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Information Asymmetry, Risk Rating, and Debt Maturity: Evidence from Small Business Data

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Abstract

This paper examines the interactive effects of risk ratings and banking relationships on debt maturity choice. Previous studies posit that there exist important interactions between risk ratings and proprietary information generated from monitoring. I test their predictions by introducing banking relationships as a proxy for proprietary information about borrowers. I find that, in the absence of prior banking relationships, both low-and high-risk firms borrow on shorter-term bases than intermediate-risk firms. With long-lasting banking relationships, however, the effects of risk ratings on maturity substantially decline. The findings here suggest that information asymmetry is at the root of debt maturity choice.

Keywords: debt maturity, information asymmetry, risk rating, banking relationship

INTRODUCTION

Firms with long-term investment opportunities can borrow short-term today and refinance later, or they can simply lock in a long-term rate instead. How do such firms choose the optimal maturity of their debt? Numerous explanations have been advanced in the literature. For example, the influential studies of Flannery (1986) and Diamond (1991) demonstrate that a firm's

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choice of debt maturity hinges on asymmetric information and the borrower's credit quality, while other theories of debt maturity stress the role of agency costs, taxes and other market frictions (e.g., Barnea, Haugen, and Senbet 1981; Haugen and Senbet 1979; Myers 1977).

In this paper, I test the predictions of Flannery's (1986) and Diamond's (1991) theoretical models. The closest work to this paper is Berger and colleagues (2005), who test Flannery's and Diamond's predictions concurrently within the framework of a single empirical model. In particular, Berger et al. investigate how the adoption of small business credit scoring (hereafter, SBCS) technology affects debt maturity and interacts with risk. Similarly to Berger et al. (2005), I test whether debt maturity is a monotonically increasing function of credit risk rating under information asymmetry as Flannery (1986) predicted, or a nonlinear function of credit risk rating as Diamond (1991) predicted. By contrast to Berger et al. (2005), however, I focus on information asymmetry due to the lack of a banking relationship rather than due to no use of SBCS.

Previous studies have shown that durable relationships between borrowers and lenders can attenuate information asymmetries, benefiting both creditors and informationally-problematic small firms (Petersen and Rajan 1994b; Berger and Udell 1995; Bharath et al. 2007). While SBCS employs quantifiable information, such as accounting information, to generate a "numerical credit score" corresponding to the borrowers' credit-worthiness at relatively low expenses, the intrinsic nature of small firms requires continuous monitoring of their credit performance through long-lasting relationships. Despite the important role of the banking relationship in small business financing, to the best of my knowledge, no prior research has assessed the impact of a durable banking relationship and its interaction with risk rating. This study attempts to fill the gap.

Banking relationships appear to be an important determinant of debt maturity choice. The reduced information asymmetry through a durable banking relationship may imply that borrowing firms do not need to incur transaction costs to get better terms in the future, indicating that they are more likely to borrow on a longer-term basis. On the other hand, with a

banking relationship established, higher-risk firms face fewer difficulties in rolling over short-term debt. As a result, intermediate or high-risk firms are less likely to lock in a relatively higher long-term rate, and therefore they decide to borrow shorter term. At the same time, there can be a supply-side effect: the reduced information gap between lenders and borrowers can also imply that the lenders are more willing to provide longer-term debt to higher-risk firms that cannot initially borrow long-term funds. Taken together, the impact of banking relationships on the debt maturity terms of borrowers is ambiguous and can only be resolved empirically.

My findings can be briefly summarized as follows. Consistent with the prediction of Diamond (1991) but against that of Flannery (1986), I find loan maturity to be a non-monotonic function of risk ratings in the presence of information asymmetry proxied by lack of a banking relationship. Specifically, when there are no durable relationships between lenders and borrowers, I find that firms with low- and high-risk ratings borrow in shorter terms than firms with intermediate risk ratings. I also find that long-lasting banking relationships do not significantly increase the maturity of low-and high-risk firms but substantially reduce that of intermediate-risk firms, reducing the overall effects of risk ratings on loan maturity.

The empirical findings of this study provide two main contributions to the existing literature. First, I provide further evidence on the important role of banking relationships in small business financing. Existing literature focuses on the impact of banking relationships on pricing and availability of loans to small businesses but tends to neglect their impact on loan maturity (see, e.g., Boot 2000 and Goldberg and Vora 1981). Second and more importantly, this study establishes the interactive effects of bank monitoring and credit scoring on debt contracting. For instance, Diamond (1991)'s theory posits the important interactions between risk ratings and additional information generated through monitoring, but no prior empirical research has directly tested its predictions. This study provides the first evidence of the validity of Diamond's model.[1)]

1) Despite the contributions of the findings, however, it is important to note that there are certain limitations in applying the main findings to publicly traded firms that can issue public debt, as this paper does not provide any evidence

BACKGROUND AND EMPIRICAL SPECIFICATION

Flannery's (1986) and Diamond's (1991) models are similar in that both models attempt to explain the debt maturity choice of borrowing firms and its link with credit quality under information asymmetry, while the models make different predictions about debt maturity choice of risky borrowers.

Flannery (1986) considers a two-period model in which borrowers choose their optimal maturities to minimize the transaction costs of debt financing. Specifically, the borrowers economize on the costs of issuing new debt and expected credit risk premia under asymmetric information. Since the probability of being a good (or bad) borrower is updated at the end of period one, a bad borrower who mimics the choice of a good borrower by choosing a short-term maturity has to pay higher risk premia than a good borrower when it rolls over its short-term debt. In a given condition, low-and high-risk borrowers sort themselves out, leading to a separating equilibrium: bad borrowers (risky borrowers) prefer long-term debt, and good borrowers (safe borrowers) prefer short-term debt. Therefore, Flannery (1986) predicts that, in the separating equilibrium, a firm's choice of debt maturity reveals its assessment of its true credit-worthiness. In summation, riskier firms borrow longer-term by considering the trade-off between lower transaction costs of having a new loan and higher risk premia.[2)]

Diamond (1991) also considers a two-period economy. Unlike in Flannery's (1986) model, however, credit rating is initially available to lenders, and some projects owned by borrowers have negative expected net present values, implying the lenders can

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on the role that credit ratings play for publicly traded firms. The findings of this paper can be specific to bank loans to small businesses that are unable to issue relatively long-term public debt. I would like to thank the anonymous referee for pointing out this careful suggestion.

2) To make sure the yield curve slopes upward, I estimate the average returns on treasury securities with different maturities by using data from the Federal Reserve website. For the period of 1993 to 2007, the average return on five-year bonds is 5.032%; the average return with ten-year bonds is 5.39%; the average return on twenty-year bonds is 5.86%. For the year of 2003, 2.97%, 4.01% and 4.96% are for five-year bonds, ten-year bonds, and twenty-year bonds, respectively, confirming the prediction. I thank the anonymous referee for this suggestion.

reject the renewal of (short-term) debt financing when bad news arrives at the end of period one. When firms borrow short-term, they can refinance at a lower rate on the arrival of good news at the end of period one, but when bad news arrives, their projects can be liquidated. Debt maturity is determined by considering the costs of early liquidation and a borrowing firm's preference for maturity based on private information about its project quality. Low-risk firms prefer shorter-term debt to refinance at lower costs since they are less likely to face liquidation, while intermediate and high-risk firms prefer long-term debt to avoid the substantial costs of early liquidation. Importantly, in Diamond's (1991) model, some high-risk firms can borrow only short-term, particularly when liquidation value is high enough to support short-term debt. In this setting, Diamond (1991) predicts that both low-risk and high-risk firms borrow on a shorter-term basis than intermediate-risk firms, particularly when information asymmetry is severe.

Prior empirical studies investigate the link between risk ratings and the maturity structure of (total) debt. For example, Barclay & Smith (1995) show that both publicly-traded firms with high bond ratings and firms without bond ratings are more likely to issue short-term debt than those with low ratings. If firms without bond ratings are considered as the riskiest firms, the evidence supports the claim that risk is non-monotonically associated with maturity. Stohs and Mauer (1996) and Scherr and Hulburt (2001) also find a non-linear relationship between debt structure and risk ratings for both listed and unlisted small firms. As pointed out by Berger et al. (2005), however, these studies do not distinguish between "a newly issued 1-year bond and a 30-year bond with 1 year remaining." Instead, they treat both types of bonds as a 1-year debt in maturity structure. This approach seriously undermines the validity of their tests. A related strand of empirical research assesses the impact of risk on the maturity terms of newly-issued debt, but it does not test for nonlinearities (Mitchell 1993; Guedes and Opler 1996).

It is important to note that, unlike Diamond's (1991) and Flannery's (1986) theoretical predictions, none of these studies directly test whether there is a link between maturity and risk rating under different levels of information asymmetry. To the best of my knowledge, Berger et al. (2005) is the only exception.

Unlike this study, however, Berger et al. do not directly test the predictions of Diamond's (1991) model but instead focus on testing the predictions of Flannery's (1986) model under which lenders cannot initially observe borrowers' risks.

The main test of Diamond's model is based on the following regression model of debt maturity:

$$\begin{aligned}\ln(1+\text{Maturity}) = {} & \beta_0 + \beta_1 \times \text{Relationship} + \beta_2 \times \text{HighRisk} + \beta_3 \text{LowRisk} \\ & + \beta_4 \times \text{HighRisk} \times \text{Relationship} + \beta_5 \times \text{LowRisk} \times \text{Relationship} \\ & + \text{Control variables for firm characteristics} \\ & + \text{Industry dummies} + \varepsilon \end{aligned} \quad (1)$$

The dependent variable is the natural log of one plus **Maturity**, where **Maturity** is the time (in months) until the full repayment of a loan is due. One is added since maturity is often a number close to zero. The variable **Relationship** is the log of one plus the length of the banking relationship (in months). The length of the banking relationship measures how long a firm conducted business with its lender before the former receives a loan.

I also include two dummy variables to allow for the non-linear effect of risk ratings on debt maturity based on credit score data from Dun & Bradstreet (see Small Business Finance Group 2007).[3] The Dun & Bradstreet Credit Scores (hereafter, DBCS) range from one (highest risk) to six (lowest risk). Specifically, the dummy variable **HighRisk** equals one if the firm's DBCS is either one or two, and zero otherwise. In a similar manner, the dummy variable **LowRisk** takes a value of one if the DBCS is five or six. Firms with intermediate risk, defined as those with DBCS of three and four, are treated as the benchmark category in the regression, and therefore the regression model does not include the dummy variable for firms with intermediate risk. Thus, the

3) Dun & Bradstreet does not provide detailed information about how it constructs credit rating. However, it has been known that the credit rating is based on accounting information about financial stability and payment history. Importantly, although the information on how to construct the credit rating is minimal, the credit rating seems to provide one of the most available pieces of information about the credit quality of small businesses. For instance, in many cases, the information from Dun & Bradstreet is required for U.S. federal government transactions.

coefficient for **Relationship**, β_1, captures the effect of the banking relationship between lenders and firms with intermediate risk on debt maturity choice.

Finally, following Petersen and Rajan (1994a) and Berger et al. (2005), I also control for various firm and contract characteristics as well as industry-specific effects. I use lack of a prior banking relationship as a proxy variable for information asymmetry. However, the increase in banking relationship may imply that the firm is larger, older, and more profitable rather than that more proprietary information was gathered by a lender, therefore resolving the information asymmetry. To avoid this possibility, I control for total assets, firm age, and ROA, and debt-to-asset ratio. Moreover, since asset maturity affects debt maturity and asset maturity is likely to be determined by industry-specific technology, I also control for 2-digit SIC industry fixed effects.

DATA

The primary data source is the Federal Reserve's 2003 Survey of Small Business Finances (SSBF). The survey contains detailed information regarding the most recent loans to small firms with fewer than 500 employees. The sample firms were selected by using a stratified sampling procedure to avoid under-representation of firms located in rural areas or managed by minority ethnic groups. All the statistics and regressions reported in this study are weighted to control for the sampling design (see the Technical Codebook for the Survey of Small Business Finances 2007).

Following Cole, Goldberg and White (2004), the data that I use for my regression estimates include bank loans to small firms but exclude those loans initiated before the information on firm characteristics was available. The final data consist of 1,859 bank loans to small firms.

Table 1 presents summary statistics for the borrower and the loan characteristics. Consistent with the description of the firms in the survey, the firm's total assets are on average less than one million dollars. The summary also shows that there is enough diversity in risk ratings that I can test the potential monotonic relationship between risk ratings on debt maturity.

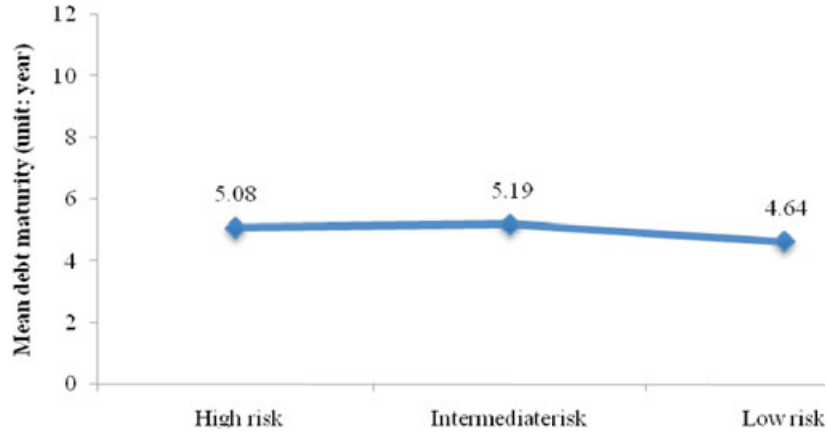
Table 1. Sample Statistics

	Mean	Linearized Std. Err.
Total assets (unit: dollars)	960,089	59,789
Firm age (unit: years)	14.21	0.37
Banking relationship (unit: months)	95.62	3.78
ROA	0.93	0.14
Cash to total assets	0.13	0.01
Outside debt to total assets	0.66	0.03
LowRisk (D&B score =1 & 2)	0.31	0.02
MedRisk (D&B score=3 & 4)	0.44	0.02
HighRisk (D&B score=5 & 6)	0.25	0.01
Loan maturity (unit: months)	60.23	3.29
Collateral requirement	53%	2%
Loan amount (unit: dollars)	194,490	11,222

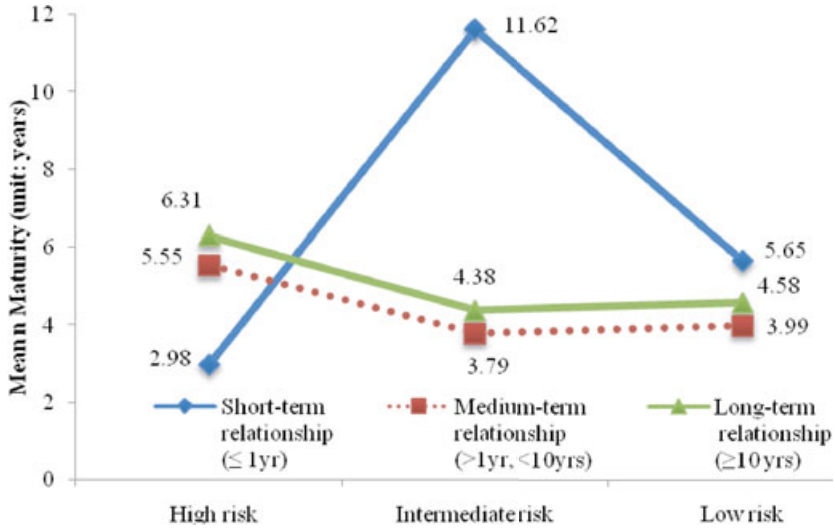
UNIVARIATE COMPARISONS

Before turning to the multivariate regression results, first I examine how loan maturity terms vary with the length of banking relationships by comparing the former for various credit ratings. Panel A of figure 1 shows that high- and low-risk firms have shorter maturities than intermediate-risk firms, but the differences appear to be trivial and economically small.

In Panel B of figure 1, I consider whether the relationship between risk ratings and maturity terms changes with the extent of the banking relationship. To that end, I divided the sample into three subsets based on the extent of the relationship: short-term (maturity terms ≤ 1 year), medium-term (1 < maturity terms ≤ 10 years), and long-term relationships (maturity terms > 10 years). As Panel B of figure 1 shows for short-term relationships, loan maturity is a non-monotonic function of risk ratings. In particular for short-term banking relationships, the loan maturity terms for low- and high-risk firms are substantially shorter than those for intermediate-risk firms by 8.64 and 5.97 years, respectively. Both Flannery and Diamond predict that, with information asymmetry reduced, firms with lower risk are more likely to borrow longer-term. Surprisingly, however, the maturity terms of low-risk firms do not increase monotonically



Panel A: Debt Maturity and Credit Rating



Panel B: Three Groups Based on Lending Relationship (Short-, Medium-, and Long-term Relationships)

Figure 1. Lending Relationship, Credit Rating and Debt Maturity

with longer banking relationships. For medium-term relationships, the loan maturity first decreases slightly before it starts increasing with longer banking relationships. The finding does not seem to square well with the extant theories.

More interestingly, when the banking relationship is short-term, the maturities for intermediate-risk firms are significantly

longer than those for low- and high-risk firms by about seven years, but the maturities sharply decrease after the relationship extends for more than one year, only starting to increase again as the relationship extends for more than ten years. This may imply that firms with intermediate risks choose shorter-term loans since durable banking relationships reduce information asymmetry and there is less difficulty in revolving loans in the future. In contrast, consistent with the predictions by Flannery (1986) and Diamond (1991), the maturity terms of high-risk firms monotonically increase with longer banking relationships.

MULTIVARIATE REGRESSION RESULTS

In this section, I formally test the findings of the previous section by estimating multivariate regression models.

Table 2 reports the results from the baseline weighted regressions of equation (1). The first column of table 2 presents the results for all types of bank loans. As specified in equation (1), the coefficients for 'LowRisk (D&B score 5-6)' and 'HighRisk (D&B score 1-2)' capture the effect of risk ratings on loan maturity in the absence of a banking relationship. The results reveal that consistent with the univariate comparisons in the previous section, loan maturity terms are a nonlinear function of risk ratings under information asymmetry. Specifically, t-tests show that both low- and high-risk firms borrow on a shorter-term basis than intermediate-risk firms, which is consistent with the prediction of Diamond's model but contrary to the prediction of Flannery's model. The coefficients of the variables LowRisk and HighRisk are –0.979 and –0.934 respectively, and those coefficients are statistically significant at the level of 0.01. These results are inconsistent with the findings of Berger et al. (2005), who found that loan maturity is a monotonically increasing function of risk ratings. In particular, Berger et al. (2005) assume that banks that do not employ risk rating technology face acute information asymmetry, and therefore the loans that such banks offer should have maturities that are monotonically increasing in risk ratings. Unlike Berger et al. (2005), I focus on the lack of a prior banking relationship between lenders and borrowers, and my results show that loan maturity is a non-

Table 2. The Interactive Effects of Risk Ratings and Banking Relationships on Loan Maturity

Dep. Var.: ln(1+Maturity)	All loans	Lines of credit	Other loans
ln(Total assets)	-0.007	0.068*	-0.039+
	(-0.40)	(2.31)	(-1.86)
ln(Firm age) (unit: years)	0.115**	0.069	0.019
	(4.07)	(1.06)	(0.61)
ROA	-0.006	-0.014**	-0.016**
	(-1.51)	(-2.77)	(-3.22)
Cash to assets	-0.048	-0.683*	0.007
	(-0.44)	(-2.29)	(0.06)
Outside debt to assets	-0.049**	0.094*	-0.064**
	(-3.58)	(2.32)	(-4.05)
ln(1+banking relationship)	-0.275**	-0.406**	-0.253**
	(-10.99)	(-8.72)	(-7.51)
LowRisk (D&B score 5-6)	-0.979**	-2.288**	-0.648**
	(-4.51)	(-7.13)	(-3.43)
HighRisk (D&B score 1-2)	-0.934**	-1.612**	-0.456**
	(-5.82)	(-5.96)	(-2.80)
LowRisk × ln (1+banking relationship)	0.232**	0.508**	0.170**
	(3.93)	(6.86)	(3.12)
HighRisk × ln(1+banking relationship)	0.258**	0.343**	0.185**
	(6.35)	(5.13)	(4.18)
Loan type fixed effects	Yes	No	Yes
2-digit SIC Industry fixed effects	Yes	Yes	Yes
Adjusted R^2	0.516	0.519	0.585
Number of obs.	2,458	817	1,641

The dependent variable for regressions is log of one plus maturity. Banking relationship refers to the period of time (in years) the first banking service was provided to a borrowing firm. The first column is a regression of all types of loans; the second column is a regression of lines of credit; the third column is a regression of other loans such as equipment loans, motor loans, (commercial) mortgage loans and capital leases. Robust t statistics are in parentheses. * and ** indicate statistical significance at 0.05 and 0.01 respectively.

monotonic function of risk ratings, particularly without durable banking relationships. This finding supports Diamond's prediction that the observed debt maturity is determined by both

the maturity choice of a borrowing firm and loan approval/rejection by a potential lender, especially for firms with high credit risks.

To check robustness, I estimate the baseline regressions for lines of credit and other types of loans separately. As can be seen in the second and third columns of table 2, the coefficients for 'LowRisk (D&B score 5-6)' and 'HighRisk (D&B score 1-2)' are negative regardless of loan types, but those for lines of credits are more significant than those for other types of loans. This is consistent with Berger and Udell (1995), who argue that lines of credit are more likely to be affected by the lack of borrower-specific private information than other types of loans.

The multivariate results may be affected by a multicollinearity problem due to the strong correlation between **relationship** and the interaction between **relationship** and the dummy variables for risk ratings. For instance, the correlation between **LowRisk** and **LowRisk**$\times$**Relationship** is 0.91, which is the highest among the correlation coefficients between explanatory variables. To avoid this potential problem, I examine the effect of risk ratings for sub-samples with different durations of banking relationships. First, I sort the small-firm loans based on the length of banking relationships and then assign the loans into four groups. The first column of table 2 presents the results for firms with short-term banking relationships, defined as those that started at most one year before loan applications. The result provides strong evidence of non-monotonic relationships between risk ratings and loan maturities. The last three columns of table 2 provide the results from regression estimates of Eq. (1) for banking relationships of more than one year. All the coefficients for 'LowRisk (D&B score 5-6)' and 'HighRisk (D&B score 1-2)' substantially shrink and become statistically insignificant at the 0.05 level, except the coefficient for high-risk ratings for firms with relationships of between five and ten years. To summarize, even after controlling for multicollinearity I found that the qualitative results of the multivariate regression remain intact.

I also explored the role of durable banking relationships. The first column of table 2 shows that the coefficients for the interaction terms between banking relationship and the dummy variables for high-and low-risk ratings are positive and significant at the 0.01 level, while the coefficient for banking

Table 3. (Robustness Tests) Evolution of Link between Maturity and Risk (Ratings)

Dep. Var.: ln(1+Maturity)	Banking Relationship			
	Dur. ≤ 1yr	1yr<Dur. ≤ 5yrs.	5yrs.<Dur. ≤ 10yrs.	10yrs < Dur.
ln(Total assets)	-0.149**	0.088**	0.210**	0.166**
	(-5.07)	(4.55)	(20.13)	(7.34)
Ln(Firm age) (unit: years)	0.178**	0.295**	-0.046	0.155*
	(3.33)	(8.02)	(-1.09)	(2.50)
ROA	-0.013**	0.007	-0.056*	-0.009
	(-2.61)	(0.16)	(-2.46)	(-1.53)
Cash to assets	-0.704**	-0.096	-0.591**	2.371**
	(-3.93)	(-0.52)	(-3.01)	(9.21)
Outside debt to assets	-0.074**	0.040	0.082	-0.057*
	(-5.18)	(0.89)	(0.89)	(-2.04)
LowRisk (D&B score 5-6)	-0.879**	0.335**	-0.153	-0.171
	(-6.25)	(4.06)	(-1.44)	(-1.39)
HighRisk (D&B score 1-2)	-0.709**	0.156	-0.244*	0.003
	(-5.13)	(1.54)	(-2.24)	(0.02)
Loan type fixed effects	Yes	Yes	Yes	Yes
2-digit SIC Industry fixed effects	Yes	Yes	Yes	Yes
Adjusted R^2	0.971	0.981	0.985	0.962
Number of obs.	569	593	487	809

The dependent variable for regressions is log of one plus maturity. Banking relationship refers to the period of time (in years) the first banking service was provided to a borrowing firm. "Dur" stands for "relationship duration," which measures the number of years after the first banking service was provided to a small business. Robust t statistics are in parentheses. * and ** indicate statistical significance at 0.05 and 0.01, respectively.

relationship, which captures the impact of a longer relationship for intermediate-risk firms, is negative and statistically significant at the 0.01 level. To be precise, the first column of table 2 shows that $= \partial \ln(1+\text{macurity})/\partial \ln(1-\text{banking reltionship}) = -0.275 - 0.232 \times \text{LowRisk} + 0.258 \times \text{HighRisk}$ implying that, for low risk ratings, the log maturity sensitivity to log banking relationship is –0.043(= –0.275+0.232); for high risk ratings, –0.017(= –0.275+0.258); for intermediate risk ratings,

–0.275 (which is significant at 0.001). In other words, for low- and high-risk borrowers, the effect of the banking relationship is insignificant on average, whereas for intermediate risk borrowers, loan maturity significantly decreases with banking relationships.

In summation, considering all types of loans, I find no statistically significant evidence that debt maturity increases with banking relationship (at the conventional levels). However, lines of credit show some economic significance: the coefficient for the lending relationship is 0.102 (=–0.406+0.508) for low-risk borrowers (its p-value is 0.13), whereas the coefficient is –0.063(= –0.406+0.343) for high-risk borrowers (p-value is 0.195), weakly consistent with the prediction by Diamond (1991). These results are also consistent with Berger and Udell (1995)'s claim that the proprietary information gathered through durable banking relationships mainly affects "the price and nonprice terms of lines of credit," which are more information-sensitive than other types of loans.

Interestingly, regardless of type of loan, the maturity for firms with intermediate risk ratings significantly decrease with longer banking relationships, seemingly contradicting the informational role of the banking relationship. This may occur because at lower levels of information asymmetry, intermediate-risk firms can more easily roll over their short-term loans and also shorten their loan maturity terms to avoid higher interest charges for long-term debt. A full analysis of this conjecture is beyond the scope of this paper.

ROBUSTNESS TESTS

In this section, I attempt to check the robustness of the main findings further. I raise two potential problems in the previous specifications and check the robustness of the main results.

First of all, if the majority of the information from the Dun & Bradstreet credit rating is in fact the same as accounting information that is included in the empirical specifications, the main findings may suffer from a multicollinearity problem. Furthermore, even in the absence of extreme multicollinearity, if much of the information from the D&B credit ratings comes from

Table 4. Credit Ratings and Borrower Characteristics

	Total assets	Firm age	ROA	Cash	Outside debt	Banking Relationship	Low Risk	High Risk
Total assets	1							
Firm age	**0.3076**	1						
ROA	**-0.0669**	**-0.0558**	1					
Cash	**-0.3694**	**-0.1050**	**-0.0540**	1				
Outside debt	**-0.2332**	-0.0323	**-0.5517**	**0.1752**	1			
Banking Relationship	**0.1541**	**0.2832**	**-0.0685**	-0.0215	0.0117	1		
LowRisk (D&B score 5-6)	**-0.1534**	**-0.1154**	0.0175	**-0.076**	0.0222	**-0.1269**	1	
HighRisk (D&B score 1-2)	**0.0601**	**0.1966**	-0.0030	0.0763	-0.0219	0.1259	-0.3769	1

The bold numbers indicate the correlation coefficients that are statistically significant at 0.10.

the same information contained in the other control variables, it can be difficult to interpret the effects of the credit rating. For instance, firm size proxied by total assets can be a dominant factor in determining credit rating. After controlling for the effect of total assets, the impact of credit rating on loan maturity will capture only the additional credit information that is economically less important. To investigate whether these potential problems drive the main findings, I report the correlations between the risk rating dummies and control variables included in the main specifications (see table 4). Consistent with the conjecture, Dun & Bradstreet credit rating appears to be significantly correlated with firm size, firm age and banking relationship. Although the estimated correlations are not perfect, the correlations can somehow contaminate the results. To avoid this concern, I reestimate the results of table 2 without controlling for borrower characteristics. Table 5 presents the results. The qualitative results remain the same.

Secondly, the main findings may suffer from an omitted variable problem. In particular, bank loans can include restrictive clauses such as call or put features. Call (or put) features imply that the realized debt maturities can be different from the maturities reported in the SSBF. Despite the importance of the issue, the SSBF does not provide detailed

Table 5. (Robustness) Credit Rating and Banking Relationship without Controls

Dep. Var.: ln(1+Maturity)	All loans	Lines of credit	Other loans
ln(1+banking relationship)	-0.232**	-0.303**	-0.236**
	(-9.91)	(-7.99)	(-7.67)
LowRisk (D&B score 5-6)	-0.879**	-1.972**	-0.581**
	(-3.91)	(-6.07)	(-3.07)
HighRisk (D&B score 1-2)	-0.798**	-1.282**	-0.446**
	(-5.06)	(-5.23)	(-2.75)
LowRisk × ln(1+banking relationship)	0.210**	0.418**	0.159**
	(3.41)	(5.76)	(2.90)
HighRisk × ln(1+banking relationship)	0.234**	0.251**	0.186**
	(5.79)	(4.08)	(4.21)
Adjusted R^2	0.508	0.494	0.581
N	2,458	817	1,641

The dependent variable for regressions is log of one plus maturity. Banking relationship refers to the period of time (in years) the first banking service was provided to a borrowing firm. The first column is a regression of all types of loans; the second column is a regression of lines of credit; the third column is a regression of other loans such as equipment loans, motor loans, (commercial) mortgage loans and capital leases. Robust t statistics are in parentheses. * and ** indicate statistical significance at 0.05 and 0.01, respectively.

information about call/put features. Instead, it provides information on loan amounts and collateral requirements. The introduction of restrictive covenants may be endogenously determined by loan amount and collateral requirement. Large loans are more likely to strengthen monitoring incentives and require stronger protections including call features. On the other hand, collateral requirements can provide strong protection, replacing other restrictive covenants. These possibilities suggest that controlling for the loan characteristics can help to mitigate the potential bias by failing to control for detailed restrictive covenants. If the main findings are affected sharply by controlling for collateral requirements and loan amounts, I can conjecture that the bias from omitting restrictive clauses can be substantial. I check the robustness of the main findings by reestimating the results after controlling for log of loan amount and a dummy variable for collateral (see table 6). The main

Table 6. (Robustness) Loan Characteristics, Credit Rating and Banking Relationship

Dep. Var.: ln(1+Maturity)	All loans	Lines of credit	Other loans
ln(Total assets)	-0.133**	0.019	-0.137**
	(-5.45)	(0.53)	(-5.36)
ln(Firm age) (unit: years)	0.089**	0.070	0.009
	(3.47)	(1.08)	(0.29)
ROA	-0.011**	-0.016**	-0.012**
	(-3.03)	(-3.21)	(-2.60)
Cash to assets	-0.343**	-0.770**	-0.206
	(-3.05)	(-2.63)	(-1.68)
Outside debt to assets	-0.070**	0.088*	-0.074**
	(-4.90)	(2.03)	(-4.41)
ln(1+banking relationship)	-0.227**	-0.382**	-0.212**
	(-9.77)	(-8.16)	(-7.22)
LowRisk (D&B score 5-6)	-0.764**	-2.196**	-0.435*
	(-4.03)	(-6.85)	(-2.33)
HighRisk (D&B score 1-2)	-0.896**	-1.599**	-0.400*
	(-5.29)	(-5.84)	(-2.44)
LowRisk × ln(1+banking relationship)	0.201**	0.496**	0.127*
	(3.98)	(6.89)	(2.43)
HighRisk × ln(1+banking relationship)	0.225**	0.325**	0.154**
	(5.44)	(4.92)	(3.72)
Collateral	0.012	-0.001	-0.030
	(0.23)	(-0.02)	(-0.44)
ln(Loan amount)	0.234**	0.093*	0.196**
	(7.40)	(2.27)	(5.47)
Adjusted R^2	0.553	0.523	0.609
N	2,458	817	1,641

The dependent variable for regressions is log of one plus maturity. Banking relationship refers to the period of time (in years) the first banking service was provided to a borrowing firm. The first column is a regression of all types of loans; the second column is a regression of lines of credit; the third column is a regression of other loans such as equipment loans, motor loans, (commercial) mortgage loans and capital leases. Robust t statistics are in parentheses. * and ** indicate statistical significance at 0.05 and 0.01, respectively.

findings remain intact.

CONCLUSION

In this study, I have tested the predictions of Flannery's and Diamond's theoretical models of debt maturity. Both theoretical models predict that risk and information asymmetry affect firms' optimal choice of debt maturity, albeit with different mechanisms. Flannery (1986) predicts that, under information asymmetry, debt maturity is a monotonically increasing function of risk, whereas Diamond (1991) predicts that it is a non-monotonic function of risk: low- and high-risk firms borrow on a shorter-term basis than those with intermediate risk.

To test the predictions of Diamond's and Flannery's models, this study focuses on the role of the banking relationship in loan maturity choice. Extensive literature in the topic of finance shows that, among financial institutions, banks are unique because of their ability to access borrowers' proprietary information through durable relationships. The longer the relationship between lenders and borrowers, the more the former can learn about the latter's risk characteristics, hence reducing information asymmetry and thereby benefiting both parties. Here I examine how the durable relationship affects the link between risk rating and maturity. I find that when banking relationship is relatively short, firms with low and high risk ratings tend to borrow on a shorter-term basis than firms with intermediate risk, confirming the prediction of Diamond's (1991) model but contrary to Flannery's (1986). In addition, I establish the impact of information asymmetry on the link between credit rating and loan maturity. Interestingly, (at the conventional significance levels) I find no evidence that longer business relationships lead to longer loan maturity terms for low- and high-risk firms, while for intermediate-risk firms the banking relationship is negatively correlated with loan maturity. In other words, durable banking relationship appears to weaken the impact of credit ratings on debt maturity. Overall, the findings here suggest that information asymmetry is at the core of the link between risk ratings and debt maturity.

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