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Lending to small businesses: the role of loan maturity in addressing information problems

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Abstract We investigate what determines the maturity of lines of credit to small businesses. Our results provide strong support for the hypothesis that shorter loan maturities serve to mitigate the problems associated with borrower risk and asymmetric information that are typical of small business lending. We find that maturity is shorter for firm owners that have poor credit histories, are older, and less experienced, and for firms that are more informationally opaque. Supporting the notion that collateral and maturity are substitute mechanisms in mitigating agency problems, we also find strong evidence that maturity increases with collateral pledges, that personal collateral is associated with longer maturities than business collateral, and that collateral types that better mitigate agency problems reduce the sensitivity of loan maturity to informational asymmetries and risk. Finally, while it is argued that relationship lending may mitigate information asymmetry, we find no relation between loan maturity and stronger firm-creditor ties.

Keywords Loan maturity · Collateral · Small businesses · Relationship lending

JEL Classification G21 · G32 · L26

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1 Introduction

There has been an increased interest by policy makers, regulators and researchers about the functioning of the financial markets that fund small businesses. In particular, there is concern that small firms may face difficulties in accessing formal financing due to their informational opacity and risky nature. Much of this concern stems from the recognition that small firms serve as an engine of economic growth and innovation. While large firms focus on cumulative, incremental technological improvements, independent inventors and entrepreneurs contribute a disproportionate fraction of breakthrough inventions. Also important is the fact that in most countries small businesses employ a large percentage of the private sector workforce (close to 50% in the US). Because of the economic and social importance of the small business sector, questions about the particular nature of the private debt contracts associated with small business finance are at the core of the research agenda.

A distinctive feature of the private debt markets that finance small businesses is that they are plagued by information and agency problems that arise from the informational opacity that is typical of these firms. Small firms do not have audited financial statements, and are unlikely to be monitored by rating agencies or the financial press. In this context, financial intermediaries make credit decisions and design loan contract terms in ways that aim to mitigate the complex problems associated with risk and asymmetric information. In addition to refusing the loan or reducing amounts lent, lenders can simply demand compensation by increasing the price of loans. Alternatively, they can use non-price elements of the contract, such as the enforcement of strict debt covenants or collateral requirements. While recent research on credit availability, borrowing costs, and collateral requirements provides many insights about small business finance, the role of loan maturity–the duration of the debt contract–in small business lending remains largely unexplored. This omission is puzzling, because theory suggests that it is precisely in loan contracts for these small firms that maturity may play a key and distinct role in addressing information and agency problems. Studying what determines the maturity of loans for these small businesses is thus the focus of our paper.

Our main hypothesis is that shorter loan maturities play a unique role in small business lending by serving to mitigate the problems associated with borrower risk and asymmetric information that are typical of such loans. When detailed debt covenants can be written, borrowers are forced to renegotiate with the lender if a covenant violation occurs, which gives lenders flexibility and control. However, formal debt covenants tied to accounting financial ratios generally cannot be imposed on small businesses that do not have audited financial statements (Berger and Udell 1998). Because the longer the agreement the greater the opportunity for the borrower to alter its risk profile and/or suffer financial distress, a shorter maturity of the loan contract can serve as a particularly strong and easy-to-enforce type of covenant. Thus, by forcing more frequent information disclosure and renegotiation of contract terms, shorter maturities may be useful in addressing control and information problems that arise in small business lending.

Theoretical research also highlights the importance of another contract term, collateral, in mitigating moral hazard and asymmetric information problems. While we are aware of no theory relating maturity and collateral requirements in debt contracts, we hypothesize that collateral and maturity may be substitute mechanisms in dealing with these problems. Therefore, collateral pledges could allow small businesses to obtain longer maturity loans. Moreover, we also hypothesize that personal collateral–and thus the personal wealth of the small business owner–may be an important determinant of the maturity of loans to small businesses. Because personal collateral (which provides additional assets for the secured creditors to claim) better mitigates the lender's exposure to losses than business collateral (which simply reorders the claims of creditors), firm owners that can afford to make personal commitments may be able to negotiate longer maturities. Alternatively, personal collateral may be more effective in reducing the incentives to shirk, as borrowers realize that their personal wealth is at stake.

We test our hypotheses using comprehensive data on lines of credit (LOC) to US small businesses obtained from the 1993 National Survey of Small Businesses Finances (NSSBF). In a LOC contract, a bank commits to lend funds up to a limit under prespecified terms and within a certain time period. We refer to the length of the commitment as LOC maturity or simply as loan maturity. In general, the funds committed under a LOC are not asset or project specific, and thus represent a substantial credit risk for the lender. This characteristic makes them ideal to test information-related hypotheses. We examine whether LOC maturity is negatively related to measures of ex-ante firm and owner risk, and whether it is negatively related to measures of asymmetric information. Because previous research suggests that stronger relationships between lenders and borrowers generate valuable information that reduces informational asymmetry, we test whether stronger relationships between the lender and the borrower lead to longer maturities. We also investigate whether maturity and collateral are substitutes in mitigating agency problems, and whether personal collateral is better than business collateral in performing this role.

Supporting our central hypothesis, we find that more informationally opaque and more risky borrowers are associated with shorter maturities. Three of our inverse proxies for informational opacity

(firm size, firm age, and asset tangibility) are positively related to maturity. Maturity is shorter for firm owners that have poor credit histories, are older, and less experienced, but is not related to firm risk characteristics. Consistent with our hypothesis that lenders use collateral and maturity as substitute mechanisms, we find that secured loans enjoy longer maturities. Moreover, the average maturity increases when collateral involves personal assets rather than business assets, even if risk characteristics and asymmetric information problems are more acute on average for loans secured with personal assets. Thus, owners that can pledge personal assets are able to increase the duration of their funding, allowing them to invest longer-term. In addition, we find that collateral types that better mitigate agency problems between borrowers and lenders reduce the sensitivity of loan maturity to informational asymmetries and risk. These results highlight the important role that the personal wealth of small firm owners may play in allowing for better credit conditions.

While previous research suggests that borrower-lender relationships attenuate information asymmetry, we do not find any relation between maturity and stronger borrower-lender ties. Though not related to our main hypothesis, we also report additional results. Consistent with borrowers matching the maturity of the loan with that of the asset being financed, maturities are shorter for loans with short-term purposes such as working capital. We also find some evidence that differences in lending practices and regulation across different types of lenders affect loan maturities.

The remainder of the paper is organized as follows. Section 2 develops the conceptual framework and discusses the related literature, Section 3 describes the data and main variables, and Section 4 presents the results and robustness checks. Finally, Section 5 concludes with a summary and discussion of the results.

2 Conceptual framework and related literature

2.1 Conceptual framework

Our main hypothesis is that shorter loan maturities play a unique role in small business lending by serving to mitigate the problems associated with borrower risk and asymmetric information that are typical of these debt markets. Debt contracts for large firms generally contain detailed covenants tied to accounting financial ratios that involve direct restrictions on firm's decisions. For example, the firm might not be allowed to issue new debt if net working capital is below a specified level or if an interest coverage ratio is too low. The terms of the loan can be renegotiated any time before the expiration date of the contract if such covenants are violated or the financial condition of the firm changes. Thus, independently of the stated maturity of the loan, these covenants give the lender control over borrowers by tying the loan's *effective* maturity to the borrower's compliance with the covenant restrictions (for a survey on the literature of debt maturity for large firms see Ravid (1996)). In fact, theory also suggests that the strictest covenants should be placed on those firms that are more risky and harder for lenders to monitor (e.g., Smith and Warner 1979a; Berlin and Loeys 1988; Berlin and Mester 1992). In contrast, small firms typically do not have audited financial statements, and thus formal debt covenants linked to financial ratios are costly to write and enforce.[1] In such a context, lenders can otherwise use shorter-term loan contracts (instead of longer-term lending coupled with debt covenants) to force more frequent renegotiation with borrowers known to be risky ex-ante. We therefore expect loan maturity to be negatively related to ex-ante borrower risk.

Moreover, our tests relating loan maturity and risk distinguish between owner and firm risk characteristics. Previous research argues that owner rather than firm characteristics are more relevant in assessing the risk of the loans (e.g., Avery et al. 1998; Berger et al. forthcoming-b). These papers report that during the 90s lenders began to apply to small businesses the statistics-based methods long used to review consumer applications for credit cards and mortgages,

[1] LOC may contain material adverse change clauses (MAC) that permit the bank to abrogate the commitment if the borrower's financial condition has changed substantially. However, in the same way as covenants, these clauses can only be contingent on verifiable characteristics of the borrower. In addition, Berger and Udell (1995) explain that because of reputation effects and lender liability laws, banks are reluctant to invoke these clauses except under very extreme circumstances.

and to base their lending decisions on the creditworthiness of small business owners rather than on the less reliable information of the business itself.[2] In addition, for the smallest firms in our sample it is typically difficult to distinguish the firm's finances from those of the owner, and therefore lenders base their credit decisions on the owner's ability and observable characteristics. Thus, we predict that loan maturity will be more sensitive to owner than to firm risk characteristics.

The extent of informational asymmetry between firms and private debt markets is another important factor that can affect loan maturity. More informationally opaque firms–firms with less public reputation–are subject to more severe moral hazard problems and are more costly for lenders to monitor. Both the literature on agency costs of debt and the literature on restrictive debt covenants suggest that agency problems associated with informational asymmetry can be solved by shorter maturities (e.g., Myers 1977, Barnea et al. 1980, Smith and Warner 1979a, Berlin and Mester 1992). Moreover, existing empirical evidence from venture capital financing also suggests a negative relation between informational asymmetry and maturity. Gompers (1995) finds that increases in asset tangibility, which reduces asymmetric information problems (tangible assets' payoffs are easier to observe), reduce venture capitalist monitoring intensity and increase financing duration. Thus, we predict a negative relation between loan maturity and the extent of asymmetric information.

We also explore the effect of firm-creditor relationships on loan maturity. The relationship lending literature argues that through close and continuous interaction a firm may provide the lender with valuable information that mitigates informational asymmetries (e.g., Petersen and Rajan 1994, 1995; Berger and Udell 1995; Cole 1998). Relationships can be built through time (length of the relationship) or through the interaction over multiple bank products (scope of the relationship). If relationships reduce informational asymmetries and shape debt contracts, then we expect stronger relationships to be associated with longer maturities.

Theoretical research also highlights the importance of collateral pledges in reducing the scope for moral hazard in situations with asymmetric information (Boot et al. 1991; Boot and Thakor 1994). In addition, the literature on agency costs shows that pledging collateral mitigates moral hazard problems and lowers a firm's cost of debt (Smith and Warner 1979a; Stulz and Johnson 1985). Thus, agency theory suggests that maturity and collateral may be substitute mechanisms to exert control over informationally opaque and risky borrowers. Collateral could also lead to longer maturities if it signals better borrower quality (Besanko and Thakor 1987a, b; Chan and Kanatas 1985; Bester 1985), in which case collateral is a proxy for unobservable borrower quality. As a result, we predict that collateral pledges should allow for longer maturities.[3] Moreover, to the extent that personal collateral, as opposed to business collateral, is more effective in mitigating the loss exposure of lenders (personal collateral provides additional assets for the secured creditors to claim, while business collateral reorders the claims of creditors), firm owners able to make personal commitments may be able to negotiate longer maturities. Alternatively, personal collateral may be more effective in reducing the incentives to shirk, as borrowers realize that their personal wealth is at stake. Thus, we also predict the personal collateral will lead to longer maturities than business collateral.

Our main testable hypotheses can be summarized as follows:

1. Loan maturity and risk
   - 1a. *Loan maturity is negatively related to ex-ante borrower risk*
   - 1b. *Loan maturity is more sensitive to owner than to firm risk characteristics*

[2] Mester (1997) reports that the first to use scoring for small-business loans were large banks that had enough historical loan data to build reliable models (e.g., Wells Fargo, BankAmerica, Citicorp). Such credit scoring models found that the most important indicators of small-business loan performance were characteristics of the business owner rather than the business itself. For example, the owner's credit history was a better predictor of performance than the net worth or profitability of the business.

[3] While both arguments predict a positive association between maturity and collateral, they have opposite implications for the relation between collateral pledges and firm risk. In our analysis we provide some additional evidence that helps to empirically distinguish between these alternatives.

2. *Loan maturity is negatively related to the extent of asymmetric information*
3. *Loan maturity is positively related to the strength of firm-creditor relationships*
4. *Loan maturity and collateral*
   4a. *Loan maturity is positively related to collateral pledges*
   4b. *Personal collateral leads to longer maturities than business collateral*

2.2 Related literature

Two previous studies examine the determinants of debt maturity for small businesses with a different focus to ours. Scherr and Hulburt (2001) examine whether the *maturity structure* of small businesses' total liabilities at a point in time is related to factors known to affect the debt maturity structure of publicly traded firms. Their overall measures of maturity structure combine all of the firm's different types of debt outstanding and do not distinguish between types of debt that have differential sensitivity to information asymmetry and firm risk.[4] Using proxies for informational asymmetry that are similar to ours, they find no effect on debt maturity structure. We differ from their study in that we focus on the maturity of new loans and on a specific type of loan–lines of credit. By studying new loans, we can relate maturity to firm and owner characteristics at the time the loan was negotiated and also control for other contract terms that affect maturity. By focusing on lines of credit, where problems associated with informational asymmetry are more severe, we can better explore the role of loan maturity in addressing information problems. Contrary to their results, our more refined tests uncover strong evidence relating debt maturity to asymmetric information.

Berger et al. (forthcoming-a) use loan contract data for the largest US banks from the Federal Reserve's Survey of Terms of Bank Lending (STBL), and restrict attention to loans with total credit size under $250,000 which are generally referred to as small business loans. The STBL provides the lender's identity but not the borrower's identity. Thus, while they are able to control for bank characteristics in their analysis, they cannot explore the effect on maturity of firm and owner characteristics other than the loan's overall risk rating.[5] Our data source is a comprehensive sample representing the population of US small businesses. These detailed data allows us to distinguish risk characteristics associated with the firm from those associated with the owner, an issue that is especially relevant for small businesses.

Previous research shows that stronger relationships increase credit availability and reduce collateral requirements. However, the evidence on their effect on borrowing costs is mixed (Petersen and Rajan 1994, 1995; Berger and Udell 1995; Cole 1998; Angelini et al. 1998; Harhoff and Körting 1998; Degryse and Van Cayseele 2000; Brick et al. 2004). Our paper is the first to explore the effect of borrower-lender relationships on loan maturities, and thus contributes to the debate on the role of relationships in reducing information asymmetries.

Previous work also suggests that the wealth of the firm owner may be an important determinant of small businesses' access to financing. For example, Cavalluzzo and Wolken (2002) find that larger personal wealth is associated with a lower probability of loan denial and Robson (1996) finds evidence that access to external collateral (in the form of housing assets) helps established small firms to stay in business. Since we can distinguish between the effects of personal and business collateral pledges, we add to this line of research by studying the role of the owner's personal wealth in explaining loan maturities.

[4] Their measures are the weighted-average maturity of the firm's different types of debt outstanding (lines of credit, capital leases, mortgages, motor vehicle, and equipment loans), and the fraction of total debt that matures in more than one year.

[5] While our hypotheses are based on the debt contracting literature, they test the implications of Flannery's (1986) and Diamond's (1991) signaling models for debt maturity choices. Flannery's model predicts that debt maturity is an increasing function of borrower risk, and Diamond's model predicts this relationship to be non-monotonic, with the safest and riskiest types issuing short-term debt and the intermediate risks issuing long-term debt. Our result of a negative relation between maturity and borrower risk (even after allowing for non-monotonicity) supports the debt contracting view.

3 The data, variable selection, and preliminary results

3.1 Data source and sample selection

Our data source is the 1993 National Survey of Small Business Finances (NSSBF), which provides information about a nationally representative sample of small businesses in the US. The survey was conducted during 1994–95 by the Board of Governors of the Federal Reserve System and the US. Small Business Administration. The main purposes of the survey were to provide information on the availability and use of credit by small businesses and to create a general-purpose database of the finances of such firms.[6] The target population is the population of all for-profit, non-financial, non-farm business enterprises with fewer than 500 employees that were in operation as of year-end 1992. The sample was drawn from firms listed on the Dun's Market Identifier file as of November, 1993. The public dataset contains information about 4,637 firms and is representative of 4.9 million small businesses in the US.

To ensure accurate representation of the population of firms, the NSSBF uses a stratified random sample design, with stratification based on census area, rural/urban location, employment size, and ethnicity of the owner. Businesses were contacted in advance to determine whether they met the target-population definition, verify addresses, and identify a contact person. The eligibility rate of sampled businesses averaged about 60%. Each eligible business was sent an advance work sheet to encourage the use of written records in responding to the survey. The data collection procedure used both mail and telephone. Surveyors made multiple calls to firm executives to collect and verify the data. The response rate was about 50%. The reference period for the sample is 1993, but income statement and balance sheet data were collected for fiscal year 1992.

The data was edited to verify the completeness of interviews, correction of interviewer errors, and verification that specified response ranges and cross-item restrictions were satisfied. The data were examined for consistency between dollar amounts in the balance sheet, income statement, and other sections of the questionnaire. As it is true for all surveys, there is some amount of missing data for some questions. The NSSBF imputed most missing values using a randomized regression model. Generally, the data collected contained few errors and few missing values (see the NSSBF 1993 Codebook for more detail on the imputation technique and other issues).

Section J of the NSSBF records detailed data about the most recent loan obtained by each firm, and classifies them by loan types. We follow Berger and Udell (1995) and we restrict attention to lines of credit (LOC). In a LOC contract, a bank commits to lend funds up to a limit within a certain time period, at pre-set price and non-price conditions.[7] Thus, throughout our study we refer to the length of the commitment under a LOC as LOC maturity or simply as loan maturity. Because a LOC represents a forward commitment by the lender to provide financing under pre-specified terms, asymmetric information problems seem typical of such loans. In addition, they are not asset or project specific, and thus represent substantial credit risk for the lender. The other loan types (capital leases, mortgages, motor vehicle, and equipment loans) are transaction-based, fully collateralized loans where the entire proceeds are used to purchase a fixed asset that is pledged as collateral, and the maturity of the loan is tied to the lifespan of the underlying asset. These loans are based on hard information and therefore they seem less exposed to informational asymmetry problems and less appropriate to test information-based theories.[8]

[6] The interest in small business finance in the US arises from the concern that the recent consolidation of the US banking industry could have a negative impact on the contract terms and availability of credit to small firms. Another objective of the NSSBF is to provide data to study whether small businesses owned by racial minorities are discriminated in lending markets.

[7] The price conditions in a typical LOC contract include a borrower-specific markup over an economy-wide interest rate, and an up-front commitment fee. The non-price conditions include collateral requirements, and compensating balances.

[8] To check whether this premise is correct we also run our regressions for the subset of other loan types reported in the NSSBF (capital leases, mortgages, motor vehicle loans, and equipment loans). As expected, our results indicate that the sensitivity of the maturity of these single purpose loans to risk and information asymmetry variables is very low compared to the lines of credit (results available from the authors).

Table 1 Sample composition

Industry	Organizational form				Total
	Proprietorships	Partnerships	S-corporations	Corporations	
Mining	0	1	2	9	12
Construction	11	1	38	58	108
Manufacturing	12	5	65	132	214
Transp., comm., & public utilities	1	2	9	29	41
Wholesale trade	16	5	34	86	141
Retail trade	27	9	66	79	181
Insurance & real estate	7	5	9	16	37
Services	50	29	68	114	261
Total	124	57	291	523	995

The sample consists of 995 line of credit applications by small businesses obtained from the NSSBF 1993

Note that the survey's focus on small firms is ideal for our purpose. Such businesses are characterized by informational opacity, and because they often lack audited financial statements, detailed debt covenants tied to financial ratios that could reduce moral hazard problems are very costly to write and enforce. Thus, for the borrowers in our sample, shorter maturities are more likely to be used as a mechanism to mitigate agency problems. Of the 4,637 surveyed firms 2,007 had recently requested loans, of which 1,009 are the lines of credit we use in our study. After deleting 14 observations with missing data for loan maturity, our final sample contains 995 lines of credit obtained by small businesses during 1990–94, although most loans were obtained in 1993–94.[9] Table 1 reports the sample composition by industry and firm organizational form.

The table shows that about 82% of the firms in the sample are incorporated, either as corporations or subchapter-S corporations, while the remaining fraction of firms lacks the limited liability feature. In addition, our sample represents a wide variety of industries. Table 2 describes the variables used in the regression analysis.

3.2 Test variables

To test our hypotheses 1.a and 1.b relating maturity and risk, we need variables that proxy for borrower ex-ante risk and distinguish between firm and owner risk attributes. Owner characteristics are especially important, as more than 70% of the firms in our sample are run by their owners. To capture the credit history of the primary owner (i.e., owner risk), we include *Owndelinq* that is equal to the number of times that the firm's primary owner was delinquent on personal obligations in the last 3 years, and *Judgment*, a dummy for whether there are any judgments rendered against the firm's principal owner. We also include *Ownage*, the age of the principal owner, and *Ownexper*, his or her experience. Owners with more experience in the business may be associated with lower default risk, as they are able to run the firm more efficiently, and may suffer larger reputational costs if the firm fails. Thus, we expect *Ownexper* to be positively related to maturity. Older owners may be associated with more risky loans, as their incentives to maintain a clean credit record decrease as they approach retirement, when their personal credit history is lost and cannot be transferred to their successor.[10] In addition,

[9] We do not use the more recent 1998 nor the older 1987 surveys because they do not contain information about some variables that are important for our analysis (e.g., information on the declared used of the loan, depreciation expenses, and the number of employees devoted to R&D).

[10] Gibbons and Murphy (1992) make a similar argument in the context of executive career concerns. They argue that as CEOs approach retirement their incentive to preserve their reputations diminishes.

Table 2 Variable definitions

Variable	Definition
Dependent variable	
Maturity	Length of commitment (months)
Ex-ante owner risk and owner characteristics	
Owndelinq	# of times the firm owner was delinquent on personal obligations during the last 3 years
Judgment	=1 if there are any judgments rendered against the firm owner, zero otherwise
Ownage	Age of principal owner (years)
Ownexper	Owner experience (years)
Ex-ante firm risk	
Firmdelinq	# of time the firm was delinquent on business obligations during the last 3 years
Bankrupt	=1 if the firm declared bankruptcy in the last 7 years, zero otherwise
Unhealthy	=1 if Z-score $\leq$1.81, and zero otherwise (omitted in regressions) [a]
Grey	=1 if 1.81< Z-score <3.0, and zero otherwise[a]
Healthy	=1 if Z-score $\geq$3.0, and zero otherwise [a]
Negequity	=1 if the firm's equity is negative, zero otherwise
St-debt	% of total debt that is short term (comprises accounts payable and other current liabilities)
Information asymmetry	
Firmsize	Total firm assets ($)
Firmage	Firm age (years)
R&Demp	% of employees devoted to R&D
Deprec	(Depreciation/assets) $\times$ 100
Relationship variables	
Length	Length of relationship with lender (years)
Noborrinst	# of institutions from which the firm borrows
Services	=1 if firm has checking or savings accounts, or other financial services with lender, zero otherwise
Distance	Distance between the lender and borrower (miles)
Lender type	
Bank	=1 if the lender is a banking institution, zero otherwise[b]
Finance	=1 if the lender is a finance company, zero otherwise[c]
Loan purpose	
Useforwc	=1 if the line of credit is used for working capital, zero otherwise
Ownership structure and governance	
Corp	=1 if the firm is a corporation, zero otherwise
Family	=1 if the firm is majority owned by a family, zero otherwise
Ownmg	=1 if the firm owner is also the manager, zero otherwise
Minority	=1 if the firm is majority owned by a racial minority, zero otherwise
Other contract terms	
Fees	Fees collected by the lending institution as a % of the total amount borrowed
Interest	Contractual coupon rate (%)
Collateral	=1 if collateral is required, zero otherwise

Table 2 continued

Variable	Definition
Perscollat	=1 if the loan is secured with personal assets, zero otherwise
Buscollat	=1 if the loan is secured only with business assets, zero otherwise
Othercollat	=1 if the loan is secured with other non-disclosed assets, zero otherwise

[a] Z-score = $0.012 \times X_1 + 0.014 \times X_2 + 0.033 \times X_3 + 0.006 \times X_4 + 0.010 \times X_5$, where X_1 = (current assets-current liabilities)/assets, X_2 = retained earnings/assets,X_3 = EBIT/assets,X_4 = equity/total debt, and X_5 = sales/assets

[b] Bank includes credit unions, savings banks, savings & loan associations, and commercial banks. In our sample, commercial banks represent 96% of the lenders in this group, and hence we label the variable ''bank''

[c] Finance includes finance, insurance, brokerage or mutual fund, and leasing companies. In our sample, 70% of the lenders in this group are finance companies, and hence we label the variable ''finance''

retirement of the current owner may force the lender to negotiate with a successor of unknown creditworthiness. Thus, we expect a negative effect of *Ownage* on maturity.

We also include several variables that capture firm risk. *Firmdelinq* is the number of times that the firm was delinquent on business obligations in the last 3 years. We also code dummy variables for whether the firm declared bankruptcy during the 7 years preceding the loan application (*Bankrupt*), and for whether the firm has negative equity (*Negequity*). To measure default risk, we use Altman's (1968) Z-score to code three dummy variables indicating the firm's financial health: *Healthy*, *Grey*, and *Unhealthy* (omitted in regressions).[11] We also include the fraction of the firm's total debt outstanding that is short-term *(St-debt)*. Because firms whose existing debt matures sooner are more risky, we expect a negative effect of *St-debt* on the maturity of new loans. *St-debt* may also capture the effect of the maturity structure of preexisting debt on the maturity of new loans. However, theory provides no guidance about the direction of this potential effect.

We test our second hypothesis using several proxies for informational asymmetry. Berger et al. (2001), Carey et al. (1998), Chittenden et al. (1996), and others, suggest that smaller firms are more informationally opaque because they typically have less informative financial statements, less experience, and lower public profiles. In their studies of small firms, Petersen and Rajan (1994) and Berger and Udell (1995) argue that as more public information is available for older firms, firm age reflects information that becomes available to the market as a whole (a firm's public reputation). Thus, the value of the firm's assets, *Firmsize*, and the age of the firm, *Firmage*, are inverse proxies for the extent of information asymmetry. Because tangible assets' payoffs are easier to observe and their use is easier to monitor, asset tangibility reduces asymmetric information problems. In fact, there is strong evidence for venture capital suggesting that increases in asset tangibility reduce the venture capitalist monitoring intensity and increase financing duration (Gompers 1995). We therefore include the fraction of the firm's employees devoted to R&D activities (*R&Demp*) and depreciation as a percentage of assets (*Deprec*) as measures of asset tangibility.[12] We expect *Firmsize*, *Firmage* and *Deprec* to be positively associated with loan maturity, and *R&Demp* to be negatively related to maturity. R&D activity could also proxy for investment opportunities and cash-flow uncertainty (e.g., Freel, 2007), as well as for the scope for moral hazard in project choice, in which case the expected effect of *R&Demp* on maturity is also negative.

To test our third hypothesis, we follow the relationship lending literature and use four variables that capture different aspects of the strength of firm-creditor relationships. *Length*, is the length of the

[11] These dummies allow for a non-monotonic effect of borrower risk on maturity.

[12] Depreciation is also used to capture asset tangibility in Scherr and Hulburt (2001), and Barth et al. (2001). *Deprec* is a potentially noisy variable, since depreciation depends on accounting policy and different asset classes have different depreciation schedules. However, difference of criteria is minimized in our sample because all our firms are based in the US and most of them use the IRS method to determine the useful life of assets on their books. While there is discretion on the method of depreciation to be used, anecdotal evidence suggests that most firms use the straight-line method.

Table 3 Summary statistics

Variable	Unit	# Obs.	Mean	Median	SD
Maturity	Months	995	22.70	12.00	27.27
Ex-ante owner risk and owner characteristics					
Owdelinq	Number of times	995	0.18	0.00	0.68
Judgment	Dummy	995	0.03		0.18
Ownage	Years	995	50.40	50.00	10.43
Ownexper	Years	995	20.47	20.00	10.49
Ex-ante firm risk					
Firmdelinq	Number of times	995	0.52	0.00	1.09
Bankrupt	Dummy	995	0.02		0.13
Unhealthy	Dummy	995	0.15		0.36
Grey	Dummy	995	0.16		0.36
Healthy	Dummy	995	0.69		0.46
Negequity	Dummy	995	0.14		0.35
St-debt	%	995	0.44	0.40	0.32
Information asymmetry					
Assets	$ 000	995	3776.30	1092.20	7075.12
Firmage	Years	995	17.31	13.00	15.53
R&Demp	%	995	0.07	0.00	0.19
Deprec	%	995	8.13	3.71	14.81
Relationship variables					
Length	Years	995	8.43	5.00	8.47
Noborrinst	Number	995	1.43	1.00	0.97
Services	Dummy	995	0.85		0.36
Distance	Miles	995	37.65	3.00	146.55
Lender type					
Bank	Dummy	995	0.94		0.24
Finance	Dummy	995	0.05		0.21
Loan purpose					
Useforwc	Dummy	995	0.73		0.45
Ownership structure and governance					
Corp	Dummy	995	0.82		0.39
Family	Dummy	995	0.72		0.45
Ownmg	Dummy	995	0.74		0.44
Minority	Dummy	995	0.09		0.28
Other contract terms					
Collateral	Dummy	995	0.62		0.49
Perscollat	Dummy	995	0.14		
Buscollat	Dummy	995	0.44		
Othercollat	Dummy	995	0.04		
Fees*	% of amount	516	1.62	0.50	3.72
Interest	%	995	8.22	8.00	1.78

* Reported information is conditional on the use of positive fees

Table 4 Selected summary statistics by maturity

Variable	Unit	Statistic	(1) <12 months	(2) =12 months	(3) >12 months	(4)=(3)-(1) Difference	(5) *P*-value
Ex-ante owner risk and owner characteristics							
Odelinq	Dummy	Mean	0.17	0.06	0.07	−0.10	0.004
Judgment	Dummy	Mean	0.06	0.03	0.03	−0.03	0.157
Ownage	Years	Median	49.00	50.00	49.00	0.00	–
Ownexper	Years	Median	18.00	20.00	20.00	2.00	0.382
Ex-ante firm risk							
Fdelinq	Dummy	Mean	0.33	0.18	0.21	−0.11	0.026
Bankrupt	Dummy	Mean	0.03	0.01	0.03	0.00	–
Unhealthy	Dummy	Mean	0.21	0.14	0.16	−0.05	0.296
Grey	Dummy	Mean	0.15	0.15	0.17	0.02	0.604
Healthy	Dummy	Mean	0.64	0.71	0.66	0.02	0.766
Negequity	Dummy	Mean	0.21	0.13	0.14	−0.07	0.088
St-debt	%	Median	0.34	0.44	0.35	0.01	0.743
Asymmetric information							
Assets	$ 000	Median	388.93	1074.55	1372.18	983.25	0.003
Firmage	years	Median	10.00	13.00	13.00	3.00	0.139
R&Demp	%	Mean	0.09	0.06	0.06	−0.02	0.300
Deprec	%	Median	3.65	3.35	4.51	0.87	0.841
Relationship variables							
Length	Years	Median	5.00	6.00	5.00	0.00	-
Noborrinst	Number	Mean	1.44	1.36	1.57	0.13	0.369
Services	Dummy	Mean	0.80	0.90	0.74	−0.06	0.234
Distance	Miles	Median	5.00	3.00	4.00	−1.00	0.168
Lender type							
Bank	Dummy	Mean	0.92	0.96	0.90	−0.01	0.685
Finance	Dummy	Mean	0.02	0.04	0.08	0.05	0.057
Loan purpose							
Useforwc	Dummy	Mean	0.80	0.81	0.50	−0.30	0.000
Ownership structure and governance							
Corp	Dummy	Mean	0.76	0.84	0.79	0.03	0.547
Family	Dummy	Mean	0.78	0.73	0.69	−0.09	0.113
Ownmg	Dummy	Mean	0.76	0.73	0.73	−0.03	0.611
Minority	Dummy	Mean	0.14	0.08	0.07	−0.06	0.057
# of obs.			95	636	264		

All variables are the same as in Table 2 except Odelinq and Fdelinq, that stand for whether the owner or the firm have been delinquent on personal or business obligations at least once during the last three years, respectively. Column (4) reports the differences between the groups with maturities longer than 12 months versus shorter than 12 months. The *P*-values in column (5) correspond to two-tailed *t*-tests of the equality in means for dummy variables, and to χ^2 tests of the equality of medians for continuous variables

relationship measured in years. *Noborrinst*, the number of institutions from which the firm borrows, is a measure of borrowing concentration. *Services*, a dummy variable indicating whether the firm uses a checking account, a savings account, or other financial services from the lending institution, accounts for the scope of the relationship. *Distance*, the number of miles between the borrower and lender, captures the

ease of monitoring due to geographical proximity. Length, borrowing concentration, scope, and geographical proximity are likely to be associated with stronger firm-creditor relationships, and thus we expect loan maturity to be positively related to *Length* and *Services*, and negatively related to *Noborrinst*.[13] and *Distance*.[14]

To test our hypotheses relating maturity to collateral (hypothesis 4a) and collateral types (hypothesis 4b), we code several dummy variables. *Collateral* indicates whether the loan was secured, *Perscollat* indicates if the loan was secured with personal assets, *Buscollat* indicates if the loan was secured with business assets only, and *Othercollat* indicates if it was secured with other non-disclosed assets. Our last two hypotheses suggest a positive effect of *Collateral* on maturity, and a larger effect of *Perscollat* than *Buscollat*.

3.3 Control variables

We also control for other potential determinants of loan maturity. To control for lender type, we code dummy variables for whether the lender is a bank, *Bank*, or a non-bank financial institution, *Finance*. Other lender types are the left-out group in our regressions. The main difference between banks and the other types of lenders is that depository institutions are constrained by certain regulations, while other lenders are not. Basel 1 does not impose any risk-based capital charge for loan commitments of one year or less, and therefore banks have special incentives to offer one-year loans. In addition, Carey et al. (1998) find that finance companies tend to specialize in loans to riskier borrowers and also to lend longer-term than banks. Based on these arguments, we expect that finance companies will lend longer-term than banks.

Almost 75% of the LOCs in our sample are used for working capital as opposed to more specific declared purposes (e.g., the purchase of vehicles, equipment, machinery, land, buildings, furniture, etc). To control for the possibility that firms try to match the maturity of the loan with the maturity of the asset to be financed, we include *Useforwc*, a dummy variable equal to one if the LOC's declared purpose is a working capital facility, zero otherwise. We expect this variable to have a negative effect on maturity.

Because the firm's ownership structure and governance may affect the severity of agency problems between borrowers and lenders, we include four dummy variables. *Corp* indicates if the firm is a corporation, *Family* indicates if the firm is majority owned by a family, and *Ownmg* indicates if the owner is also the manager. In addition, Blanchflower et al. (1998) and Cavalluzo et al. (2002) find that racial minorities are discriminated in credit markets. Thus, we include *Minority*, which indicates if Hispanics or African-Americans own the firm.

Finally, we also control for the up-front fees collected by the lending institution as a percentage of the total amount borrowed, *Fees*, and for the interest rate paid on the loan, *Interest.* Because we are aware of no theory relating maturity to interest and fees, we include them as control variables but make no strong prediction about their effect.

3.4 Descriptive statistics and preliminary results

Table 3 reports summary statistics of all the variables that we use in our empirical analysis. The median loan commitment maturity is one year, while the mean is almost two years. Because of the skewness of loan maturity, we use its natural logarithm as the dependent variable. About half of the loans require fees, with a median fee equivalent to 0.5% of the loan amount, 62% are secured, and the median interest paid is 8%.

The median firm size is about $1 million and the median firm age is 13 years. Because these variables are skewed and to mitigate the impact of outliers, we use the natural logarithm of these variables. The summary statistics of these and the remaining variables are similar to those reported in

[13] *Noborrinst* might also be a proxy of the firm's credit risk, as more risky firms could be credit-constrained at their primary lender, and therefore may seek additional financing in other institutions. This generates the same prediction regarding maturity

[14] While Degryse and Ongena (2005) argue that geographical proximity makes monitoring easier, Petersen and Rajan (2002) find that the importance of distance between borrower and lender in the US has decreased over time due to technological changes in information processing. This would predict no effect of *Distance* on maturity.

studies that examine lines of credit using the NSSBF 1993.

By way of a preview of our results, Table 4 splits our sample according to loan maturity (less than a year, a year, and more than a year), and reports summary statistics for selected variables (medians for continuous variables and means for dummy variables). A substantial fraction of the LOCs in our sample have maturities of exactly one year. One reason that explains this phenomenon is the fact that loan commitments of one year or less are not subject to capital requirements under Basel 1. This gives banks a strong incentive to lend with a maturity of exactly twelve months. We argue that deviations to longer or shorter maturities are likely to be associated with important variation in informational asymmetries and borrower risk. The last two columns show the differences between firms obtaining loans with maturities *longer* and *shorter* than one year, and the corresponding *P*-values.

Column (4) shows some preliminary evidence on the determinants of LOC maturity. Consistent with a negative association between ex-ante risk and maturity, the group of firms with longer maturity loans is associated with a substantially lower fraction of owner delinquencies, firm delinquencies, and firms with negative equity than the group with shorter maturities. Moreover, consistent with our hypothesis of a positive association between informational transparency and loan maturity, larger and older firms receive longer maturity loans, although the difference in firm age is not statistically significant. The univariate results do not provide evidence of any association between stronger relationships and maturity. The fraction of loans granted by finance companies increases as we move from the shorter maturity to the longer maturity group, while the fraction granted by banks remains constant. Although finance companies represent a small percentage of the lenders in our sample, the evidence suggests that finance companies specialize in longer-term loans. The fraction of the loans in the longer maturity sample whose declared use is working capital is substantially lower than for shorter maturity loans, supporting the hypothesis that borrowers try to match the maturity of the loan with the maturity of the asset being financed. Finally, the table uncovers a negative relation between loan maturity and ownership by racial minorities.

4 The determinants of loan maturity

4.1 Empirical approach

Our empirical model regresses the natural logarithm of maturity (the length of the commitment in months) on all the right-hand side variables presented in Table 2, two-digit SIC industry dummies, nine geographic location dummies, and four year of application dummies. The *P*-values we report are robust to heteroskedasticity.[15]

To test our first three hypotheses, we first run an OLS regression of Ln(*Maturity*) on all exogenous test variables, but exclude all other contract terms (i.e., *Collateral*, *Interest*, and *Fees*) because they are potentially determined simultaneously with maturity and thus endogenous. We interpret these reduced-form estimates as the effect of the exogenous variables on maturity, inclusive of any effect through the potentially endogenous contract terms that they may imply. While we make no strong statement about the exogeneity of collateral pledges, previous work on the determinants of borrowing costs argues that collateral can be treated as an exogenous variable because the collateral decision typically precedes the interest rate decision (Berger and Udell 1995; Harhoff and Körting 1998; Elsas and Krahnen 1998; Degryse and Ongena 2005). To test our hypothesis relating collateral and maturity we also follow this approach and add *Collateral* to our regressions.

We then sequentially add the potentially endogenous *Fees* and *Interest* as additional control variables, as their omission may bias the collateral results if fees and interest payments are related to collateral pledges. However, this may also introduce endogeneity and bias all coefficients in our analysis. Our main objective when introducing these other contract terms is simply to check the robustness of our results. Thus, rather than attempting to instrument these contract terms with ad-hoc instruments, we follow Berger and Udell (1995) and conduct our regression

[15] We examined the pair-wise correlations among the right-hand side variables and verified that our independent variables are not highly correlated. We also examined pair-wise correlations between our dependent variable and each of the independent variables in our empirical model, and obtained results that are consistent with the detailed multivariate regression analysis we report. Thus, we are confident that multicollinearity is not a problem in our regression analysis.

analysis with and without the potentially endogenous contract terms to determine whether any serious bias is present. When the contract terms are included, the coefficients of the test variables should be viewed as the effect of these variables on maturity, excluding their effects through the other contract features.

4.2 Results

4.2.1 Test variables

Table 5 reports the results. In column (1) we report the OLS reduced-form results with no contract terms, and in column (2) we add the collateral dummy. Columns (3) and (4) report the results replacing *Collateral* by *Fees* and *Interest*, respectively. Column (5) reports the results including all contract terms. Results are robust across specifications. The coefficients in column (1) keep their sign, magnitude and statistical significance when the collateral dummy is added in column (2). In addition, none of the results reported in column (2) are affected by the inclusion of *Fees* and *Interest* in columns (3)–(5). This suggests that our results are robust to the inclusion of other contract terms as additional control variables.

Among the ex-ante owner credit history and owner characteristics variables, the effect of *Owndelinq* is negative and statistically significant in all specifications, suggesting that ex-ante owner risk is negatively associated with maturity. We also find a negative effect of *Ownage* and a positive effect of *Ownexper* on LOC maturity. The first finding suggests that firms with older owners may be more risky, perhaps because the owner's incentive to maintain a clean credit record decreases as she approaches retirement, or because older owners are more likely to leave their firms in the short run and force the lender to negotiate with a successor of unknown creditworthiness. The second finding is consistent with the view that more experienced owners run their firms more efficiently and/or are less prone to shift risk given their potential cost in terms of lost reputation, allowing such firms to obtain longer-maturity loans. While owner variables are important determinants of maturity, we find no effect of our ex-ante firm risk characteristics. Our results are thus consistent with previous research that argues that owner rather than firm characteristics are more relevant in assessing the risk of loans to small businesses. Taken together, our findings provide support for hypotheses that maturity is negatively related to ex-ante borrower risk (hypothesis 1a), and is more sensitive to owner-related risk than to firm-related risk (hypothesis 1b).

Consistent with our second hypothesis of a positive association between informational transparency and loan maturities, we also find positive and statistically significant effects of *Firmage*, *Firmsize*, and *Deprec* on LOC maturity in all specifications. However, the effect of R&Demp is not statistically significant. These results are consistent with shorter maturities being helpful in mitigating agency problems that are more severe in more informationally opaque firms. In addition, our findings support the argument that a reduction in informational asymmetry improves contract terms. In fact, Petersen and Rajan (1994) find *Firmage* and *Firmsize* to be negatively related to interest rates, and Berger and Udell (1995) find that older firms are less likely to pledge collateral.

Contrary to our third hypothesis, we find no evidence that stronger firm-creditor relationships lead to longer maturities, as none of our relationship variables has the expected effects on LOC maturity (in fact, *Length* is sometimes negative and marginally significant at 10%). The existing empirical evidence suggests that stronger bank-borrower relationships improve credit availability and reduce the need of collateral. However, our results on maturity together with existing mixed results on borrowing costs suggest that the effect of relationship variables on other contract characteristics is not conclusive.

Our results also support our hypothesis 4.a that collateral pledges are positively related to maturity, a result that is statistically significant and robust to the inclusion of other contract terms as additional control variables.[16] This finding is consistent with findings

[16] In unreported regressions, we also included a dummy variable for whether the loan has a personal guarantee or not. However, the guarantee dummy is not statistically significant, and does not affect any of the results we report. One interpretation for the lack of effect of personal guarantees on maturity is that, as opposed to collateral, they are a more general and weaker claim on personal wealth that does not involve liens to specific assets and thus are less effective in mitigating moral hazard problems. Another possible explanation is that most states in the U.S. have homestead acts that limit the creditor's access to some personal assets in exercising guarantees, but do not take precedence over security interests in assets pledged as collateral (Avery et al. 1998).

Table 5 Analysis of Ln(Maturity)

	(1)	(2)	(3)	(4)	(5)
Ex-ante owner risk and owner characteristics					
Owndelinq	−0.101**	−0.105**	−0.101**	-0.096**	−0.099**
	(0.021)	(0.017)	(0.020)	(0.029)	(0.023)
Judgment	0.047	0.038	0.033	0.058	0.038
	(0.744)	(0.787)	(0.821)	(0.689)	(0.793)
Ln(Ownage)	-0.550***	-0.540***	−0.531***	−0.554***	−0.527***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln(1 + Ownexper)	0.151***	0.149***	0.155***	0.150***	0.152***
	(0.004)	(0.005)	(0.003)	(0.004)	(0.004)
Ex-ante firm risk					
Firmdelinq	0.031	0.024	0.030	0.030	0.022
	(0.234)	(0.346)	(0.241)	(0.246)	(0.376)
Bankrupt	0.274	0.287	0.209	0.291	0.242
	(0.334)	(0.297)	(0.451)	(0.317)	(0.380)
Grey	0.022	0.006	0.027	0.013	0.001
	(0.805)	(0.948)	(0.754)	(0.884)	(0.991)
Healthy	0.065	0.057	0.068	0.048	0.040
	(0.397)	(0.461)	(0.374)	(0.543)	(0.612)
Negequity	−0.060	−0.064	−0.058	−0.062	−0.064
	(0.471)	(0.437)	(0.483)	(0.458)	(0.432)
St-debt	0.034	0.044	0.023	0.034	0.034
	(0.686)	(0.599)	(0.779)	(0.680)	(0.677)
Information asymmetry					
Ln(Assets)	0.051***	0.043**	0.055***	0.046***	0.041**
	(0.002)	(0.012)	(0.001)	(0.008)	(0.020)
Ln(Firmage)	0.087**	0.096**	0.085**	0.085**	0.093**
	(0.040)	(0.024)	(0.043)	(0.044)	(0.028)
R&Demp	0.216	0.225	0.173	0.218	0.186
	(0.171)	(0.149)	(0.270)	(0.163)	(0.225)
Deprec	0.005***	0.005***	0.005***	0.005***	0.005***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
Relationship variables					
Ln(1 + Length)	−0.069*	−0.063*	−0.067*	−0.069*	−0.061
	(0.078)	(0.099)	(0.087)	(0.082)	(0.116)
Noborrinst	0.006	−0.000	0.008	0.005	0.002
	(0.843)	(0.995)	(0.787)	(0.849)	(0.955)
Services	−0.123	−0.130	−0.127	−0.121	−0.131
	(0.178)	(0.153)	(0.165)	(0.187)	(0.150)

Table 5 continued

	(1)	(2)	(3)	(4)	(5)
Ln(1 + Distance)	−0.009	−0.011	−0.011	−0.009	−0.013
	(0.663)	(0.596)	(0.588)	(0.653)	(0.518)
Lender type					
Bank	0.712**	0.678**	0.740**	0.684**	0.671**
	(0.023)	(0.028)	(0.018)	(0.033)	(0.032)
Finance	0.861***	0.821**	0.898***	0.842**	0.834**
	(0.008)	(0.011)	(0.006)	(0.011)	(0.010)
Loan purpose					
Useforwc	−0.446***	−0.440***	−0.435***	−0.447***	−0.430***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ownership structure and governance					
Corp	−0.085	−0.104	−0.079	−0.092	−0.105
	(0.253)	(0.162)	(0.295)	(0.216)	(0.158)
Family	−0.020	−0.022	−0.011	−0.015	−0.008
	(0.719)	(0.694)	(0.837)	(0.785)	(0.884)
Ownmg	0.042	0.037	0.050	0.038	0.040
	(0.440)	(0.492)	(0.358)	(0.492)	(0.464)
Minority	0.114	0.114	0.106	0.115	0.108
	(0.242)	(0.235)	(0.270)	(0.236)	(0.256)
Contract terms					
Collateral		0.168***			0.168***
		(0.001)			(0.001)
Fees			0.026**		0.025**
			(0.016)		(0.019)
Interest				−0.024	−0.027*
				(0.148)	(0.099)
Constant	4.822***	4.722***	4.614***	5.142***	4.889***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R^2	0.279	0.287	0.286	0.281	0.296

All regressions are OLS and are based on 995 observations, and include two-digit SIC industry, year of application, and nine region dummies (not reported). Heteroskedasticity-robust *P*-values are reported in parenthesis. *, **, and *** mean significant at 10%, 5%, and 1%, respectively

for large firms by Dennis et al. (2000), and with findings for small firms by Leeth and Scott (1989). Our results suggest that collateral and maturity are substitutes in reducing agency problems, that is, collateral leads to longer maturity because it mitigates risk-shifting or under investment problems and induces good behavior by borrowers. However, as discussed in section 2, an alternative interpretation is that collateral leads to longer maturities because it signals better borrower quality, and thus collateral would be a proxy for unmeasured borrower characteristics in our regressions. We can empirically distinguish between these two interpretations because while the signaling argument predicts a negative relation between risk and collateral pledges, the agency argument predicts a positive relation. Existing

empirical evidence shows that collateral is associated with riskier loans and/or riskier borrowers (see Berger and Udell 1990, 1995; Carey et al. 1998; Booth and Booth, forthcoming), and we document below that this is also true in our data (see Table 6). Thus, the agency interpretation is more plausible than the signaling explanation for the firms in our sample.

4.2.2 *Control variables*

Table 5 also shows that fees are positively related to maturity, suggesting that for longer maturities the lender may require a larger compensation as an up-front fee. When we include all contract terms, we find that interest rates are negatively related to maturity, supporting the conjecture that they may be complements in imposing stricter conditions for riskier borrowers. However, we caution that our results are exploratory, since these variables may be simultaneously chosen with maturity, which may bias our results.

We also find that banks and finance companies lend with longer maturities than other lenders. Supporting the results in Carey et al. (1998) for large firms, we also find some evidence that finance companies lend with longer maturities than banks. However, a formal test cannot reject the null that the effects of *Finance* and *Bank* are equal. Thus, our results are weakly consistent with both lender specialization and differences in regulation across lender types affecting the length of loan commitments.

We find a negative effect of *Useforwc* on loan maturity, indicating that maturity is longer for single-purpose LOCs used for the purchase of a long-term asset than for working capital LOCs that are short-term in nature. This is consistent with borrowers matching the maturity of the loan with the maturity of the asset being financed (Myers 1977). Alternatively, since working capital loans are ''general purpose'' loans, the actual use of the funds is hard for lenders to monitor, making such loans more risky. Thus, the finding can also be due to the use of shorter maturities to mitigate agency problems.

Finally, our variables capturing ownership structure and governance, limited liability, family ownership, separation of ownership and control, and racial minority ownership, do not affect maturity in our sample of small businesses.

4.2.3 *The effect of different types of collateral on loan maturity*

To explore the relation between loan maturity and specific types of collateral, Table 6 reports means of selected variables for unsecured loans (column 1), secured only with business collateral (column 2) and secured with personal collateral (column 3).[17, 18]

Relative to unsecured loans, maturity increases with collateral pledges of any type. This is particularly striking given the large differences in risk and asymmetric information between the firms in columns (3) and (1). The maturity of loans secured with personal assets is much longer than that of unsecured loans (the difference is statistically significant), even when the firms in the collateralized group are younger, have a larger fraction of owner delinquencies, a larger fraction of owners with judgment rendered against them, a larger fraction of firm delinquencies, a larger fraction of firms with negative equity, as well as a larger percentage of firms in the grey area and a smaller percentage in the healthy area according to the Z-score. The comparison of loans secured with personal collateral and those secured by business collateral only (columns (2) and (3)), also show longer maturity for personal collateral pledges even though this group exhibits more ex-ante firm and owner risk, as well as more information asymmetries including less asset tangibility. The difference in maturities is, however, not statistically significant. Thus, the table provides some support for our hypothesis 4b that personal collateral better mitigates the loss exposure of lenders or better mitigates borrower incentives to shirk than business collateral, and thus firm owners that are able pledge personal assets obtain longer maturities.[19]

[17] Personal collateral includes personal real estate and other personal non-specified, and business collateral includes business real estate, business securities or deposits, equipment, accounts receivable, or other

[18] Table 6 excludes the 40 observations corresponding to loans with unspecified types of collateral. Because the median owner delinquencies, firm delinquencies, and fees paid are zero, we replace them by three dummy variables *Odelinq*, *Fdelinq*, and *Hasfees*, that are equal to one when these variables take positive values.

[19] Table 6 shows that collateral pledges are associated with more rather than less borrower risk and information asymmetry. This is consistent with the agency argument for collateral pledges and maturity, but not with the signaling argument.

Table 6 Sample splits by types of collateral

Variable	(1) No collateral	(2) Business only	(3) Personal	(4) Diff. (3)–(2)	*P*-value	(5) Diff. (3)–(1)	*P*-value	(6) Diff. (2)–(1)	*P*-value
Maturity	19.21	24.43	26.83	2.40	0.4096	7.62	0.0023	5.22	0.0049
Ex-ante owner risk and owner characteristics									
Odelinq	0.05	0.06	0.14	0.08	0.0051	0.09	0.0011	0.01	0.5046
Judgment	0.03	0.03	0.07	0.04	0.0233	0.04	0.0363	0.00	-
Ownage	50.71	50.35	49.47	−0.88	0.3683	−1.24	0.2521	-0.36	0.6258
Ownexper	20.49	20.84	19.26	−1.58	0.1110	−1.23	0.2478	0.35	0.6358
Ex-ante firm risk									
Fdelinq	0.14	0.22	0.30	0.08	0.0532	0.16	0.000	0.08	0.0049
Bankrupt	0.02	0.01	0.02	0.01	0.3597	0.00	–	-0.01	.5829
Grey	0.11	0.19	0.18	−0.01	0.7159	0.07	0.0534	0.08	0.0019
Healthy	0.74	0.67	0.61	−0.06	0.1410	−0.13	0.0034	-0.07	0.0438
Negequity	0.13	0.13	0.19	0.06	0.0814	0.06	0.1019	0.00	-
St-debt	0.46	0.44	0.41	−0.03	0.3007	−0.05	0.2019	-0.02	0.5616
Asymmetric information									
Assets	2747.06	5063.91	2791.71	−2272.20	0.0027	44.65	0.9383	2316.85	0.0000
Firmage	18.24	17.56	14.15	−3.41	0.0223	−4.09	0.0068	-0.68	0.5440
R&D	0.08	0.04	0.10	0.06	0.0002	0.02	0.2870	-0.04	0.0014
Deprec	9.03	7.38	8.66	1.28	0.3346	−0.37	0.2226	-1.65	0.0001
Relationship variables									
Length	9.46	8.14	6.70	−1.44	0.0734	−2.76	0.0006	-1.32	0.0305
Noborrinst	1.24	1.57	1.46	−0.11	0.2836	0.22	0.0069	0.33	0.0000
Services	0.84	0.85	0.87	0.02	0.6282	0.03	0.4518	0.01	0.6850
Distance	28.49	45.22	33.87	−11.35	0.4324	5.38	0.6863	16.73	0.1174
Lender type									
Bank	0.94	0.94	0.95	0.01	0.7945	0.01	0.6065	0.00	-
Finance	0.03	0.05	0.05	0.00	0.8772	0.02	0.3838	0.02	0.3341
Loan purpose									
Useforwc	0.73	0.71	0.75	0.04	0.3500	0.02	0.6766	-0.02	0.4689
Other contract terms									
Interest	8.25	8.08	8.39	0.31	0.0338	0.14	0.4858	-0.17	0.1608
Hasfees	0.44	0.57	0.59	0.02	0.6535	0.15	0.0017	0.13	0.0001
# of obs.	379	439	137						

The table reports means for selected variables, and distinguishes between lines of credit that are not secured, secured only with business collateral, and secured with personal collateral (the loan can be secured with business collateral or other type of collateral as well). Loans secured with other types of collateral (40 observations) are not reported in the table. As the medians for the original variables defined in Table 2 are zero, we code two dummies, Odelinq and Fdelinq, for whether Owdelinq>0 and Firmdelinq>0, respectively. Hasfees = 1 if Fees>0, and =0 otherwise. The *P*-values in the last column correspond to two-tailed *t*-tests of the equality of means

To better explore this idea, we also run a regression similar to that in Table 5, column 5, but distinguishing among collateral types using *Buscollat*, *Perscollat*, and *Othercollat*, which indicate only business collateral, at least some personal collateral,

Footnote 19 continued
Thus, this supports our interpretation of the positive association between collateral and maturity as suggesting that collateral and maturity are substitute mechanisms that mitigate agency problems.

or other (not-specified) types of collateral which are not personal nor business. Thus, no collateral is the left-out group in the regression. The coefficients of *Perscollat* and *Buscollat* are positive (0.231 and 0.154, respectively) and statistically significant, while the effect of *Othercollat* is not significant and the effects of other variables remain similar to those reported in Table 5. Thus, while other collateral types likely provide little security to lenders and thus do not affect maturity, personal pledges lead to longer average maturities than pledges of business collateral only. While an *F*-test suggests that this difference is not statistically significant, this provides some evidence suggesting that borrowers that pledge personal collateral obtain longer-maturity loans as stated in our hypothesis 4b.

If collateral and maturity are substitutes as suggested by our last hypothesis, we would also expect the sensitivity of loan maturity to risk and information asymmetry variables to be lower when collateral is pledged, and decreasing in the quality of the collateral offered. In unreported regressions, we explore this possibility by running separate regressions for loans with no collateral, only business collateral, and at least some personal collateral. We find that while *Ln(Assets), Owndelinq* and *Deprec* have the predicted effects for loans with no collateral and only business collateral, the results vanish for the group of loans with personal collateral (the safest type). In addition, owner characteristics *(Ln(Ownage)* and *Ln(1 + Exper))* also lose significance for loans with personal collateral. While our tests lose some statistical power due to the reduced sample sizes, the results suggest that the sensitivity of loan maturity to risk and information asymmetry decreases in collateral quality (results available from the authors).

4.2.4 *Robustness checks for main maturity regressions*

We also checked the sensitivity of our results in Table 5 to alternative specifications of our variables and controls. Two of our main proxies for risk are *Owdelinq* and *Firmdelinq*, the number of times the owner or the firm has been delinquent on personal or business obligations, respectively. We replaced both of these variables by dummy variables indicating whether the owner or firm had been delinquent at least once. The results are similar to those reported. Our analysis breaks the Z-score into three dummy variables to capture potential non-linear effects of firm risk on loan maturity. For robustness, we also included the continuous version of the Z-score, as well as quadratic terms. However, the effect of the Z-score remains insignificant. We also controlled for whether the loan required compensating balances or a guarantor, and whether the loan had a fixed or floating rate, but our results remain unchanged.

Since firms may follow a pecking order in their choice of debt instruments, the choice of a particular type of debt vehicle, such as the lines of credit we study, may be endogenous. Thus, it is possible that firms self-select into those that use lines of credit and those that do not based on some distinct firm characteristics. To address the concern that sample selection may bias our results, we first compared firms that use lines of credit and those that do not, and found no statistically significant differences between the two groups. We then ran a Heckman selection model where the first-stage selection equation determines whether the firm obtains a line of credit instead of another type of loan or no loan, and the second-stage loan maturity regression includes the Inverse Mills Ratio to correct for any potential bias. The results with Heckman correction are qualitatively similar to those reported in Table 5, and the Inverse Mills Ratio is not statistically significant, suggesting that sample selection is not a concern in our study.

Our results show no effect of firm characteristics on loan maturity. It is possible, however, that firm characteristics are not significant in the maturity regressions due to a high correlation with owner characteristics. This is not the case for our data, except for *Owndelinq* and *Firmdelinq* (the correlation is 0.40). To explore whether the coefficient on *Firmdelinq* is insignificant due to its correlation with *Owndelinq*, we drop the latter from the regression in column 5 of Table 5. However, the coefficient on *Firmdelinq* remains insignificant. Dropping all owner characteristics provides similar results. Thus, the lack of significance of firm characteristics in the maturity regressions is not due to a high correlation with owner characteristics.

We also explored whether the relation between firm characteristics and loan maturity depends on organizational form. In particular, we run our analysis on Table 5 for the sub-sample of incorporated firms

and for the sub-sample of un-incorporated firms separately. However, all firm characteristics remain insignificant in both sub-samples.

5 Discussion of results and conclusions

In this closing section, we focus on the contributions and limitations of this study and make some suggestions for future research. This paper examines the determinants of the maturity of lines of credit granted to small firms using a comprehensive sample representing the population of US small businesses. Our main hypothesis is that shorter loan maturities play a unique role in small business lending by serving to mitigate the problems associated with borrower risk and asymmetric information that are typical of such loans. We develop and test several hypotheses relating loan maturity to ex-ante risk, asymmetric information, the strength of firm-creditor ties, and different types of collateral pledges.

Our results show that maturity is shorter for firm owners that have poor credit histories, are older, and less experienced, and for firms that are more informationally opaque. We also find strong evidence that maturity increases with collateral pledges, that personal collateral (which provides additional assets for the secured creditors to claim) is associated with longer maturities than business collateral (which simply reorders the claims of creditors), and that the pledge of personal collateral reduces the sensitivity of loan maturity to informational asymmetries and risk. However, while previous research suggests that borrower-lender relationships mitigate information asymmetries, we do not find any relation between maturity and stronger borrower-lender ties.

Overall, our main findings give support to the hypothesis that shorter loan maturities serve to mitigate the problems associated with risk and asymmetric information that plague small business lending, and that collateral pledges and shorter maturities are substitutes in mitigating these problems. Our results also suggest that the personal wealth of the owners may be an important determinant of the maturity of bank loans to small businesses, and therefore highlight the key role that personal wealth may play in allowing small firms to undertake long-term projects.

While shorter maturities are useful for lenders in addressing the information and control problems that arise in small business lending, their use is likely a second best solution compared to longer-term nominal maturities coupled with effective debt covenants. Our results suggest that more informationally opaque and risky borrowers may find it difficult to obtain longer-term bank financing, which in turn may introduce a distortion in their investment decisions. A bias towards short-term projects, or towards projects that pay-off early, may adversely affect projects with distant cash-flows, notably those requiring investment in research and development. However, it is also possible that for entrepreneurs with innovative projects, other types of financing such as venture capital fill up the potential financing gap.

While our predictions apply to small private companies in general, maturity is more likely to play a differential role in the smallest businesses that we examine. Our main hypothesis points to the role of loan maturity in a setting where loan covenants are hard to enforce, thus potentially giving maturity a unique role in addressing problems related to risk and asymmetric information. However, as firms grow in size disclosure requirements become stricter and the enforcement of debt covenants improves, leaving less room for the role of maturity that we explore. Thus, while shorter maturities can mitigate risk and asymmetric information problems in small private companies in general, they play a more important role in the debt markets financing the smallest businesses of the spectrum as those in our sample.

A limitation of our study is that part of our tests relies on imperfect proxies for the extent of asymmetric information. Constructing variables related to the extent of asymmetric information is a difficult task. While our proxies are widely used in the small business literature (e.g., Berger et al. 2001; Carey et al. 1998; Petersen and Rajan 1994; Berger and Udell 1995), such proxies are admittedly noisy. While inversely related to information opacity, firm size is also a reflection of the (financial) reliability of a firm and thus may also reflect the firm's riskiness. In addition, while older firms are generally informationally transparent, firm age may not be a good measure of information opacity because there may be very little information available for small, private firms, even if older. Research on publicly traded firms

uses alternative proxies for asymmetric information, such as dispersion of analysts forecasts, earnings surprises, or past returns (e.g., Barclay and Smith 1995; Guedes and Opler 1996). However, such measures cannot be constructed for our sample of private firms because market values, analyst forecasts, or time series data for earnings are not available.

Our analysis also relies on tests that use proxies for borrower risk. Ex-ante borrower risk is also a difficult concept to measure in any empirical setting, precisely because the true underlying risk associated with the borrower is unobservable to the econometrician. However, our comprehensive set of variables related to ex-ante firm and owner risk (which include Altman's Z-score and credit history of both firm and owner) capture different dimensions of this risk and are reasonably good proxies for the concepts we need to measure. Thus, while we acknowledge that our borrower risk variables may ignore some aspects of risk that could be of importance, we believe that this is not a serious concern for our study.

Our data contains very detailed information about loan contract terms, but our analysis is limited by the cross-sectional nature of the data. If we had repeated time-series information for each firm, our analysis could also include firm-fixed effects to mitigate omitted variable bias due to unobserved firm heterogeneity. Also, we could track businesses in time and examine how their contract terms are adjusted as they grow and become less informationally opaque. In addition, while our data allows us to control for the type of lender granting the loan, we do not have specific bank characteristics such as size, and bank risk, which could affect the nature of the debt contract offered to small businesses.

The hypothesis we investigate is not specific to certain countries. However, our empirical study is focused on US small businesses. The role of loan maturity in addressing problems associated with asymmetric information and risk should be more important in countries with thin capital markets, poor disclosure policies and weak legal enforcements. We believe that exploring the impact of different institutional settings on the role of loan maturity is a promising area for future research.

The potential role of maturity in controlling risky borrowers could also be important in US states where there are high exemptions in personal bankruptcy proceedings. A similar argument to the one put forth in this paper can be made for loans granted in those states, because personal bankruptcy procedures also apply to small firms. If a firm is unincorporated, its debts are personal liabilities of the firm's owner, so that lending to the firm is legally equivalent to lending to its owner.[20] If the firm fails, the owner has an incentive to file for personal bankruptcy, since the firm's debts will be discharged. There is already evidence that if small firms are located in states with unlimited rather than low homestead exemptions, they are more likely to be denied credit, and when loans are made, they are smaller and interest rates are higher (Berkowitz and White 2004). We think that the variation across states and in time in exemption levels in the US provide a unique natural experiment to test whether lenders reduce loan maturity of unsecured loans to small firms when exemption levels are high. If this were the case, then the next step would be to study whether this brings a short-term bias in small businesses choice of projects. We also think this is an interesting topic for future research.

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[20] In practice personal bankruptcy exemptions also affect small corporations. Because when making loans to small corporations, lenders require that owners personally guarantee the loans, the legal distinction between corporations and their owners for purposes of the particular loan disappears for small corporations and puts the owner's personal assets at risk to repay the loan.

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