Structure of Debt Maturity across the Firm Type Spectrum

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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 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 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 might influence debt maturity structures.

Keywords: debt maturity structure, nonfinancial firms, Turkey
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*The views expressed herein are solely of the authors and do not represent those of the Central Bank of the Republic of Turkey or its staff.

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1 Introduction

The theories of modern corporate finance have been developed mainly with the goal of understanding the financing decisions of publicly-traded firms in developed economies, particularly the U.S.. However, even the smallest of publicly-traded firms is large relative to most firms in any economy. Small, privately-held firms differ from large, publicly-traded firms in many respects, including 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 countries (see, for example, Rajan and Zingales, 1995; 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 corporate finance theories apply to small, privately-held firms in less-developed economies is directly interesting.

This paper investigates a key dimension of business financing decisions, specifically debt maturity structure decisions, in a developing economy.[1] A main goal in our paper is to examine how the debt maturity structure decisions of small, privately-held firms differ from those of large, publicly-traded firms. Although we are not the first to do this, our paper contributes to the extant literature in two important ways. First, there are only a handful of papers that study small, privately-held firms. In the context of developed economies, Scherr and Hulburt (2001) and Ortiz-Molina and Penas (2008) focus on the U.S., Heyman, Deloof, and Ooghe (2008) focus on Belgium, and Magri (2010) focuses on Italy. In the context of developing economies, we are aware of only two studies; Bas (2012) examines 24 developing economies and Stephan, Talavera, and Tsapin (2011) examine the case of Ukraine. Our paper contributes to this strand of literature by bringing evidence from the case of a major developing economy, Turkey.

Second, this line of empirical work generally focuses on the manufacturing sector and analyzes the debt maturity decisions of small, privately-held firms using datasets which do not contain information on large, publicly-traded firms. To our knowledge, the only exception is Gonzalez-Mendez (2013) who studies the maturity differences across firm size classes in Spain using a dataset that includes

[1] There is also a separate and more established strand of literature that studies firms' capital structure (debt-equity) decisions. See Harris and Raviv (1991) or Frank and Goyal (2008) for excellent reviews of this literature.

both large and small firms. The exclusion of large, publicly-traded firms severely limits the extent to which the debt maturity decisions of these two widely different types of firms can be compared. We overcome this limitation by using a unique and 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 significantly more accurate assessment of the debt maturity decisions of the average (typical) firm in the economy than most previous studies. It also allows us to systematically investigate the debt maturity structure differences between large and small firms, publicly-traded and privately-held firms, and manufacturing and non-manufacturing firms.

Our empirical analyses build on the major theories of debt maturity structure. These are the agency (or contracting cost) theory, tax-based theory, signaling and liquidity risk theories, and the maturity-matching theory. As we discuss in Section 2, each of these theories suggests a number of explanatory variables that either positively or negatively influence debt maturity. We use all of these theory-based proxy variables in our regression analyses and examine how the predictions of various theories pan out in the data. Since previous research has established that debt maturity and capital structure (leverage) decisions are interactive, we model these decisions as being simultaneously made. However, in order to highlight the significance of this modeling choice, we also present results from the case where leverage is excluded from regressions and show how the two sets of results differ. In addition, we analyze in detail the debt maturity differences between different types of firms as well as conduct a battery of checks to confirm that our results are robust.

Our analyses reveal several interesting findings. First, our strongest and most robust finding is that firms that have high leverage also have long debt maturity. This finding holds in all of our models without exception. Leverage is also the most economically significant determinant of debt maturity and by a large margin. These findings indicate that firms are concerned about the risk of bankruptcy or premature liquidation by lenders as suggested by debt maturity theories.

Although not as economically significant as leverage, firm size and asset maturity also play important roles in the determination of firms' debt maturity structures. However, results appear to depend on the type of firm group considered. In particular, size does not appear to be related with the maturity structures of micro and small enterprises. In addition, our results suggest that firm size likely plays a more important role in the choice between issuing long-term debt or not than in the

choice of how much debt to issue once the firm has issued some long-term debt. This might indicate, in turn, that adverse selection problems are a more serious problem than moral hazard problems in the provision of financing in Turkey.

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.

For the remaining firm-level proxy variables, we do not find consistent and robust evidence that they influence firms' debt maturity structures. However, our results provide some evidence that macroeconomic variables influence 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 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.

Our results also provide guidance on when a given debt maturity theory is likely to be most useful in understanding firms' maturity decisions. First, our findings on size and growth opportunities indicate that the agency perspective is not likely to be useful in understanding the maturity choices of micro and small enterprises. The agency perspective is also not likely to be useful in understanding incremental maturity decisions of firms that already have positive amounts of long-term debt in their capital structure. These findings suggest that creditor-shareholder conflicts are likely a more relevant concern for larger firms and/or when a firm decides to issue long-term debt for the first time.

Second, the maturity-matching perspective appears to be most useful in thinking about the maturity decisions of medium-to-large, privately-held, non-manufacturing firms. Moreover, our results indicate that while privately-held micro and small enterprises are unable to hedge liquidity risks by matching maturities, publicly-traded firms do not need to do so as liquidity and/or bankruptcy risks are minimal for these firms.

Third, our findings provide little evidence that tax considerations matter for debt maturity deci-

sions. This might be because effective taxes are simply too low in Turkey to have any meaningful and empirically observable effect on firms' financing decisions. The low level of effective taxes, in turn, likely reflects an economic and legal environment that is conducive to tax evasion. Nevertheless, we do find some weak evidence that taxes might possibly matter more for firms that raise debt mainly from external sources of finance such as banks or capital markets rather than from related firms.

Fourth, we find that the signaling perspective might be more useful when thinking about the debt maturity structures of large, publicly-traded firms. Thus, if firms do in fact take actions to signal their creditworthiness, they do so to distinguish themselves from other large, publicly-traded companies and not from small, privately-held enterprises. For the entire spectrum of firms, however, the liquidity perspective likely provides a significantly better framework of analysis than the signaling perspective. This is because we find relatively strong evidence of a non-monotonic relationship between various indicators of firm credit quality and debt maturity in our full sample, as predicted by the liquidity risk perspective. Hence, firms that rely heavily on shorter-term debt are a mix of the very high and low quality firms, with the middle quality firms using more longer-term debt.

In our analyses, we treat leverage as a control variable and do not necessarily associate it with any of the debt maturity theories. However, the idea that leverage is a key determinant of debt maturity is probably is most closely related with the liquidity risk perspective. This is because the liquidity risk perspective argues a theoretical link between debt maturity and firm credit quality, and credit quality, in turn, is a decreasing function of leverage. Viewed this way, our results provide additional evidence in favor of the liquidity risk perspective. In addition, although we have considered maturity-matching as an independent hypothesis, it can also be rationalized within the contexts of both the agency and liquidity risk theories. Accordingly, our findings on maturity-matching can be interpreted as further evidence in support of both of these debt maturity perspectives.

Overall, our results are therefore probably best understood within the context of the liquidity risk theory. The agency theory also appears to capture some of the essential aspects of firms' debt maturity choices such as the effects of firm size and asset maturity. The signaling model is probably best viewed as a special case of the liquidity risk theory and can be useful in thinking about the maturity choices of large, publicly-traded firms. We find little evidence that tax theories are useful in understanding the debt maturity choices of Turkish non-financial firms.

It is important to emphasize, however, that these leading theories of debt maturity cannot en-

tirely 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 reduce 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 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 hypotheses about the determinants of firm debt maturity structure. These are: agency hypotheses, tax hypotheses, signaling and liquidity risk hypotheses, and maturity matching hypothesis. The theories underlying these hypotheses are not necessarily mutually exclusive. We now consider each in turn.

2.1.1 Agency hypotheses

The agency perspective suggests that a firm's growth opportunities and size influence its maturity structure of debt.

Growth opportunities: Myers (1977) argues that a firm's future investment opportunities are akin to growth options. Viewed this way, the value of a firm with growth options depends on whether the firm's managers optimally exercise these options. The decision to exercise or not, in turn, depends critically on how the firm is financed. If the firm is financed entirely by equity, managers optimally exercise all profitable growth options. With risky debt in the firm's capital structure, however, managers

acting on behalf of shareholders may fail to exercise some of the profitable options if creditors stand to capture a large enough fraction of the expected earnings. Myers (1977) calls this conflict of interest between creditors and shareholders the *underinvestment problem*. He also shows that this problem can be solved, among other ways, by issuing debt that matures before the growth options are to be exercised. The testable hypothesis implied by the Myers (1977) analysis is that *a firm's debt maturity decreases with its degree of growth options*.

Hart and Moore (1995) point to another important agency problem. In particular, they recognize the possibility that managers may be self-interested with possible empire-building motives. In that case, conflicts of interest may also arise between managers and shareholders of a firm, a situation that is not considered by Myers (1977). Hart and Moore (1995) go on to show that when a firm with new investment opportunities (i.e. growth options) has little or no long-term debt, the management will have a tendency to finance unprofitable investments by borrowing against (i.e. diluting) future earnings. They argue that the shareholders can mitigate this overinvestment problem by requiring management to issue sufficient amounts of long-term debt. The testable hypothesis is thus the opposite of Myers (1977): *a firm's debt maturity increases with its degree of growth options*.

Firm size: Smith and Warner (1979) argue that the conflicts of interest between creditors and shareholders faced by smaller firms are likely to be greater in variety as well as in severity than large firms.[2] For example, smaller firms would find it easier to substitute high-risk assets for low-risk assets and to engage in claim-dilution, both of which benefit shareholders at the expense of creditors. Barnea, Haugen, and Senbet (1980) and Leland and Toft (1996) show that these agency problems, like Myers (1977)'s underinvestment problem, can be attenuated by shortening the maturity of debt. The testable hypothesis would be that *a firm's debt maturity increases with its size*.

2.1.2 Tax hypotheses

The taxation perspective suggests that tax rates, volatility of firm value, term structure of interest rates and volatility of interest rates all play a role in determining the maturity structure of debt.

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.[3] 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

[2] See, also, Pettit and Singer (1985) and Ang (1992). On the other hand, it is hard to see why agency problems between the managers and shareholders would be more severe in a small firm, as managers and owners are often the same people in such firms.

[3] See, also, Brennan and Schwartz (1978).

than expected floatation and bankruptcy costs. The testable hypothesis is therefore that *a firm's debt maturity decreases with its effective tax rate.*

Term structure of interest rates: Brick and Ravid (1985) and Kim, Mauer, and Stohs (1995) also present multi-period tax-based frameworks to analyze debt maturity choice. In the Brick and Ravid (1985) 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.[4] This is because an increasing term structure accelerates the tax benefit of debt into the early periods of the debt obligation, thereby increasing the total tax advantage of debt in present value terms. Kim, Mauer, and Stohs (1995) focus instead on how corporate debt maturity policy affects investor tax-timing options to tax-trade corporate securities. Their model predicts that long-term debt maturity strategy maximizes investors' tax-timing option value when the term structure is increasing, reflecting the fact that long-term bond prices are more sensitive to changes in interest rates. The testable hypothesis implied by both of these models is that *a firm's debt maturity increases with slope of the term structure of interest rates.*

Volatility of interest rates: A key feature of the Kim, Mauer, and Stohs (1995) model is that it allows for volatility in interest rates. 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. Therefore, the testable hypothesis is that *a firm's debt maturity increases 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. In particular, they show that debt maturity increases when the volatility of firm value decreases, as the firm does not have to rebalance its capital structure as often to moderate expected bankruptcy costs. Sarkar (1999) also finds a negative relation between maturity and volatility. In his model, the firm shortens debt maturity in an attempt to mitigate volatility-induced financial distress costs. The testable hypothesis implied by both of these models is that *a firm's debt maturity decreases with the volatility of firm value.*

A common feature of the abovementioned tax-based models is that they analyze the debt maturity decision taking the firm's capital structure decision as given. However, a number of theoretical studies including Wiggins (1990) and Lewis (1990) argue that the implications of these models 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

[4]Note that there is no uncertainty concerning interest rates in this model. Brick and Ravid (1991) show that, under certain qualifications, this result extends to the case where interest rates are uncertain.

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.[5]

2.1.3 Signaling and liquidity risk hypotheses

The signaling perspective highlights the possibility that a firm's private information about its quality can influence its choice of debt maturity (Flannery, 1986). The liquidity risk perspective, on the other hand, posits that a firm's choice of debt maturity is determined as the outcome of a trade-off between the benefits of signaling quality and the costs of possible loss of control rents due to premature liquidation by lenders (Diamond, 1991). Both perspectives suggest the existence of a relation between a firm's quality and its maturity of debt, albeit in slightly different ways.

Signaling: Flannery (1986) explores the signaling implications of a firm's debt maturity choice when a firm's insiders are systematically 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. In the more realistic case where issuing debt is sufficiently costly, low-quality firms may be forced to issuing long-term debt in order 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.[6] The testable signaling hypothesis is that *a firm's debt maturity decreases with the firm's quality.*

Liquidity risk: Similar to Flannery (1986), Diamond (1991) explores the choice of debt maturity when a firm has private information about its future credit-standing. A firm expecting favorable news in the future 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

[5] 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.

[6] 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.

its debt. In that case, the lender can sell the assets of the firm or remove the borrower from control, provided a more competent manager can be found (termed liquidation). Lenders, 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 very high credit quality (i.e. low credit risk) can issue short-term debt because the risk of liquidation is minimal. Firms with medium credit quality issue long-term debt to reduce the risk of liquidation. Finally, firms with very low credit 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 very high quality and firms with very low quality, with medium-quality firms borrowing longer term. The testable hypothesis implied by the liquidity risk model is thus 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. 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.[7] Diamond (1991) argues that liquidity risk can be reduced by financing long-term assets with long-term debt. The testable hypothesis is thus that *a firm's debt maturity increases with the maturity of its assets.*

[7] See Hart and Moore (1994) for another agency-theoretic explanation of why firms might want to match the maturity of assets and liabilities.

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 the various debt maturity theories hold up in the data. In this section, we provide a brief review of this literature. There are two main categories: Studies that use a sample of large, publicly-traded firms and those that use a sample of small, privately-held firms. While studies generally (but not universally) find evidence in support of maturity-matching, the findings concerning the rest of the debt maturity hypotheses are mixed at best.

2.2.1 Large, 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 standard 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. Even when a proxy variable is significant and has the correct sign, the magnitude of the associated coefficient is in general too low to be economically significant. By contrast, Goyal and Wang (2013) and Newberry and Novack (1999) provide evidence that strongly supports, respectively, the signaling hypothesis and some of the tax-related hypotheses.[8] 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 of debt maturity on advanced 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)

[8] 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).

reports similar qualitative findings as those in Ozkan (2000, 2002) for Spanish firms. Antoniou, Guney, and Paudyal (2006) focus instead 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 of debt maturity receives reasonable support in all three countries. 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 countries. Despite the lack of evidence in these case of U.K., France, Germany, and Spain, Alcock, Finn, and Tan (2012) present strong evidence in favor of the signaling view in the case of Australian firms.

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

As noted earlier, small, privately-held firms differ from large, publicly-traded firms in many respects, including expected life, taxability, ownership, flexibility, industry, economies of scale, financial market access, and level of information asymmetry. However, due to the lack of pertinent data, 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 small, privately-held firms are similar to those for much larger, 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 small firms' debt maturity. The authors also find that small firms with either high or low default risk use debt of shorter maturities than do small firms with intermediate default risk as predicted by Diamond (1991). However, the authors find almost no evidence for the importance of the small firm's 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. small 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 advanced 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 hypotheses of debt maturity. The relevance of the tax hypotheses are 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 small firm studies on developing economies. Using data on 24 developing countries, Bas (2012) finds that in countries 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), on the other hand, focus on Ukraine and report evidence that is relatively more consistent with the agency and signaling perspectives.

3 Data and variables

In this section, we describe our data, construct proxy variables for the different debt maturity hypotheses, and present the key descriptive statistics.

3.1 Data

Our firm-level data come from the survey-based Sectoral Balance Sheets (SBS) dataset of the CBRT.[9] 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 to 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 and an attendant structural transformation took place in Turkey.[10] Relatedly, 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).[11] 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.[12] 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

[9] 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.

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

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

[12] 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.

and comprises roughly 53.1 percent of all firms.[13] Since most of our sample non-manufacturing firms are service firms, we will use the terms "service" and "non-manufacturing" interchangeably in the sequel.

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. Specifically, of the roughly 9400 firms each year in the dataset, roughly 18 percent are microenterprises, 70.5 percent are SMEs, and 11.5 percent are large firms.[14] 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.[15] The dataset nevertheless provides us with a unique opportunity to study the financial decisions of small, privately-held firms in a developing economy context.

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 (BIST), 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 of firm debt maturity. We begin with the dependent variable, debt maturity, and then consider in turn each of the independent variables which serve as proxies for various maturity structure hypotheses. Finally, we introduce and define a number of control variables. In Section 5, we investigate the robustness of our results to

[13] The service 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 service industries from our analyses 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.

[14] 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.

[15] 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.

alternative variable definitions.

A remark concerning the choice of proxies is in order. Note that empirical studies of debt maturity generally focus on publicly-traded firms. This allows them to use proxy variables that are based on market values of various types of assets and liabilities. For instance, studies generally use the market-to-book value of the firm's assets as a proxy for the firm's available growth opportunities. However, the majority of firms in our data set are privately-held firms, for which market values are not available. As such, all proxy variables we develop below are based on book values.

3.2.1 Dependent variable: 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 related firms (parent, sister, and subsidiary) and employees (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* if Myers (1977)'s underinvestment hypothesis holds and a positive association if Hart and Moore (1995)'s overinvestment hypothesis holds.

Firm size: Firm size, denoted *Size*, is defined as the natural logarithm of 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 such as Barclay and Smith (1995) and Stohs and Mauer (1996) typically use yields on 10-year and 6-month government

bonds as proxies for long-term and short-term interest rates, respectively. However, government bond markets are not as advanced in less developed countries such as Turkey. 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 September 2002. Historically, there has also been a tendency of longer-term government bond markets in Turkey 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. Given the level of development of the Turkish government bond market, 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. Note that the fiscal and calendar years are one and the same in Turkey. We expect a positive relation between *Term* and *DebtMat*.[16]

Volatility of interest rates: To measure the volatility of interest rates, *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 *Term* 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; Ozkan, 2000), 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, 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 *Tax*es, *RE* is retained earnings, and *WC* is working

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

capital (current assets minus current debt). Higher levels of *Z-score* indicate lower default risk and hence higher firm quality. Therefore, 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, 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. This approach is also consistent with the original approach proposed by Altman (1968). 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 Proxies 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). If firms match the maturity of their assets and liabilities, then we would expect a positive relation between *AssetMat* and *DebtMat*.

3.2.6 Control variables

We also employ a number of variables to control for effects not captured by the proxies associated with the different debt maturity hypotheses. These are: i) firms' leverage ratios, ii) macroeconomic variables, and iii) crisis year dummies.

Leverage: As noted 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.[17] 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). Consistent with this line of literature, we consider capital structure and debt maturity decisions as being simultaneously made. However, in order to highlight the importance of this choice for our findings, 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: Macroeconomic 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*, on the other hand, 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.

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

[17] 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.

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 use the first lags of *leverage* and the ratio of operating income to total assets (profitability) to instrument for *Leverage*. The instruments pass Hansen (1982)'s test of instrument validity in all of our regression analyses.[18]

4.2 Full sample results

Table 3 reports the estimation results on the relationship between debt maturity and relevant independent variables. The first and second columns, respectively, display the results from estimating the regression equations without and with the fitted value of *Leverage*. The third column displays the results that are obtained by standardizing all variables in the regression specification that includes *Leverage*. The magnitudes of standardized estimates are comparable across independent variables as each shows the impact of a one standard deviation change in the associated independent variable on the dependent variable.

As the table shows, there are as many similarities as there are differences between the results of the regression specifications with and without the fitted value of the leverage variable, *Leverage*. Most importantly, while the sign and significance of some independent variables are invariant to the inclusion/exclusion of *Leverage*, the same is not true for others. This result confirms the importance of accounting for the simultaneity of debt maturity and capital structure decisions as suggested by previous studies such as Barclay, Marx, and Smith (2003). In what follows, we elaborate on our findings with reference to various maturity hypotheses.

[Insert Table 3 about here]

[18] 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 that passes Hansen (1982)'s test.

4.2.1 Agency hypotheses

Growth opportunities: Regardless of whether the regression includes *Leverage* or not, the coefficient estimates on *Growth* are never significant. Thus, we find no support for either the Myers (1977) or Hart and Moore (1995) 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 countries.

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 estimates in the equation with *Leverage* imply that a one standard deviation increase in *Size* increases debt maturity roughly by 0.12 standard deviations. A positive and significant coefficient estimate on *Size* is consistent with the findings reported in the majority of empirical studies.[19]

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. 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. An insignificant estimate on the tax variable is consistent with the 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 on *EarnVolat* 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 countries. The estimate on *IntVolat* is negative and significant at the 5 percent level

[19] There are also studies which find a negative and significant coefficient estimate on the firm size variable; examples include Dennis, Nandy, and Sharpe (2000), Scherr and Hulburt (2001), and Heyman, Deloof, and Ooghe (2008).

in the equation that includes Leverage. Although inconsistent with the tax perspective, this result indicates that firms avoid entering into long-term debt contracts when the degree of macroeconomic uncertainty is high. A similar finding is reported by Antoniou, Guney, and Paudyal (2006) for British firms. Moreover, 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 with *Leverage*, *Term*'s coefficient estimate is not significant, consistent with the 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 related firms each year, this is a genuine possibility.[20]

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

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

the non-monotonic relationship between maturity and firm quality for our sample firms.

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 estimates in the regression equation that includes *Leverage* suggest that there is a strong positive association between *DebtMat* and *Leverage*. A one standard deviation increase in *Leverage* increases *DebtMat* by about 0.41 standard deviations. This suggests that 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 delay their exposure to bankruptcy risk or to avoid premature liquidation. 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* crisis year dummies have a significant impact on *DebtMat*, especially when *Leverage* is included in the regression equation. We find, however, that *Inflation* is negatively associated with *DebtMat* in both regression equations, 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 negative and significant 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.[21] 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 related firms and employees but excludes trade debt. 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.[22] 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. In particular, the coefficient on *Growth* turns significant (albeit at the 10 percent level) in the bank debt maturity equation. This might be because agency conflicts between shareholders and creditors (which can lead to underinvestment problems)

[21] To save on space, we do not report all of these results. However, they are available upon request from the corresponding author.

[22] 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.

are likely to be more severe when funds are borrowed entirely from external sources rather than from related firms. Moreover, 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. Last but not least, the coefficient 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 of debt is not less than these higher floatation and bankruptcy costs.

[Insert Table 4 about here]

Independent variables: For expositional convenience, we begin with the economy-wide variables. Here, we only consider robustness to the choice of the term structure variable 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 government bond yields rather than between 2-year and 3-month government bond yields does not affect our results.[23]

For 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.[24] 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. In addition, when the investment opportunity set faced by a firm is instead proxied by capital expenditures to total assets, the coefficient estimate on firm growth becomes positive and

[23] Important developments took place in the Turkish government bond market during our sample period. In particular, the Treasury began issuing 5-year bonds towards the end 2004 and 10-year bonds towards the end of 2009. In order to take these developments into account, we also considered a term structure measure based on the difference between the available longest and shortest maturity government bonds. The results were similar.

[24] 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.

significant.[25] 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.

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.

[25] 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.

5.4 Capital markets

The domestic supply of capital might influence firms' debt maturity structures.[26] In order to explore this possibility, we now also include as independent variables the size of debt markets (domestic credit to the 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 stock market variable is positive and highly significant (at the 1 percent level) whereas the coefficients on the debt markets and government debt 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

[26] 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).

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 show 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.

In order to consider this possibility, we also explore the maturity choices of only those firms with positive amounts of long-term debt in their capital structure. Results reported in Table 6 reveal interesting new 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 these 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. On the other hand, the coefficient estimate on *Size* turns insignificant, implying that debt maturity is unrelated with firm size for firms with positive amounts of long-term debt in their capital structure. 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 above-mentioned 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. For such firms, in turn, our finding of a positive and significant coefficient estimate on *Z-score* implies that higher quality is associated with longer-term debt.

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 these client firms, then maturity-mismatches or uncertainties in the macroeconomic environment 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 finding might also be explained by a close borrower-lender relationship whereby lenders 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 countries 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 the maturity of their debt 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 debt maturity structure differences between publicly-traded and privately-held corporations as well as the differences between privately-held corporations and private limited companies. These exercises can also be viewed as further robustness checks on our main results in Sect. 5.

Figure 2 displays firms' debt maturity structures by industry membership, firm size, and legal form averaged over the entire sample period. 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. 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 displays the average leverage ratios and maturity structures across firms of different size groups. The

figure suggests 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

In order to explore the debt maturity structure 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 of manufacturing and service firms are determined largely by the same factors. For example, the two most economically important factors, *Leverage* and *Size*, are the main determinants of debt 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 of firms 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. In particular, uncertainties at both the firm and aggregate levels may not matter much for manufacturing firms if they have close relationships with their lenders. 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 the maturity of their debt.

[Insert Table 7 about here]

6.2 Large versus small firms

We next explore the debt maturity structure differences across firms of various sizes. 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 play no role in the determination of debt maturity structures in any 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 this group of firms.[27] To the extent that firm size proxies for firm 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 firms of intermediate quality borrow longer-term. This intuition is also broadly consistent with the patterns of estimated coefficients on the firm quality indicator variable *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 short-term.

Results also indicate that microenterprises and SMEs do not engage in maturity-matching.[28] This result contrasts sharply with the results reported by small firm studies such as Scherr and Hulburt (2001) and Heyman, Deloof, and Ooghe (2008).[29] However, it is quite likely that the small firms in our sample are smaller than the small 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

[27] 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 tangible capital, and suffer less from asymmetric information problems, suggesting that liquidation risk is minimal for such firms. On the other hand, creditors are probably not highly willing to lend long-term to microenterprises in the first place as these firms are typically characterized by low liquidation values.

[28] 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-sized and large firms match maturities, microenterprises and small firms do not.

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

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.[30] 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 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,[31] 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.

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 structure decisions of publicly-traded firms. One possible interpretation of this result is that debt maturity

[30] 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.

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

decisions of publicly-traded firms are not affected materially by uncertainties in the economic environment because these firms have substantial internal funds, have diversified their external sources of finance, and are viewed by 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 maturity of debt when their earnings are more volatile. This likely indicates the existence of a close relationship between corporations and their creditors, where the latter protects the former during their times of financial distress 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. Firms may choose to do so to delay their exposure to bankruptcy risk (Leland and Toft, 1996) or to avoid premature liquidation by lenders (Diamond, 1991). 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 the economic significance of all other determinants of debt maturity, including that of *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 who 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 role in the choice between issuing long-term debt or not 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 the provision of financing.

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 extremely 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 of asset maturity in our analyses. Our results show that while asset maturity is positively associated with debt maturity for most of the 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. Unimportance of asset maturity for debt maturity decisions of small private firms was also reported by Stephan, Talavera, and Tsapin (2011) in the case of Ukraine. This result contrasts with the evidence coming from advanced economy small private firm studies such as Scherr and Hulburt (2001), Heyman, Deloof, and Ooghe (2008), and Magri (2010) that find a positive association between asset and debt maturity.

Perhaps, our most unexpected finding is the result that public firms do not match maturities, a finding that 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, public 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 (as suggested by *Z-score* values), however, they are unlikely to face serious difficulties in servicing debt.[32]

Macroeconomic variables appear to influence firms' debt maturity choices as well. Specifically,

[32]The opposite appears to hold for small, privately-held firms 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 small, privately-held firms only exacerbates this risk.

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 in facilitating long-term contracting among businesses.

On the other hand, we find little evidence that the remaining independent variables (*Growth*, *EarnVolat*, *Z-score*, *Tax*, *Term*, and *GDPGrowth*) affect debt maturity decisions. Interestingly, the insignificance of *Growth* occurs despite the fact that our sample includes both very small firms (with potentially high growth opportunities) and very large firms (with potentially low growth opportunities). 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 small firm studies such as Scherr and Hulburt (2001), Heyman, Deloof, and Ooghe (2008), and Magri (2010) and large firm studies such as Stohs and Mauer (1996) and Antoniou, Guney, and Paudyal (2006). The only instance where our proxy for growth opportunities has a significant and negative coefficient estimate is the bank debt maturity equation. Since our baseline debt definition includes debts from related firms, this finding might suggest that agency conflicts between shareholders and creditors might be more serious when debt is acquired entirely from external sources. On the other hand, when we use capital expenditures as an alternative proxy for growth opportunities, we find a positive association between growth opportunities and debt maturity. This finding would suggest the presence of an overinvestment problem along the lines suggest by Hart and Moore (1995).

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 most prior empirical studies, our findings provide little evidence that tax considerations matter for debt maturity decisions. The insignificance of tax proxies is consistent with the theoretical model of Lewis (1990), who argued that when leverage and debt maturity are chosen simultaneously, taxes have no effect on maturity decisions.

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. Although our aim is not to pick a winner among various debt maturity hypotheses, it is still instructive to briefly discuss how our empirical findings relate to these hypotheses. First, 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 enterprises. The agency perspective is also not likely to be useful in understanding incremental maturity decisions of firms that already have positive amounts of long-term debt in their capital structure. However, consistent with large firm studies such as Barclay and Smith (1995) and Stohs and Mauer (1996), we find evidence that size (but still not growth opportunities) matters for the debt maturity choices of larger firms, which might suggest that conflicts of interest between creditors and shareholders are a more relevant concern for larger firms.

Second, our findings on asset maturity 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.

Third, our findings provide little evidence that tax considerations matter for debt maturity decisions. As noted earlier, this is consistent with the theoretical model of Lewis (1990). However, the insignificance of taxes might also 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. Nevertheless, our results also suggest that taxes might possibly matter more for firms that acquire the majority of their debt from external sources of finance such as banks or capital

markets rather than from related firms.

Fourth, our results provide only weak support for the signaling perspective since the coefficient estimate on the firm quality proxy is significantly negative only in the corporation (public as well as private) and large firm regressions. This finding suggests that signaling perspective might be more useful when thinking about the debt maturity structures of publicly-traded large firms. When the entire population of firms is considered, however, Diamond (1991)'s liquidity risk perspective offers greater promise. Several of our results seem to support this claim, but the clearest evidence is provided by our finding that the firm quality variable is positively associated with debt maturity for private limited companies and negatively associated with debt maturity 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 is non-monotonic as suggested by Diamond (1991).

Note that we have not classified leverage as a proxy for any of the debt maturity perspectives. Although leverage appears in some of the tax-based theories, it probably is most closely related with the liquidity risk perspective. This is because the liquidity risk perspective argues a theoretical link between debt maturity and firm credit quality, and credit quality, in turn, is a decreasing function of leverage (Diamond, 1991). Viewed this way, our results provide additional support for the liquidity risk perspective.

Note also that we have considered maturity-matching as an independent hypothesis. However, as stated in our literature review, maturity-matching can also be rationalized within the contexts of both the agency and liquidity risk perspectives. In that case, 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. The agency theory of Myers (1977) also appears to capture some of the essential aspects of firms' debt maturity choices such as the effects of size and asset maturity. Flannery (1986)'s signaling model can be potentially useful if viewed as a conditional theory about the maturity choices of large, publicly-traded firms. We find little evidence that tax theories are useful in understanding the debt maturity choices of Turkish non-financial firms.

Finally, it should be noted that none of these theories were developed with the developing countries in mind. Firms in developing countries may differ from those in developed countries in many respects including in size, ownership, taxability, information asymmetry, and the surrounding financial and institutional environment. These differences might have potentially important ramifications for investigations of debt maturity. In the context of the present paper, such differences might explain, in part, the apparent weakness of some of the debt maturity theories as well as some of our unexpected

findings. For example, some of our results were suggestive of the existence of close relationships between borrowers and their lenders. To a certain extent, this could be expected as our measure of debt includes those from related firms. However, it probably is not the complete story. Therefore, it would be worthwhile to investigate more fully the nature of borrower-lender relationships and how they impact on business financing 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.

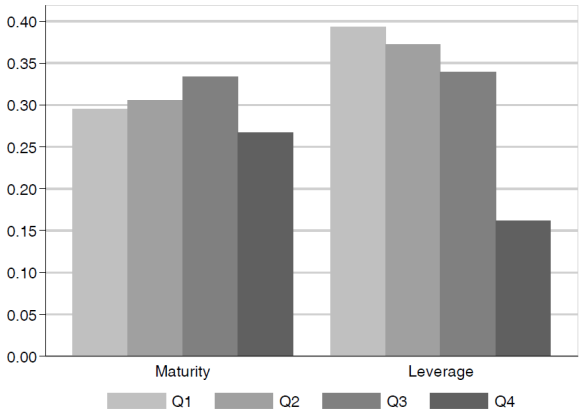

Figure 1: Debt maturity and firm quality. This figure shows the relationship between debt maturity (*DebtMat*) and firm quality (*Z-score*) for different firm quality subsamples. Firms are divided into quartiles according to their *Z-score* values. The 2^{nd} and 3^{rd} quartiles are pooled together. The variables *DebtMat*, *Leverage*, and *Z-score* are defined in Table 1.

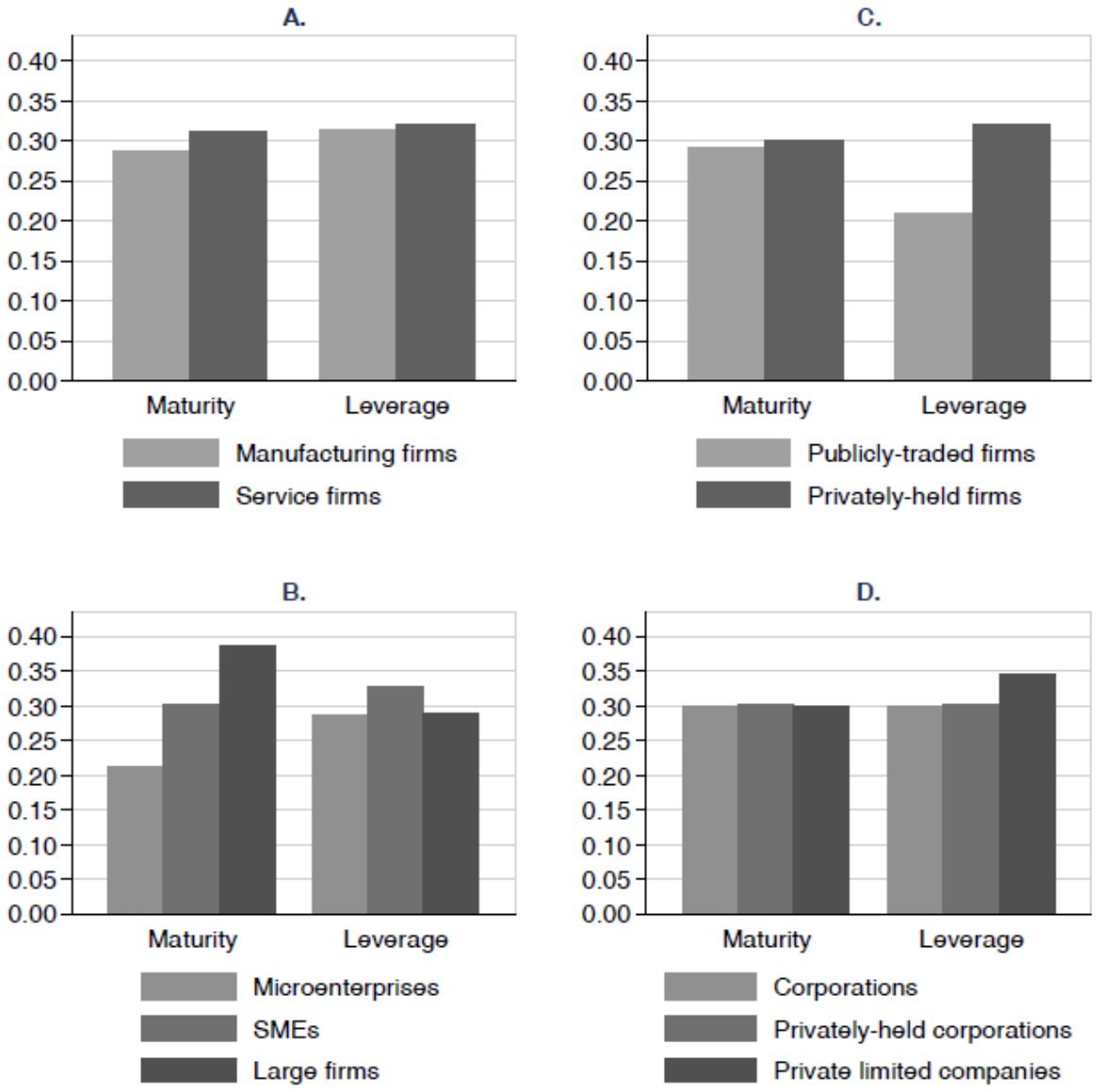

Figure 2: Debt maturity and capital structures for different types of firms. This figure shows debt maturity and capital structures (*DebtMat* and *Leverage*) for different types of firms. Panel A compares manufacturing and service firms, Panel B compares microenterprises, SMEs, and large firms, Panel 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.