(0.0001)
Size	0.0403***	0.0327***	0.0270***
	(0.0040)	(0.0045)	(0.0051)
Growth	-0.0055**	-0.0023	-0.0021
	(0.0026)	(0.0028)	(0.0032)
EarnVolat	0.0330	0.0576*	0.0525
	(0.0297)	(0.0341)	(0.0372)
Z-score	-0.0001***	-0.0000	-0.0000
	(0.0000)	(0.0000)	(0.0000)
Tax	-0.0128	-0.0091	-0.0079
	(0.0083)	(0.0090)	(0.0096)
Term	-0.0025	-0.0036	-0.0045
	(0.0025)	(0.0027)	(0.0051)
IntVolat	-0.0017	-0.0046**	-0.0050**
	(0.0020)	(0.0021)	(0.0021)
Inflation	-0.0002	-0.0034**	-0.0037**
	(0.0011)	(0.0014)	(0.0015)
GDPGrowth	0.0007	0.0007	0.0007
	(0.0008)	(0.0008)	(0.0011)
D2008	0.0011	0.0053	0.0063
	(0.0059)	(0.0060)	(0.0078)
D2009	0.0229*	0.0193	0.0194
	(0.0126)	(0.0130)	(0.0178)
Observations	60,831	56,223	51,035
Number of firms	12,135	11,687	11,374

This table presents the findings from estimating Equation (1) for different sample start years. The variables are as defined in Table 1. Heteroskedasticity and serial correlation robust standard errors are reported in parentheses. ***, **, and * denote significance at the 1, 5, and 10% levels, respectively.

Table 6: All firms versus firms with positive amounts of long-term debt in their capital structure

	Full sample	Positive long-term debt firms
Leverage	0.6336***	0.3611***
	(0.0339)	(0.0467)
AssetMat	0.0004***	0.0003*
	(0.0001)	(0.0002)
Size	0.0327***	0.0067
	(0.0045)	(0.0062)
Growth	-0.0023	0.0042
	(0.0028)	(0.0034)
EarnVolat	0.0576*	0.1527***
	(0.0341)	(0.0506)
Z-score	-0.0000	0.0014***
	(0.0000)	(0.0002)
Tax	-0.0091	-0.0040
	(0.0090)	(0.0116)
Term	-0.0036	0.0067*
	(0.0027)	(0.0036)
IntVolat	-0.0046**	-0.0031
	(0.0021)	(0.0027)
Inflation	-0.0034**	-0.0047**
	(0.0014)	(0.0019)
GDPGrowth	0.0007	0.0009
	(0.0008)	(0.0011)
D2008	0.0053	-0.0062
	(0.0060)	(0.0077)
D2009	0.0193	0.0084
	(0.0130)	(0.0170)
Observations	56,223	33,923
Number of firms	11,687	8,205

This table presents the findings from estimating Equation (1) also for firms that carry strictly positive amounts of long-term debt in their capital structure. Such firms comprise on average about 60 percent of our sample each year. The variables are as defined in Table 1. Heteroskedasticity and serial correlation robust standard errors are reported in parentheses. ***, **, and * denote significance at the 1, 5, and 10% levels, respectively.

Table 7: Manufacturing versus non-manufacturing firms

	Full sample	Manufacturing firms	Service firms
Leverage	0.6336***	0.5971***	0.7010***
	(0.0339)	(0.0409)	(0.0602)
AssetMat	0.0004***	0.0005	0.0003**
	(0.0001)	(0.0004)	(0.0002)
Size	0.0327***	0.0329***	0.0338***
	(0.0045)	(0.0068)	(0.0061)
Growth	-0.0023	-0.0037	-0.0014
	(0.0028)	(0.0050)	(0.0036)
EarnVolat	0.0576*	0.0933**	0.0466
	(0.0341)	(0.0476)	(0.0496)
Z-score	-0.0000	-0.0000	-0.0000
	(0.0000)	(0.0000)	(0.0000)
Tax	-0.0091	-0.0051	-0.0110
	(0.0090)	(0.0118)	(0.0139)
Term	-0.0036	-0.0018	-0.0069
	(0.0027)	(0.0035)	(0.0043)
IntVolat	-0.0046**	-0.0059**	-0.0042
	(0.0021)	(0.0027)	(0.0033)
Inflation	-0.0034**	-0.0024	-0.0048**
	(0.0014)	(0.0019)	(0.0022)
GDPGrowth	0.0007	0.0004	0.0012
	(0.0008)	(0.0011)	(0.0013)
D2008	0.0053	-0.0039	0.0177*
	(0.0060)	(0.0077)	(0.0096)
D2009	0.0193	0.0180	0.0239
	(0.0130)	(0.0168)	(0.0204)
Observations	56,223	30,770	25,150
Number of firms	11,687	5,833	5,958

This table presents the findings from estimating Equation (1) separately for manufacturing and non-manufacturing firms. The variables are as defined in Table 1. Heteroskedasticity and serial correlation robust standard errors are reported in parentheses. ***, **, and * denote significance at the 1, 5, and 10% levels, respectively.

Table 8: Microenterprises, SMEs, and large firms

	Full sample	Microenterprises	SMEs	Large firms
Leverage	0.6336***	0.4387***	0.7184***	0.6377***
	(0.0339)	(0.1094)	(0.0464)	(0.0753)
AssetMat	0.0004***	0.0009	0.0003	0.0005*
	(0.0001)	(0.0005)	(0.0002)	(0.0003)
Size	0.0327***	0.0109	0.0298***	0.0466***
	(0.0045)	(0.0141)	(0.0063)	(0.0146)
Growth	-0.0023	-0.0077	0.0015	-0.0030
	(0.0028)	(0.0078)	(0.0037)	(0.0070)
EarnVolat	0.0576*	0.0231	0.0516	0.0264
	(0.0341)	(0.0746)	(0.0439)	(0.0949)
Z-score	-0.0000	0.0001	0.0000	-0.0001**
	(0.0000)	(0.0001)	(0.0000)	(0.0001)
Tax	-0.0091	-0.0176	-0.0014	0.0110
	(0.0090)	(0.0219)	(0.0111)	(0.0259)
Term	-0.0036	-0.0004	-0.0015	-0.0102
	(0.0027)	(0.0068)	(0.0033)	(0.0073)
IntVolat	-0.0046**	0.0005	-0.0061**	-0.0055
	(0.0021)	(0.0060)	(0.0026)	(0.0052)
Inflation	-0.0034**	-0.0024	-0.0047***	0.0048
	(0.0014)	(0.0047)	(0.0018)	(0.0035)
GDPGrowth	0.0007	0.0003	0.0002	0.0032
	(0.0008)	(0.0024)	(0.0010)	(0.0021)
D2008	0.0053	-0.0006	0.0031	-0.0001
	(0.0060)	(0.0177)	(0.0074)	(0.0152)
D2009	0.0193	-0.0109	0.0157	0.0581*
	(0.0130)	(0.0360)	(0.0160)	(0.0329)
Observations	56,223	7,979	38,460	8,276
Number of firms	11,687	1,880	9,064	1,544

This table presents the findings from estimating Equation (1) separately for microenterprises, SMEs, and large firms. According to the European Union's firm *Size* classification, microenterprises, SMEs, and large-sized firms are, respectively, firms with balance sheet totals less than EUR 2 million, between EUR 2 million and EUR 43 million, and more than EUR 43 million. We estimate that the ratios of value added by sample microenterprises, SMEs, and large firms to their population counterparts are roughly about 10 percent, 60 percent, and 90 percent. The variables are as defined in Table 1. Heteroskedasticity and serial correlation robust standard errors are reported in parentheses. ***, **, and * denote significance at the 1, 5, and 10% levels, respectively.

Table 9: Results according to firms' legal forms of organization

	Full sample	Public firms	Private firms	Private corporations	Corporations	Private limited companies
Leverage	0.6336***	0.6535***	0.6338***	0.5904***	0.5921***	0.7538***
	(0.0339)	(0.1691)	(0.0346)	(0.0362)	(0.0353)	(0.0857)
AssetMat	0.0004***	-0.0022	0.0004***	0.0008***	0.0008***	-0.0001
	(0.0001)	(0.0018)	(0.0001)	(0.0002)	(0.0002)	(0.0002)
Size	0.0327***	0.1241***	0.0314***	0.0372***	0.0389***	0.0226***
	(0.0045)	(0.0340)	(0.0045)	(0.0056)	(0.0055)	(0.0078)
Growth	-0.0023	-0.0136	-0.0022	0.0011	0.0010	-0.0057
	(0.0028)	(0.0298)	(0.0029)	(0.0036)	(0.0036)	(0.0047)
EarnVolat	0.0576*	0.2575	0.0550	0.0821**	0.0852**	0.0015
	(0.0341)	(0.2688)	(0.0345)	(0.0411)	(0.0406)	(0.0635)
Z-score	-0.0000	-0.0002***	-0.0000	-0.0001***	-0.0001***	0.0003***
	(0.0000)	(0.0001)	(0.0000)	(0.0000)	(0.0000)	(0.0001)
Tax	-0.0091	-0.0030	-0.0090	-0.0103	-0.0103	-0.0068
	(0.0090)	(0.0555)	(0.0091)	(0.0112)	(0.0110)	(0.0157)
Term	-0.0036	0.0097	-0.0039	-0.0046	-0.0042	-0.0047
	(0.0027)	(0.0168)	(0.0027)	(0.0033)	(0.0033)	(0.0048)
IntVolat	-0.0046**	-0.0181	-0.0044**	-0.0042	-0.0047*	-0.0045
	(0.0021)	(0.0127)	(0.0021)	(0.0026)	(0.0025)	(0.0038)
Inflation	-0.0034**	0.0099	-0.0039***	-0.0026	-0.0020	-0.0064**
	(0.0014)	(0.0082)	(0.0014)	(0.0018)	(0.0017)	(0.0026)
GDPGrowth	0.0007	-0.0021	0.0007	0.0012	0.0011	0.0001
	(0.0008)	(0.0049)	(0.0008)	(0.0010)	(0.0010)	(0.0015)
D2008	0.0053	-0.0901***	0.0077	0.0088	0.0052	0.0084
	(0.0060)	(0.0349)	(0.0061)	(0.0074)	(0.0073)	(0.0109)
D2009	0.0193	0.0247	0.0183	0.0271*	0.0282*	0.0067
	(0.0130)	(0.0749)	(0.0132)	(0.0160)	(0.0156)	(0.0236)
Observations	56,223	1,482	54,716	34,800	36,301	19,922
Number of firms	11,687	196	11,505	6,683	6,864	4,823

This table presents the findings from estimating Equation (1) separately for firms with different legal forms of organization. The variables are as defined in Table 1. Heteroskedasticity and serial correlation robust standard errors are reported in parentheses. ***, **, and * denote significance at the 1, 5, and 10% levels, respectively.

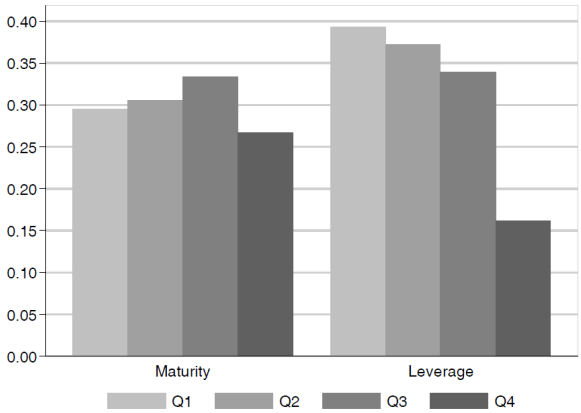

Figure 1: Debt maturity, leverage, and firm quality. This figure shows the relationship between debt maturity (*DebtMat*) and firm quality (*Z-score*) as well as between leverage (*Leverage*) and firm quality for different firm quality subsamples. Firms are divided into quartiles according to their *Z-score* values on the horizontal axis. The variables *DebtMat*, *Leverage*, and *Z-score* are defined in Table 1.

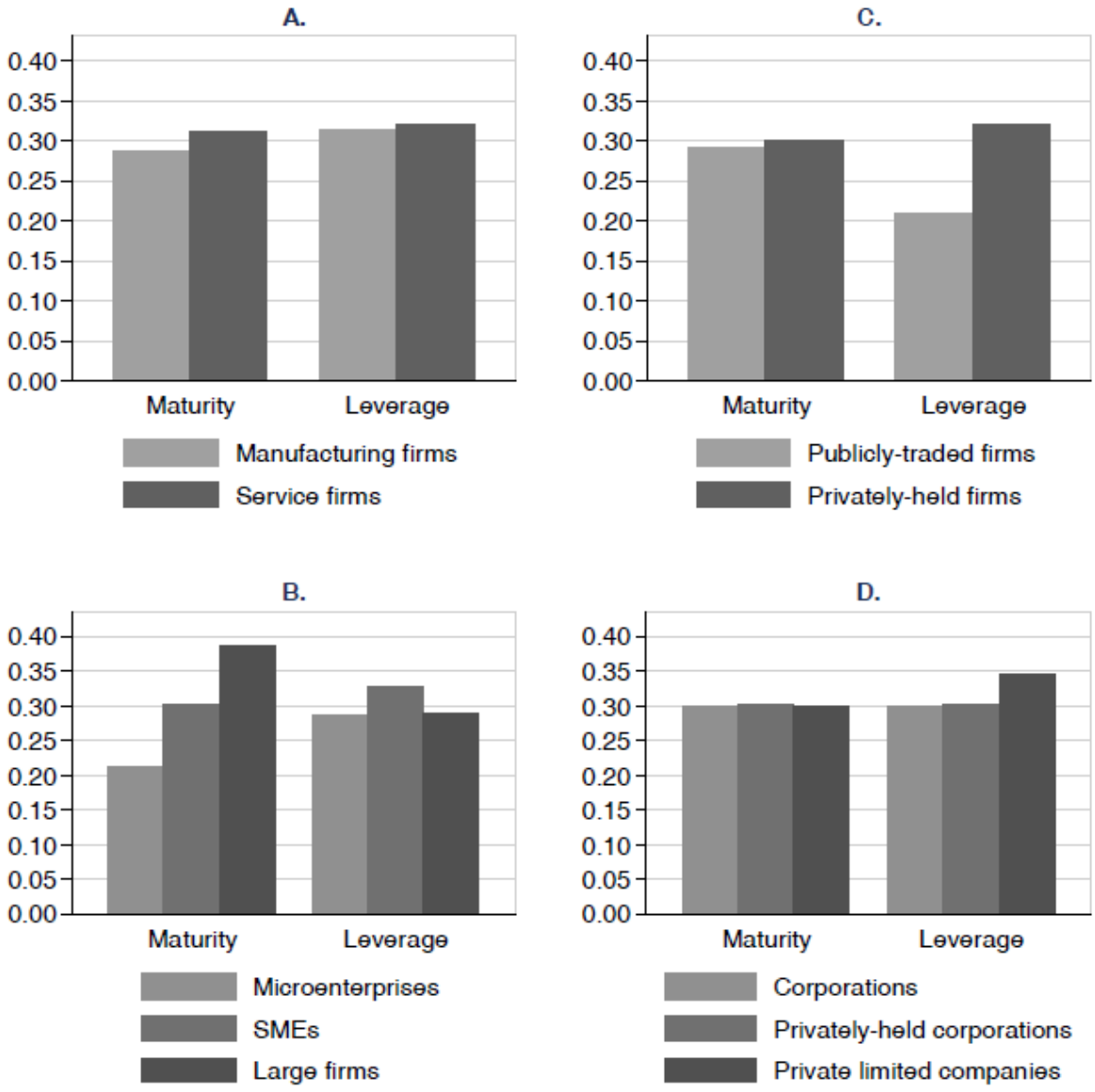

Figure 2: Debt maturity and capital structures for different firm types. This figure shows debt maturity and capital structures (*DebtMat* and *Leverage*) for different types of firms. Panel A compares manufacturing and service firms, Panel B compares microenterprises, SMEs, and large firms, Panel C compares publicly-traded firms and privately-held firms, and Panel D compares corporations, privately-held corporations, and private limited companies. The variables *DebtMat* and *Leverage* are defined in Table 1.