# The relation between borrower risk and loan maturity in small business lending

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**Abstract**

Debt maturity is an important element in financial contracting that ultimately affects the borrower's financial flexibility and financing costs. We investigate the relation between borrower risk and loan maturity in small business lending which represents a well-suited institutional environment to study financial contracting under asymmetric information. Analyzing data on new loan approvals and renewals made by a German bank in 2005, we find a robust, significantly positive and monotonic risk-maturity relation. This relation is stronger for loans granted under relatively high asymmetric information and weaker if borrower bargaining power is high. Our results are consistent with theoretical models on adverse selection and the view that relationship lenders concede favorable loan terms to those borrowers that are most likely to need a "helping hand".

JEL classification: G20, G21, G32

Key words: Relationship lending; Debt maturity; Asymmetric information; Bargaining power

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## 1. Introduction

Lenders need to find appropriate mechanisms to deal with risks arising from asymmetric information in financial contracting. Adverse selection and moral hazard can be restricted by means of debt contract terms, by investing in information production, or both. Perhaps, the most important terms of debt contracts are the amount, price, collateral (including covenants), and maturity. While there are many studies investigating how borrower risk influences the availability of credit, loan rates and collateral (e.g., Petersen and Rajan, 1995; Berger and Udell, 1995; Elsas and Krahnen, 1998; Machauer and Weber, 1998), there is very little research that directly analyzes the relation between borrower risk and debt maturity. Maturity is of key importance because it ultimately affects the borrower's financial flexibility and financing costs. This paper provides extensive evidence in favor of two complementary hypotheses that both suggest a positive relation between borrower risk and loan maturity in small business lending.

The theory on the relation between borrower risk and debt maturity makes mixed predictions. Models are mainly based on signaling to overcome the adverse selection problem that may arise in the presence of asymmetric information. For example, Flannery (1986) predicts a positive and monotonic relation whereas the model of Diamond (1991) suggests a non-monotonic relation. The signaling argument implies that riskier firms borrow at longer maturities and seems to be reasonable in the case of small informationally opaque firms because the risk of adverse selection is relatively high. At the same time, relationship lending may provide a very different explanation for the same result. Borrowers can benefit from a reduction in information asymmetries over the course of a close banking relationship (Petersen and Rajan, 1995), also implying a monotonic and positive relation between borrower risk and loan maturity. Despite of the key importance of debt maturity there are no models that coherently explain maturity *preferences* or actual debt maturity *outcomes* of the bargaining process between lenders and borrowers. Empirical evidence is also mixed. For

example, Berger, Espinosa-Vega, Frame and Miller (2005) provide evidence for a significantly positive relation between borrower risk and loan maturity based on U.S. loan data while Ortiz-Molina and Penas (2008) find a negative relation using NSSBF data from the U.S. Considering theory and empirical evidence suggests that there is no "one size fits all"-explanation.

In this study, we analyze the relation between borrower risk and loan maturity in small business lending. Small firms play a significant role in many countries, promoting growth, innovation, and employment. Lending to small firms represents a particularly interesting opportunity to test theoretical models on adverse selection because these firms are considered as informationally opaque. In addition, small firms are also riskier in the sense that they exhibit considerably higher average default rates than big firms. Analyzing a recent dataset on incremental financing decisions, including all new loan approvals and renewals of commercial and industrial loans from a German universal bank in 2005, we find a robust, significantly positive and monotonic relation between borrower risk and loan maturity. Furthermore, we differentiate the analysis by the degree of asymmetric information, borrower bargaining power, and collateral. Eventually, our main findings are not changed by potential problems of endogeneity.

In contrast to previous studies, we find evidence in favor of two complementary hypotheses on the relation between borrower risk and loan maturity. First, our result is consistent with theoretical models on adverse selection and signaling for some loans (e. g., Flannery, 1986, and partially, Diamond, 1991). In this respect, our findings are similar to those of Berger, Espinosa-Vega, Frame and Miller (2005), but they are based on data from a very different institutional setting. Germany is considered as a bank-based financial system, small businesses heavily depend on borrowing from relationship lenders (Hausbanks), and there no covenants in small business lending (e.g., Elsas and Krahnen, 1998; Machauer and Weber, 1998). Our analysis reveals that loans made under high asymmetric information

exhibit a significantly shorter maturity and the risk-maturity relation becomes stronger for these loans, which is in line with the theory. Recall that theoretical models assume that a borrower knows his own type with certainty but banks cannot identify the credit quality of an individual borrower. Consequently, in the presence of asymmetric information signaling may lead to a solution. However, if banks base their lending decisions on a screening technology (credit ratings), signaling may not be the only explanation. Instead, banks typically face lending situations of varying degrees of informational asymmetries. In such an environment a bank first makes a credit risk assessment that is not based on the demanded loan maturity. Subsequently, throughout the loan contracting process the bank may also take into account the maturity demanded by the borrower. This can be interpreted as a signal (or: external validation) allowing the bank to update its a-priori-information (credit rating) by means of the observed signal (the demanded loan maturity).

Second, for other loans the positive relation between borrower risk and loan maturity can be explained with the view that risky borrowers can benefit from renegotiations with relationship lenders (e.g., Chemmanur and Fulghieri, 1994, Elsas and Krahnen, 1998). It is noteworthy that we observe particularly long maturities in the case of loans made to relatively risky borrowers under low asymmetric information. The effect becomes even stronger if the borrowers exhibit a high bargaining power. This result indicates that the bank has intensified its monitoring efforts which, in turn, can be beneficial for the borrowers, resulting in relatively long loan maturities. In other words, relationship lenders offer relaxed loan terms to those borrowers that are most likely to need a “helping hand”.

Further results are that loan maturities are longer and the risk-maturity relation is more pronounced for secured loans in comparison to unsecured loans. The relation also holds for loans made to borrowers with high and low bargaining power but it is stronger in the case of low borrower bargaining power. Repeating all analyses at the borrower level, with alternative risk measures and different regression estimation techniques confirm previous findings.

The remainder of this paper is organized as follows. Section 2 summarizes the related theoretical and empirical literature and proposes two main hypotheses. Section 3 provides institutional details on the loan contracting process and describes the data. Section 4 includes the empirical analysis and reports main findings on the relation between borrower risk and loan maturity. Section 5 presents results from various tests of robustness. Section 6 concludes.

## 2. Review of related literature and hypotheses

Subsequently, we briefly outline theoretical models on the relation between borrower risk and debt maturity in the presence of asymmetric information (and the problem of adverse selection[1]), then turn to related empirical studies, and finally propose two main hypotheses.

Flannery (1986) considers a situation in which firm insiders are better informed about the project they want to finance than the market. The choice of debt maturity may be used as a quality signal to the market under certain conditions. In this model, firms have two-period positive net present value (NPV) projects which they may finance either long-term with a debt maturity of two periods or short-term with one-period borrowing that has to be refinanced at an ex-ante unknown interest rate. There are good and bad projects, whereby project quality is the firms' private information. However, creditors can observe project performance at the end of the first period, which gives them probabilistic information on the quality of the projects since good projects have a higher probability to increase in value than bad projects. If transactions costs to roll over debt are high enough to prevent bad firms (those with unfavorable private information) from imitating good firms (those with favorable private information), a separating equilibrium may occur with good firms borrowing short-term and

[1] We do not consider potential problems arising from moral hazard, implying a negative risk-maturity relation, since these are relatively less important (in comparison to adverse selection) in small business lending. There is some evidence for a negative relation between borrower risk and loan maturity in lending to *big* firms (e.g., Guedes and Opler, 1996) where the scale and scope of moral hazard can be substantial. However, Strahan (1999), pp. 20-21, also finds that non-investment grade and unrated firms "borrow on a longer term basis than investment grade firms", which is explained with demand-side factors and consistent with our results.

rolling over debt at a relatively low interest rate and bad firms borrowing long-term at a higher rate. Bad firms are willing to accept this relatively higher rate to avoid transactions costs and a high second-period interest rate when having to roll over short-term debt. In contrast, good firms benefit from transactions costs because they can signal their good quality by choosing short debt maturity. Summarizing, Flannery (1986) predicts a *positive and monotonic* relation between borrower risk and debt maturity.

Diamond (1991) extends the previous model by adding the risk of liquidation as well as a third risk category (medium risk). The firms' debt maturity choice is based on a trade-off between the preference for short-term debt due to an expected better credit rating in the future and the risk of liquidation, i. e. the inability to roll over short-term debt. This model also considers a two-period setting in which firms may finance a two-period project either short-term or long-term. However, firms are distinguishable in the beginning and there are projects with negative NPV. In detail, there are good borrowers with favorable private information and positive NPV projects and bad borrowers with unfavorable private information and negative NPV projects. In the beginning, banks may distinguish firms by means of credit ratings[2] that reflect a firm's previous credit reputation but they do not know whether firms have positive or negative NPV projects. After one period, lenders receive new non-verifiable information about borrowers and either upgrade or downgrade their credit ratings. Accordingly, the terms for refinancing short-term debt depend on this new information. As a result, low-risk good borrowers choose short-term debt because their probability of a downgrade is low and they thus can refinance at favorable terms when good news arrives. At the same time, medium-risk good borrowers prefer long-term debt at a higher interest rate as they must fear liquidation after the first period. Bad low and medium risk borrowers will imitate these strategies because otherwise they would be identified as having projects with negative NPVs and be unable to

[2] We will use the bank's internal credit ratings as empirical proxies for borrower risk in our analysis.

receive any financing. Finally, some high risk borrowers cannot obtain long-term finance due to their high probability of having projects with negative NPVs. However, they may get short-term debt if the lender receives sufficiently high returns from liquidation after one period in the case of bad news. In summary, Diamond (1991) predicts a *nonmonotonic* relation between borrower risk and debt maturity.

Chemmanur and Fulghieri (1994) examine a situation in which firms face liquidity risk arising from financial distress. Firms have private information about their probability of financial distress and can choose between bank and publicly traded debt. If financial distress occurs, the lender has to decide whether to liquidate or renegotiate its debt. Since banks strive for a reputation as good decision makers that provide financial flexibility, they have an endogenous incentive to devote more resources than bondholders to evaluate borrowers and come to the right decision about liquidation vs. renegotiation. Thus, this model provides an argument why relatively risky firms benefit most from financing relationships with banks. It also implicitly predicts longer maturities for relatively risky borrowers as a renegotiation outcome or a preemptive device to avoid financial distress.

Empirical evidence on the relation between borrower risk and debt maturity at SMEs is rather mixed because these studies are based on different data sets and different methodologies.[3] For example, Berger, Espinosa-Vega, Frame and Miller (2005) analyze the risk-maturity relation by means of commercial and industrial loans granted to small U.S. firms in 1997. They consider bank risk ratings to proxy for borrower risk, which allows to jointly test the positive and monotonic versus nonmonotonic relation in one empirical model. They find evidence in favor of a positive relation between risk and loan maturity, which is in line with Flannery (1986) and partially consistent with Diamond (1991) for low and medium

[3] Consistent with the theory we focus on *incremental* financing decisions and do not follow the literature on debt maturity *structure* (e.g., Scherr and Hulburt, 2001; Heyman, Deloof and Ooghe, 2003). This approach has the advantage that contract terms are more easily identified and the problem of averaging all outstanding debt financing decisions over time and across contract types is avoided (Dennis, Nandy and Sharpe, 2000).

risk borrowers. Moreover, Ortiz-Molina and Penas (2008) analyze new credit lines of small U.S. firms (NSSBF 1993 data). They find a negative and monotonic relation between borrower risk and loan maturity, relying on an accounting measure (firm and owner delinquency) to proxy for firm risk.

Based on this literature, we propose two main hypotheses, providing two complementary explanations for the relation between borrower risk and loan maturity. Following Flannery (1986) we argue that signaling may help to overcome the problem of adverse selection if asymmetric information is relatively high.

*H1 (Signaling): There is a positive and monotonic relation between borrower risk and loan maturity if asymmetric information is relatively high.*

Moreover, close bank-firm relationships (relationships with Hausbanks) lead to the prediction that riskier firms borrow at longer maturities. Because of their informational advantage relationship lenders are more willing to provide long-term funding than arm's length lenders to help these borrowers through times of economic problems. Interestingly, this explanation differentiates low-risk from high-risk borrowers because the latter are more likely to need a "helping hand". Note that this argument is very different from H1 although the predicted outcome is exactly the same. We argue that signaling is not a reasonable explanation in lending situations where asymmetric information is relatively low.

*H2 ("Helping hand"): There is a positive and monotonic relation between borrower risk and loan maturity if asymmetric information is relatively low because high-risk firms benefit most from borrowing from relationship lenders.*

## 3. The institutional background and data

### 3.1. Institutional information on the loan contracting process

To get insights on the subsequent steps in the loan contracting process in small business lending, we have conducted informal interviews with loan officers from the bank that

provided the data and with other bankers. This is an important issue because we need to take into account potential problems of endogeneity as well as the influence of bargaining power in the subsequent empirical analysis.

Loan negotiations in small business lending work generally as follows. First of all, the bank assigns internal credit ratings to its borrowers. These credit ratings are based on financial and, if available, private and soft information (e.g., Elsas and Krahnen, 1998; Machauer and Weber, 1998; Treacy and Carey, 2000; Grunert, Norden, and Weber, 2005). When a borrower approaches the bank, having in mind the purpose of the loan, he may ask for a specific loan amount and maturity (both amount and maturity should be highly dependent on the purpose of the loan). The loan officer then compares the a priori risk assessment reflected by the internal credit rating with the borrower's demanded maturity. Consequently, the maturity choice can be seen as an external signal in this stage of the negotiations and may allow the loan officer to update his decisions about other loan terms. Importantly, loan officers of the bank that provided us with the data do have discretionary power to exploit the signal from the borrower's maturity preference. This bank behavior is consistent with Cerqueiro, Degryse and Ongena (2007) who find that loan officers have more discretion in the loan-pricing process if firms are small, risky and difficult to monitor. Based on the credit rating, the loan amount and the loan maturity, the bank negotiates with the borrower on collateral and, finally, both parties agree on the loan rate. We will consider potential problems of endogeneity later in our analysis.

In addition, the bargaining power of the borrower is an important factor that may influence the outcomes for the various loan contract terms. Since measuring bargaining power in loan contracting is highly challenging it has been largely neglected in the existing literature. We believe that the price of a loan (which we will define as SPREAD in the next section) represents a potential indirect ex-post indicator of borrower's bargaining power for the following reasons. First, in most of the loan negotiations the spread represents usually the

*last* contract feature to be determined. The main reason for this is that the loan spread is initially based on the borrower risk reflected by the internal credit rating only and then adjusted conditional on the amount of collateral that is pledged by the borrower (i.e. the final spread is calculated *after* the credit rating process and *after* a decision on collateral has been made). Second, the loan spread allows for negotiation in both directions and borrowers are less constrained in bargaining on interest rates than in bargaining on collateral. Frequently, there is little or no room for small businesses to pledge additional collateral to obtain a lower interest rate simply because all available collateral has already been pledged to banks. Third, competition in bank lending is typically based on loan rates and volumes but not on other lending terms like maturity and collateral. Fourth, interest payments affect the financial statements of firms and, for example, the interest coverage represents an important financial ratio that affects the bank's loan approval decision. Consequently, borrowers with a relatively high bargaining power are expected to get relatively low loan spreads (and/or to pledge little collateral). We condition our subsequent analysis of the relation between borrower risk and loan maturity on three measures of borrower bargaining power that are based on the above reasoning.

### 3.2. The data and main variables

Our data set consists of all new loans and renewals to small businesses[4] from a German universal bank[5] during 2005. The total volume of these loans amounts to 86.1 million Euros which corresponds to approximately 10% of the bank's entire commercial lending portfolio. The data set includes timely information on the borrower risk, further borrower

[4] There are two standard definitions for micro and small businesses: Either firms with less than 10 employees and annual sales of less than 1 million Euros (Institut für Mittelstandsforschung Bonn, 2004) or firms with less than 50 employees and annual sales of less than 10 million Euros (Kommission der Europäischen Gemeinschaften, 2003).

characteristics, and loan contract terms. We exclude all consumer loans and all observations with missing data for relevant variables. This procedure leads to a final sample of 668 loans, hereof 297 new and 139 renewed loans to small businesses with unlimited liability, as well as 180 new and 52 renewed loans to small businesses with limited liability. Our sample is comparable in terms of size to Brick and Palia (2007) who analyze data on 766 credit lines from the 1993 National Survey of Small Business Finances (NSSBF). However, we analyze commercial and industrial (term) loans and do not analyze credit lines and loan commitments because their nominal maturity is typically either short term (e.g., 6 or 12 months) or not specified whereas the effective maturity may be relatively long since credit lines are frequently rolled over. We are also aware of the apparent limitation that our data comes from a single bank. Nevertheless, this fact may actually have the advantage that the lending behavior is relatively homogeneous, i.e. we do not need to control for heterogeneity in loan supply between banks which is a standard problem when using the NSSBF data because it neither reveals the identity of the lending banks nor includes any bank characteristics.

The main dependent variable in our analysis is the nominal maturity of each single loan measured in months as stipulated in the loan contract (MATURITY). The key explanatory variable is borrower risk that we measure by means of the most natural empirical proxy: the bank's internal credit ratings (RATING). The bank's internal credit rating system consists of rating categories from grade 1 being the highest creditworthiness to grade 5 including borrowers in financial distress (the borrower is 90 days past due on any of his obligations, the bank has established a specific loan loss provision or the borrower has filed for bankruptcy). Taking the internal credit rating as a measure of borrower risk has several advantages. Most important, the rating is not part of the loan contract and it is assigned *before* the bank

[5] The bank, which requests to stay anonymous, is among the largest 5% by total assets in the category of similar banks, as defined by the Deutsche Bundesbank. The credit portfolio is representative for small business lending in Germany.

negotiates the loan maturity and the amount of collateral with the customer. Accordingly, the rating can be seen as a predetermined (or exogenous) variable in comparison to loan maturity. This interpretation is consistent with literature on the determinants of lending terms (e.g., Dennis, Nandy, and Sharpe, 2000), using Altman's Z-Score as a predetermined variable. Second, the bank includes public and private as well as hard and soft information into the rating (e.g., Grunert, Norden, and Weber, 2005) and uses the latter systematically for all loan approval decisions, loan pricing and loan loss provisioning (e.g., Elsas and Krahnen, 1998; Machauer and Weber, 1998). Although rating grade 5 refers to borrowers in financial distress, we include these observations in our analysis for the following reason. The fact that these firms obtain new loans or renewals indicates that the bank is engaged in a restructuring process and that it expects recovery from distress in the medium-term.

In addition to the credit ratings we include borrower characteristics like age (AGE_LOW), the duration of the bank-firm relationship (DUR), the existence of a checking account with the same bank (CHECK), the contribution of each borrower to the bank's overall loan portfolio (CLUSTER), and an indicator variable for unlimited liability (LIAB) as control variables in our analysis. Further loan contract terms are included in an augmented regression model to study the robustness of our baseline results. For example, NEW indicates new loans (vs. renewals). AMOUNT measures the amount of a single loan in Euros. COL indicates the value of the collateral relative to the loan amount (the secured percentage of the loan). SPREAD is the maturity-adjusted loan spread, i.e. the loan rate minus a same-maturity risk-free interest rate. FIX is a dummy variable that equals one if the loan's interest rate is fixed and zero if it is floating; BUL is a dummy variable indicating bullet loans; TRANS is a dummy variable which indicates whether the loan is a start up, development or special purpose loan initiated under a federal development bank program (e.g., Kreditanstalt für Wiederaufbau (KfW)). BUILD is a dummy variable indicating whether the loan is used for building and construction purposes. Unfortunately, we cannot exploit the purpose of the loan

because there is little cross-sectional variation on the purpose of the loan (81.74% of all loans are investment loans). Table 1 reports summary statistics.

Insert Table 1 here

Panel A indicates that the mean internal credit rating is 2.58. The mean duration of the bank-borrower relationship DUR is 5.4 years, 52% of the loans are granted to borrowers having a checking account with the bank, 8% of the loans are granted to borrowers that are among the top 10% largest borrowers of the bank, and 65% of the loans in our sample are granted to firms with unlimited liability. The mean loan maturity MATURITY amounts to 83 months (6.9 years) and the median is 55 months. Moreover, 71% are new loans. The mean loan amount AMOUNT is 129,044 Euros (maximum of 3.1 million Euros) which is close to other empirical studies on small business lending. For comparison, the mean loan size in the U.S. dataset analyzed by Berger, Espinosa-Varga, Frame, and Miller (2005) is 43,580 USD (for loans < 100,000 USD) and 183,720 USD (for loans < 250,000 USD). On average, 46% of a loan amount is secured with collateral (the maximum is slightly above 100% because in five cases the bank has collateral that exceeds the loan amount). Since MATURITY, DUR, and AMOUNT exhibit a strongly skewed distribution, we take the natural logarithm of these variables in all subsequent analyses. Finally, the mean loan spread is 2.48 percentage points above the bank's same-maturity refinancing costs (while six new loans and six renewals exhibit negative spreads).[6]

Panel B reports the mean and median loan maturity, the duration of bank-borrower relationship, the existence of checking account, the secured percentage of loan and the spread,

[6] Micro and small businesses are usually considered as non-investment grade borrowers. The corresponding average credit spreads on loans granted to borrowers with a S&P credit rating of BB (B) in 2005 are 1.84 (2.60) percentage points over Libor which is relatively close to the spreads we observe in our data set.

differentiated by rating. Most importantly, it can be seen that the relation between borrower risk and loan maturity is positive and monotonic for the entire sample. A non-parametric Wilcoxon rank sum test indicates that differences between adjacent rating grades are significantly different when comparing maturities for RATING1 vs. RATING2, RATING3 vs. RATING4, and RATING4 vs. RATING5. Maturities between RATING2 and RATING3 are not significantly different at conventional levels (p-value = 0.2761). Also note that risky borrowers exhibit a relatively long duration of their banking relationships and are more likely to have a checking account.

As stated in our two main hypotheses, we differentiate the analysis by the extent of asymmetric information. To test how the relation between borrower risk and loan maturity varies across high and low levels of asymmetric information, we proceed as follows. We consider the duration of the bank-borrower relationship (DUR), the existence of a checking account (CHECK[7]), and the type of the loan (NEW) as potential indicators for the extent of asymmetric information. Although NEW refers to the loan level and is not a borrower characteristic as the other indicators, it captures some details on the extent of informational asymmetries. In the case of a loan renewal there has already been interaction between the bank and the borrower with respect to the financing of a specific project. Moreover, cash flows from the project have been realized and the bank may draw better conclusions on the project quality. Comparing the relative importance of these variables, we believe that the duration of the bank relationship is the key variable while the other two indicators mainly matter in combination with duration. For example, a long duration may be useful for the bank to accumulate information of the borrower (e.g., Petersen and Rajan, 1995; Boot, 2000).

[7] We have also considered the variable NEAR (=1 if a borrower's domicile is within a radius of 10 kilometers around the bank's head office; e.g., Degryse and Ongena, 2005). However, the variables NEAR and CHECK exhibit a Spearman rank correlation coefficient of 0.83 ($p<0.001$), i.e. borrowers with a domicile near to the bank are most likely to have a checking account with the bank (and vice versa). Therefore, we consider only one of these variables (CHECK) in the subsequent multivariate tests. A differentiation by checking accounts with or without credit lines leads to results that are very similar to the reported ones.

However, the usefulness of duration may be considerably increased if the borrower has a checking account with the bank since there is theory and empirical evidence that this information is valuable for monitoring existing borrowers (e.g., Mester, Nakamura, and Renault, 2007; Norden and Weber, 2007). There is also evidence that borrowers are more likely to have checking accounts with and use information-intense financial services from their Hausbank (e.g., Elsas, 2005; Berger, Miller, Petersen, Rajan, and Stein, 2005). In addition, making a new loan to a new borrower implies a higher extent of asymmetric information than making a new loan to a standing, well-known customer. Based on these arguments we construct a multi-attributive index to differentiate between loans made under relatively high and low asymmetric information. The main advantage of this approach is that we can condition our analysis on a compact measure that is based on several input factors instead of reporting univariate relationships. Taking into account the importance of DUR, we decide to multiply an indicator variable for short duration (SHORTDUR = 1 if the duration of the firm-bank relationship is below the median duration in our sample) with the sum of indicators for no checking accounts and new loans to obtain ASYINFO.[8]

$$\text{ASYINFO} = \text{SHORTDUR} \times [(1 - \text{CHECK}) + \text{NEW}] \qquad (1)$$

ASYINFO can take values of 0, 1, 2, and higher values indicate a higher extent of asymmetric information. The rank correlation between the three input variables ranges from 0.2 ((1 – CHECK vs. NEW) to 0.5 (SHORTDUR vs. NEW), indicating a positive but not a perfect correlation. Multiplying by SHORTDUR implies that this variable serves as a knockout criterion, i.e. in case of long durations (SHORTDUR = 0) we always assume a low

[8] Note that ASYINFO is based on variables that are not included in the bank's internal credit ratings. Moreover, note that we do not include AGE_LOW in this context since the duration of a firm-bank relationship is a more precise proxy.

informational asymmetry.[9] Lacking quantitative information on the relative importance of these factors, we apply equal weights.

Finally, as argued in Section 3.1, the bargaining power of the borrower may be a further factor that influences the risk-maturity relation. If the borrower has a relatively low bargaining power in comparison to the bank, it is likely that there is a strong relation between borrower risk and loan maturity. In contrast, if the borrower has a relatively high bargaining power, this relation should be mitigated or disappear completely. We believe the loan spread to be an indirect ex-post measure of borrower bargaining power. Consequently, we compare the individual loan spreads of all borrowers with the average loan spreads per rating grade and construct an indicator variable (POWERSPREAD) that is one if the loan spread is below the mean loan spread of the same rating grade. We acknowledge that POWERSPREAD is not an ideal proxy but we believe that this measure captures, at least, *partial effects* from bargaining in loan contracting. In addition, we calculate POWERCOL which takes a value of one if COL is below the mean of COL in the same rating grade. Finally, we study the extreme case by combining POWERSPREAD and POWERCOL to POWERTOTAL. This variable differentiates between loans with below-mean spreads and below-mean collateral in the same rating grade (very high bargaining power) vs. loans with above-mean spreads and above-mean collateral in the same rating grade (very low bargaining power).

## 4. Empirical Analysis

### 4.1. Univariate results

In a first step we study the relation between borrower risk and loan maturity by means of univariate tests. We expect to find support for Hypothesis H1 (signaling) in the case of high

[9] Alternatively, we have also calculated a simpler, additive index by summing up the dummy variables. Conditioning the risk-maturity relation on this index leads to similar results as ASYINFO and does not change our conclusions.

asymmetric information whereas Hypothesis H2 ("helping hand") is expected to be more appropriate in the case of low asymmetric information. Recall that both hypotheses predict a positive relation between risk and maturity but the rationale for the positive relation is very different. In addition to asymmetric information, we condition our tests on a measure of borrower bargaining power that may affect the risk-maturity relation. Table 2 reports the mean maturity and mean credit rating for the four lending situations defined by our measures ASYINFO and POWERSPREAD in a two-by-two matrix. We also display the Spearman rank correlation coefficient and an estimated slope coefficient from a bivariate OLS regression for the relation between credit ratings and loan maturity.

Insert Table 2 here

This analysis reveals several noteworthy insights. Starting in the upper left cell, we observe a relatively short mean loan maturity of 41 months and a mean rating of 1.98. Consistent with Hypothesis H1, the relation between borrower risk and loan maturity is highly significant and positive. The signaling argument underlying H1 may be a reasonable explanation in this situation since asymmetric information is relative high and borrower bargaining power is low. Turning to the upper right cell, we notice an increase in the mean loan maturity to 62 months and a deterioration of the rating. However, there is no significant relation between risk and maturity anymore. We argue that this effect may arise from borrower bargaining power, leading to correlation and slope coefficients that are not significantly different from zero. In this situation, almost all borrowers manage to obtain relatively long maturities, i.e. the difference in maturities between low-risk borrowers and high-risk borrowers disappears.[10] Turning to the lower left cell, there is a further increase in

[10] This finding may also be driven by the fact that most observations are clustered on rating grades 2 and 3 while there a very few observations in rating grades 1, 4, and 5.

the mean loan maturity to 83 months (and a further decrease in the rating). Here, we observe a significantly positive relation between borrower risk and loan maturity. Finally, the lower right cell exhibits the longest mean loan maturity with 138 months and the worst mean rating. Interestingly, consistent with the upper row, the relation between borrower risk and loan maturity in the lower row becomes weaker when moving from low to high borrower bargaining power. Also note that pair-wise differences between the mean loan maturities in the four lending situations are all significant at the 0.01-level (Wilcoxon rank sum test).

In summary, consistent with the signaling argument (H1), the relation is stronger if asymmetric information is high and borrower bargaining power low. Moreover, the riskiest borrowers obtain the longest maturities if there is low asymmetric information, consistent with theoretical predictions that risky borrowers can benefit most from relationship lenders (H2). Finally, an increase of borrower bargaining power weakens this relation because more borrowers get loans of longer maturities.

### 4.2. Multivariate analysis and baseline results

We now analyze the empirical relation between borrower risk and loan maturity by means of multivariate regression models. Specifically, we proceed as follows. First, we estimate cross-sectional OLS regression models to investigate the basic link between borrower risk (measured by dummy variables RATING = {RATING2, …, RATING5} for the internal credit ratings, RATING1 serves as a reference category) and the natural logarithm of loan maturity MATURITY (Model I). Second, we re-estimate Model I augmented by control variables for borrower characteristics. Third, we extend Model II by also including further loan contract variables (Model III). The stepwise regression model has the following specification:

$$\text{Ln(MAT)}_i = \beta_0 + \beta_1 \text{RAT}_i + \beta_2 \text{Borrower Characteristics}_i + \beta_3 \text{Loan Contract Terms}_i + \varepsilon \qquad (2)$$

As discussed earlier, we are well aware of potential endogeneity problems and its consequences for the estimated coefficients and standard errors. However, note that Model I and II show the *unbiased* effects of the risk variable RATING (because we do not include other loan contract terms) while all estimates in Model III may be biased because of a potential endogeneity problem. Consequently, the specification in Model III can be seen as a robustness check of Model II (this argument has been made in many other studies; e.g., Berger and Udell, 1995; Degryse and Ongena, 2005; Berger, Espinosa-Vega, Frame and Miller, 2005; Ortiz-Molina and Penas, 2008). In addition, as outlined in Section 3.1 it is reasonable to assume that there is a certain order in the loan contracting process, i.e. not all contract terms are determined simultaneously. We refrain from estimating a simultaneous equation model because in the case of loan contracting it is very difficult to find adequate and reliable instrumental variables. Table 3 reports the basic results for the entire sample.

Insert Table 3 here

Model I clearly indicates a significantly positive and monotonic relation between borrower risk, measured by RATING, and loan maturity. Note that the coefficients of the dummy variables for all rating grades are highly significant and increase when moving to lower grades. Model II which additionally includes the borrower characteristics DUR, AGE_LOW, CHECK, CLUSTER, and LIAB as control variables confirms findings from Model I. Moreover, when we also include further loan contract terms, we observe that the significantly positive risk-maturity relation persists. Note that the coefficients of the control variables LIAB and CHECK are statistically significant in Models II and III. Unlimited liability as well as the existence of a checking account with the bank allows the borrower to

obtain loans of a relatively long maturity. The strong positive influence of duration detected in Model II disappears in Model III due to the correlation with further loan contract terms.[11]

In a next step, we deepen the previous analysis to gain first insights on factors influencing the relation between borrower risk and loan maturity. For this purpose, we re-estimate the Models II and III from Table 3 on various subsamples. Specifically, we differentiate by loan type (new vs. renewal) and collateral (unsecured vs. secured loans) since both of these factors capture some extent of the informational asymmetry in a bank-borrower relationship. We first calculate some descriptive statistics. For different loan types, we find that loan maturity is significantly lower for new loans than for renewals at the 0.01-level (means: 59 vs. 143 months, medians: 47 vs. 108 months). Moreover, the mean credit rating is 2.37 for new loans and 3.12 for renewals indicating that riskier borrowers have less new loans. Analyzing the risk-maturity relation for unsecured (COL = 0%) and secured loans (COL > 0%), we observe that loan maturity is significantly higher for secured loans than for unsecured loans at the 0.01-level (means: 101.26 vs. 60.51 months, medians: 61 vs. 47 months). Besides, the mean credit rating of secured loans amounts to 2.54 and is significantly different from that of unsecured loans which is 2.63 (p-val. = 0.058).

We now turn to multivariate regression results that are reported in Table 4.

Insert Table 4 here

Panel A shows that there is a significantly positive relation between risk and maturity for both new loans and renewals (except for RATING4 in the case of loan renewals). This is in line with Hypothesis H1 for new loans. Since there has not been any interaction between the

[11] We have also conducted regressions by the borrower's legal form (unlimited vs. limited liability) and by loan size (small vs. big loans, based on a median split) and find a positive and monotonic risk-maturity relation in all subsamples except for the extended model (with further loan terms included) in the case of limited liability.

bank and the borrower on the financing of this specific project, asymmetric information is higher for these loans and signaling may be a device to overcome adverse selection. For loan renewals, the positive risk-maturity relation can be explained with Hypothesis H2. Asymmetric information is lower for these loans because the bank has accumulated information on the project quality over the course of the previous loan(s). On the basis of this informational advantage, the bank might be willing to grant relatively long maturities to risky borrowers to lower their repayment pressure. Moreover, we find that the risk-maturity relation is *stronger* for new loans. This seems plausible because loan maturity is more likely to matter if the informational asymmetry is relatively high. Recall that this is especially important in Germany where banks do not make use of covenants in small business lending.

Turning to Panel B, we investigate how the risk-maturity relation is affected by the amount of collateral pledged by borrowers. Collateral is an important device for banks to mitigate default risk and problems arising from asymmetric information (for an excellent overview see Berger, Espinosa-Vega, Frame, and Miller, 2007). Furthermore, it represents a major determinant of the recovery rate of bank loans (e.g., Basel Committee on Banking Supervision, 2006; Grunert and Weber, 2007).

The multivariate analysis yields two main findings. First, the risk-maturity link is weaker for unsecured loans (Models I and II) than for secured loans (Models III and IV). This interpretation is based on the magnitude and statistical significance of the coefficients as well as on the explanatory power of the regression models (adjusted $R^2$). Second, we find a significantly positive relation for both subsamples (except in case of RATING4 for secured loans). In the case of unsecured loans, signaling à la Flannery (1986) may be a useful device for good borrowers to deal with problems arising from asymmetric information confirming H1. However, problems of asymmetric information may also be mitigated by pledging

collateral.[12] Moreover, informational asymmetries are lowered since the bank has to evaluate and monitor the pledged assets. At the same time, the credit risk of the loan may be reduced considerably which makes the loan safer for the bank. Given that it is more likely that borrowers with relatively bad ratings are in a difficult economic situation or face financial distress, we argue that the bank is more willing to grant longer maturities to relatively risky borrowers in the case of secured loans. Consequently, the result is consistent with H2.

### 4.3. Asymmetric information and the risk-maturity relation

We now formally test the influence of informational asymmetries between the bank and borrower on the risk-maturity relation in a more comprehensive framework. The main goal here is to disentangle the effects on maturity due to borrower risk and asymmetric information. Unlike Berger, Espinosa-Vega, Frame and Miller (2005) who measure differences in asymmetric information *between banks* we investigate how varying informational asymmetries of different borrowers from the *same bank* influence the loan maturity and the risk-maturity relation.[13] In addition, as explained above, our measure of asymmetric information (ASYINFO) is based on several important dimensions of the bank-borrower relationship (duration, access to private information from checking accounts, new loan vs. renewal).

Before turning to the multivariate test of Hypotheses H1 and H2, we calculate some additional descriptive statistics differentiated by ASYINFO. We find that the loan maturity is shorter in case of loans made under high asymmetric information (means: 51 vs. 115 months, medians: 36 vs. 68 months) and that this result is highly significant ($p<0.01$, Wilcoxon rank

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[12] From theoretical point of view, collateral can be used as a signaling device in an environment with asymmetric information (e.g., Chan and Kanatas, 1985; Chan and Thakor, 1987).

[13] Berger, Espinosa-Vega, Frame and Miller (2005) exploit whether a bank uses the Small Business Credit Scoring (SBCS) as part of its lending technology as a proxy for asymmetric information. It is assumed that banks that do not use SBCS face higher informational asymmetries in comparison to banks that use SBCS. It turns out

sum test) for the entire sample and for rating grades 1 to 3. In addition, the Spearman rank correlation coefficient between the internal credit rating and loan maturity amounts to 0.32 for ASYINFO=0 and 0.47 for ASYINFO>0, indicating a stronger association for loans made under high asymmetric information.

In the following, we re-estimate the basic regression models from Table 3 separately on samples of loans made under relatively low (ASYINFO = 0) and high (ASYINFO > 0) asymmetric information. Table 5 reports the regression results.

Insert Table 5 here

The differentiation by ASYINFO indicates several interesting findings. First, it turns out that the relation between borrower risk and loan maturity is more pronounced for loans made under high informational asymmetries. Note that this finding is relatively strong because all coefficients for the ratings (RATING2-RATING5) are considerably higher in the case of high informational asymmetries, the goodness-of-fit ($R^2$) of the regression model is more than twice as large (Model I vs. III), and including further loan contract terms does not change the conclusion. This finding is in line with the view that maturity is an important element of financial contracting under relatively high asymmetric information.

Moreover, it is noteworthy that there is a significantly positive and monotonic risk-maturity relation for *both* levels of asymmetric information. For loans made under high asymmetric information, this is in line with Hypothesis H1 and confirms the predictions of Flannery (1986). For low and medium-risk borrowers, this is also consistent with the predictions of Diamond (1991). Thus, the fear of low-risk borrowers to be pooled together with high-risk borrowers provides incentives to signal their good quality to the bank by

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that maturities become significantly longer for low risk borrowers when informational asymmetries are smaller (i.e. at banks using the SBCS).

choosing short maturities. Note that signaling mainly seems to provide a plausible rationale for the observed risk-maturity relation in rating grades 1-3 (where the rating-specific share of loans made under high asymmetric information is roughly 50% in each of grades) but not for rating grades 4-5 (where only 12% and 4% of the loans are made under relatively high asymmetric information).

Interestingly, if informational asymmetries are low, the observed positive risk-maturity relation can be explained with Hypothesis H2 ("helping hand") that is motivated by theoretical models predicting that especially high-risk borrowers can benefit from a reduction of asymmetric information over the course of their bank relationships (e. g. Chemmanur and Fulghieri, 1994). These findings are in line with Degryse and Van Cayseele (2000) who find that borrowers that purchase financial services in addition to credit from their bank benefit from more favorable lending terms. Moreover, Elsas and Krahnen (1998) provide empirical evidence about the behavior of Hausbanks that is consistent with our results. They find that borrowers whose credit quality has deteriorated get more financing (an increase of credit lines) from Hausbanks which is interpreted as evidence for an implicit liquidity insurance. We obtain a similar result for loan maturities. In the case of borrowers that are at the edge of financial distress (rating grade 4) or already in default (rating grade 5) relationship lenders may be more willing to provide a "helping hand" that is reflected by preemptive actions or restructuring efforts. We think that there are at least two main reasons why relationship lenders, as opposed to arm's-length lenders, are able to provide these favorable lending terms to risky borrowers: (i) low informational asymmetries and (ii) the possibility of intertemporal and cross-product income smoothing. Finally, note that this type of bank behavior implies that loan maturity is *not* used as a (restrictive) covenant to reduce the risk of moral hazard because the latter would result in a negative risk-maturity relation.

Summarizing, we find evidence for two complementary rationales that both imply a positive risk-maturity relation but in different stages of the bank-borrower relationship. To

shed more light on this issue, we proceed by investigating the influence of borrower bargaining power in the next section.

### 4.4. Borrower bargaining power and the risk-maturity relation

An important issue that has been neglected in the empirical banking literature is that the outcome of the loan contracting process may also be influenced by the bargaining power of the bank and the borrower. As discussed in Section 3.1, borrowers with a strong bargaining power may obtain more favorable lending terms than others. Admittedly, analyzing effects from bargaining power in the context of loan contracting is not an easy task and has therefore been largely ignored in related studies (some exceptions are: for the decision between private and public debt, e.g. Rajan, 1992; for effects due to market power in relationship lending, e.g. Petersen and Rajan, 1995). Subsequently, we analyze the influence of borrower bargaining power on the risk-maturity relation *in addition* to effects arising from asymmetric information. We rely on three empirical ex post measures that are based on outcomes of the loan contracting process. Eventually, we do not need to deal with heterogeneity in the bargaining behavior *between* banks since our loan data comes from one single bank.

The variable POWERSPREAD equals one for 354 loans and is significantly negatively rank-correlated with the index of asymmetric information ASYINFO (rank correlation coefficient = -0.12, p-val. < 0.002). Accordingly, borrowers that obtain loans made under high informational asymmetries exhibit, on average, a relatively low bargaining power, which is consistent with economic intuition. Interestingly, the average maturity is 104 months for borrowers with high bargaining power and 59 months for borrowers with low bargaining power. This difference is highly significant (p-val. < 0.01-level, Wilcoxon rank sum test) and rules out that borrowers with a relatively high bargaining power get lower loan spreads

because they demand *shorter* maturities[14] – we observe longer maturities for these borrowers. Furthermore, the share of borrowers with high bargaining power is large in case of big loans (65%) and firms with limited liability (68%). Finally, the rank correlation between borrower risk and loan maturity is 0.65 for POWERSPREAD = 0 and 0.17 for POWERSPREAD = 1, indicating that the (positive) risk-maturity relation is substantially reduced by borrowers with high bargaining power. Following the structure of Table 2 (the two-by-two matrix, defined by ASYINFO and POWERSPREAD), Table 6 summarizes the multivariate regression results differentiated by asymmetric information and borrower bargaining power.

Insert Table 6 here

Panel A is based on a measure of borrower bargaining power that equals one if the loan spread is below the mean spread of the same rating category (POWERSPREAD). Considering the case of high asymmetric information (Models I vs. II), we find that the risk-maturity relation is clearly stronger if borrower bargaining power is low (Model I) than if it is high (Model II). It can be seen that all coefficients of the rating dummy variables (RATING2-RATING5) are positive and highly significant for loans to borrowers with low bargaining power and not significant at all for borrowers with high bargaining power. Moreover, the goodness-of-fit ($R^2$) of Model I is substantially bigger than that of Model II. Considering the case of low asymmetric information (Models III vs. IV), we obtain again that the risk-maturity relation is stronger if borrower bargaining power is low (based on the magnitude of the coefficients and the difference between the coefficients of RATING5 and RATING5).

[14] In addition, note that the term structure of interest rates in Germany was normal in the year 2005 (estimated yields for 1 year: 2.27%, 5 years: 2.91%, 10 years: 3.47%, source: Deutsche Bundesbank) and changed only slightly towards a flat structure. Accordingly, loans with a longer maturity exhibit higher loan rates (risk-free rate plus loan spread) than short-term loans on average.

Consistent with Table 2, we observe in both cases that the risk-maturity relation is weakened if borrower bargaining power is relatively high.

In a next step, we calculate a second proxy for bargaining power that is based on the secured percentage of a loan (POWERCOL). This measure equals to one if the value of collateral relative to the loan amount is below the corresponding mean of loans to firms from the same rating grade. It turns out that POWERCOL is one in case of 327 loans. The rank correlation between POWERSPREAD and POWERCOL is -0.01 which is statistically not different from zero (p-val. = 0.67). Hence, both proxies can be seen as statistically *independent* (both measures exhibit the same value for 329 loans but opposite values for 339 loans). This finding also sheds light on the discussion whether loan spreads and collateral are substitutes or complementary contract terms (e.g., Brick and Palia, 2007). Our data provides evidence that the loan spread and collateral are in roughly 50% of all cases substitutes (loans with low spreads display high collateral and vice versa) and in the other 50% complementary, mutually reinforcing contract terms (loans with low spreads display low collateral and loans with high spreads display high collateral). Recall that these findings are conditional on the borrower's credit rating. Re-estimating the basic regression models on samples differentiated by POWERCOL (not reported here) shows that the risk-maturity relation is stronger for loans to borrowers with low bargaining power, which is in line with the former results based on POWERSPREAD.

Finally, in Panel B of Table 6 we combine the previous two ways of measuring borrower bargaining power to a third measure (POWERTOTAL) to study the extreme cases: borrowers with a very strong bargaining power (relatively low loan spread and low collateral, n = 178) versus borrowers with a very weak bargaining power (relatively high loan spreads and high collateral, n = 151), controlling for credit ratings. This proxy of bargaining power has the advantage that it rules out the possibility that the loan contract terms collateral and spread have been used as substitutes. It turns out that the regression analyses completely confirm our

previous conclusions. We obtain qualitatively similar and, as expected, quantitatively even stronger results. The risk-maturity relation (under high and low asymmetric information) is rather strong for borrowers with very low bargaining power and rather weak in the case of high borrower bargaining power.

In summary, considering effects from borrower bargaining power *in addition* to the extent of asymmetric information provides further support for the signaling argument (Hypothesis H1) in the case of high asymmetric information and low bargaining power and a "helping hand" provided to risky borrowers by relationship lenders (Hypothesis H2) if asymmetric information is low. Furthermore, it turns out that borrower bargaining power consistently weakens the risk-maturity relation, regardless whether asymmetric information is high or low.

## 5. Tests of Robustness

Subsequently, we briefly summarize results from five further tests to study the robustness of our previous results. These tests address the following issues: (i) loan vs. borrower level data, (ii) the influence of extreme rating grades, (iii) loan maturity vs. loan duration, (iv) expected loss vs. credit ratings as risk measures, and (v) linear vs. non-linear regression models.

First, in all previous regression analyses at the loan level we have controlled for clustering at the borrower level (668 loans from 471 borrowers). We now study the sensitivity of our results by repeating all steps with aggregate variables at the borrower level. The latter are calculated as means and loan amount-weighted means for all variables that refer to the loan level (loan contract terms like maturity, amount, collateral, spread, etc.). Essentially, we obtain results that are highly similar to Sections 4.1-4.4, indicating that the correction of standard errors for the clustering of observations on borrowers in the loan-level analysis was adequate.

Second, there may be a concern that our findings are mainly driven by effects in the extreme rating categories 1 and 5. To address this issue, we carry out the following two robustness checks. In a first step we use rating grade 3 (intermediate credit quality) as a reference category for the rating dummy variables. As a result, we still find a significantly positive and monotonic relation between borrower risk and loan maturity. The only noteworthy difference is that we obtain a non-significant coefficient for rating grade 2, indicating that loan maturities are not significantly different in rating grades 2 and 3 which is consistent with Section 4. In a second step we leave aside all loans to borrowers with rating grades 1 and 5 to study whether we can also observe the significantly positive risk-maturity relation in the intermediate rating range (grades 2, 3, and 4 with grade 2 as reference category). Essentially, this test confirms previous findings. Again, rating grades 2 and 3 do not show significantly different loan maturities, while rating grade 4 displays a significantly longer maturity.

Third, we consider a different dependent variable. Instead of the nominal loan maturity, we now include a Macaulay-style duration (in months) for each loan, explicitly considering the type of loan and its specific repayment schedule (bullet or amortizing loans, effective interest rate, amount of installments, etc.). As expected, duration (mean of 47 months, median of 35 months) is considerably shorter than the nominal loan maturity (mean of 83 months, median of 55 months), it is positively skewed and highly correlated with maturity. Given these statistical properties, it is unsurprising that all of our previous results are confirmed when we use duration as a dependent variable.

Fourth, to further investigate the role of collateral and its relation to risk and maturity, we consider an alternative way to measure risk. We calculate the expected loss (which includes collateral) and test its relation to loan maturity. The expected loss is an important variable for credit risk management and represents the key input for loan pricing, i.e. calculating risk-based loan spreads. Moreover, it is widely considered in the new capital adequacy regulation

for banks (Basel Committee on Banking Supervision, 2006). It is defined as the product of the probability of default, the loss given default (in our case: 100 – secured fraction of a loan), and the exposure at default (in Euros). The absolute expected loss (AEL) is calculated as follows:

$$AEL = PD \times ((100 - COL)/100) \times AMOUNT \quad (3)$$

In the subsequent regressions we include the natural logarithm of the absolute expected loss. In addition, we also consider the relative expected loss per Euro loan amount. The relative expected loss (REL) is calculated as follows:

$$REL = PD \times ((100 - COL)/100) \quad (4)$$

We are aware of the problem that collateral (as an input factor to calculate the expected loss) may be endogenous to loan maturity. However, given the practical relevance of the expected loss for banks and banking supervisors, we believe that it is useful to study the relation between this risk measure and loan maturity as well. Table 7 reports the main findings on the basic regression model. Both models based on the expected loss (I and II) reveal a highly significant and positive link between risk and loan maturity. This is in line with our findings from Section 4.2.

Insert Table 7 here

Finally, instead of using ordinary least squares (OLS) we have estimated the baseline model by means of non-linear least squares (NLLS) with a regression coefficient as power of

the probability of default (PD) associated with each rating grade.[15] This estimation technique leads to a root function, exhibiting again a significantly positive and monotonic relation between PD and loan maturity.

## 6. Conclusions

The maturity of corporate debt represents an important element in financial contracting. In this paper, we empirically analyze the relation between borrower risk and loan maturity in small business lending. Due to the structure of our data set, including all new loan approvals and renewals made by a German Bank in 2005, we can measure borrower risk by means of internal credit ratings and differentiate the analysis by proxies for asymmetric information and borrower bargaining power. Small business lending is an especially interesting case because theoretical models on adverse selection are more applicable and relationship lending is more common than in case of lending to large firms.

Our analysis reveals a robust, significantly positive and monotonic relation between borrower risk and loan maturity. This relation is more pronounced for new loans and also holds for unsecured and secured loans. In addition, we find that loans made under relatively low asymmetric information exhibit a longer maturity and the positive risk-maturity relation is weaker. Furthermore, conditioning on three proxies for borrower bargaining power shows that borrowers with a low bargaining power receive loans with a relatively short maturity and the risk-maturity relation is more pronounced for these borrowers. Eventually, our main findings are not influenced by potential problems of endogeneity.

Unlike related studies, we provide detailed evidence in favor of two hypotheses, providing *complementary* explanations for a positive relation between borrower risk and loan maturity. First, we find support for theoretical models on adverse selection and signaling in *some*

[15] The average PD ranges from 0.085% (rating grade 1) to 16.75% (rating grade 5).

situations (new loans, unsecured loans, relatively high asymmetric information, low borrower bargaining power). Second, the view that well-informed relationship lenders grant loans of relatively long maturities to the most risky borrowers represents a different explanation for the positive risk-maturity relation (renewals, secured loans, relatively low asymmetric information and high borrower bargaining power). Interestingly and consistent with our findings, note that a "helping hand" (here: relatively long maturities) is mostly needed by borrowers that are at the edge of financial distress or already in default. While signaling relates to demand side effects, the cooperative behavior of relationship lenders ultimately relates to the supply side in credit markets.

We conclude that asymmetric information is an important but not a universal explanation for the detected positive relation between borrower risk and loan maturity in small business lending. Borrower bargaining power also plays a major role and reduces the risk-maturity relation. Finally, our results imply that small businesses can clearly benefit from a reduction in asymmetric information and an increase of their bargaining power. Consequently, in contrast to arm's length lending close relationships with Hausbanks may be particularly valuable for relatively risky borrowers because the need for favorable lending terms is highest at these firms.

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Table 1: Summary statistics

Panel A: Main variables

| Variable | Description | Mean | St.dev. | Min | Median | Max | N |
|---|---|---|---|---|---|---|---|
| *Borrower risk* | | | | | | | |
| RATING | Internal credit rating, grades 1 (best), to 5 (default) | 2.58 | 1.02 | 1 | 3 | 5 | 668 |
| *Borrower characteristics* | | | | | | | |
| DUR | Duration of the bank-borrower relationship (years) | 5.43 | 7.36 | 0 | 2.16 | 57.42 | 668 |
| AGE_LOW | = 1 if age of the borrower or firm is below median age, 0 otherwise | 0.49 | 0.50 | 0 | 0 | 1 | 668 |
| CHECK | = 1 if the borrower has a checking account, 0 otherwise | 0.52 | 0.49 | 0 | 1 | 1 | 668 |
| CLUSTER | = 1 if the borrower is among top 10% borrowers in the bank's credit portfolio, 0 otherwise (based on net loan exposure) | 0.08 | 0.26 | 0 | 0 | 1 | 668 |
| LIAB | = 1 if the borrower has unlimited liability, 0 for limited liability | 0.65 | 0.48 | 0 | 1 | 1 | 668 |
| *Loan contract terms* | | | | | | | |
| MATURITY | Loan maturity (months) | 82.84 | 83.71 | 3 | 55 | 396 | 668 |
| NEW | = 1 for new loans, 0 for renewals | 0.71 | 0.45 | 0 | 1 | 1 | 668 |
| AMOUNT | Loan amount (Euro) | 129,044 | 290,948 | 508.46 | 30,187 | 3,137,496 | 668 |
| COL | Collateral relative to loan amount (%) | 45.71 | 45.20 | 0 | 42.68 | 100.80 | 668 |
| SPREAD | Loan spread (percentage points) | 2.48 | 2.08 | -3.26 | 2.25 | 16.76 | 668 |
| FIX | = 1 if loan rate is fixed, 0 for floating rates | 0.78 | 0.41 | 0 | 1 | 1 | 668 |
| BUL | = 1 if bullet loan, 0 otherwise | 0.11 | 0.31 | 0 | 0 | 1 | 668 |
| TRANS | = 1 if transferred loan under development programs, 0 otherwise | 0.10 | 0.30 | 0 | 0 | 1 | 668 |
| BUILD | = 1 if building or construction loan, 0 otherwise | 0.06 | 0.23 | 0 | 0 | 1 | 668 |

Panel B: Main variables by rating grades

| RATING | | MATURITY (months) | | DUR (years) | | CHECK (1/0) | | COL (%) | | SPREAD (%) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | Mean | Median | Mean | Median | Mean | Median | Mean | Median | Mean | Median |
| 1 | 96 | 28 | 12 | 3.79 | 0.74 | 0.23 | 0 | 69 | 80 | 2.24 | 2.48 |
| 2 | 213 | 75 | 49 | 5.18 | 2.16 | 0.49 | 0 | 38 | 0 | 2.11 | 2.07 |
| 3 | 280 | 86 | 60 | 4.94 | 2.16 | 0.58 | 1 | 38 | 0 | 2.86 | 2.23 |
| 4 | 33 | 133 | 97 | 10.12 | 6.26 | 0.70 | 1 | 74 | 100 | 2.80 | 2.22 |
| 5 | 46 | 178 | 144 | 9.70 | 7.62 | 0.74 | 1 | 58 | 75 | 2.12 | 1.41 |

Table 2: Univariate results on the relation between borrower risk and loan maturity

This table reports univariate findings on the relation between borrower risk and loan maturity, differentiated by asymmetric information (rows) and borrower bargaining power (columns). We report the mean internal credit rating (on a 5-grade scale; 1 is the best, 5 the worst rating), the mean loan maturity (in months), the Spearman rank correlation (RHO) between RATING and MATURITY, a regression coefficient (COEFF, based on OLS estimation with log(MATURITY) as dependent and RATING as explanatory variable), and the number of observations. The regressions take into account the clustering of observations at the borrower level and are based on p-values calculated from Huber-White robust standard errors. ***, **, * denote coefficients that are statistically significant at the 0.01, 0.05, and 0.10-level.

| | | Borrower bargaining power (POWERSPREAD) | | | | Hypotheses |
|---|---|---|---|---|---|---|
| | | low | | high | | |
| Asymmetric information (ASYINFO) | high | MATURITY | 41 | MATURITY | 62 | Signaling |
| | | RATING | 1.98 | RATING | 2.62 | |
| | | RHO | 0.74*** | RHO | -0.10 | |
| | | COEFF | 0.69*** | COEFF | -0.01 | |
| | | N | 177 | N | 158 | |
| | low | MATURITY | 83 | MATURITY | 138 | "Helping hand" |
| | | RATING | 2.83 | RATING | 2.90 | |
| | | RHO | 0.41*** | RHO | 0.30*** | |
| | | COEFF | 0.31*** | COEFF | 0.25*** | |
| | | N | 137 | N | 196 | |

## Table 3: Basic results on the risk-maturity relation

This table reports results from OLS regression models for the entire sample of loans. The dependent variable is the natural logarithm of the loan maturity MATURITY. Explanatory variables are dummy variables indicating the rating grades 2 (RATING2) to 5 (RATING5) with grade 1 serving as reference category, the natural logarithm of one plus the duration of the bank-borrower relationship DUR, and dummy variables indicating whether the borrower exhibits a below-median age AGE_LOW, the borrower has a checking account with the bank CHECK, the borrower is among the top 10% borrowers in the credit portfolio CLUSTER, the borrower has unlimited liability (vs. limited) LIAB. Moreover, NEW indicates new loans (vs. renewals), AMOUNT is the loan amount (as natural logarithm), COL is the percentage of collateral per loan (secured fraction of a loan), SPREAD the loan spread, and dummy variables indicating fixed-rate loans FIX (vs. floating rate loans), bullet loans BUL, transferred loans under federal development bank programs TRANS, and loans for building and construction purposes BUILD. All regressions take into account the clustering of observations at the borrower level and are based on p-values calculated from Huber-White robust standard errors. ***, **, * denote coefficients that are statistically significant at the 0.01, 0.05, and 0.10-level.

| | | (I) | | | (II) | | | (III) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Dep. Var. | Ln(MATURITY) | Coeff. | | p-val. | Coeff. | | p-val. | Coeff. | | p-val. |
| | CONST | 2.886 | *** | 0.000 | 2.275 | *** | 0.000 | 1.825 | *** | 0.000 |
| *Borrower risk* | | | | | | | | | | |
| | RATING2 | 1.115 | *** | 0.000 | 1.116 | *** | 0.000 | 0.864 | *** | 0.000 |
| | RATING3 | 1.223 | *** | 0.000 | 1.185 | *** | 0.000 | 0.963 | *** | 0.000 |
| | RATING4 | 1.669 | *** | 0.000 | 1.457 | *** | 0.000 | 1.030 | *** | 0.000 |
| | RATING5 | 2.056 | *** | 0.000 | 1.832 | *** | 0.000 | 1.364 | *** | 0.000 |
| *Borrower characteristics* | | | | | | | | | | |
| | Ln(1+DUR) | | | | 0.145 | *** | 0.004 | 0.037 | | 0.434 |
| | AGE_LOW | | | | 0.031 | | 0.700 | 0.057 | | 0.382 |
| | CHECK | | | | 0.316 | *** | 0.001 | 0.157 | ** | 0.034 |
| | CLUSTER | | | | 0.060 | | 0.787 | 0.001 | | 0.993 |
| | LIAB | | | | 0.410 | *** | 0.000 | 0.414 | *** | 0.000 |
| *Loan contract terms* | | | | | | | | | | |
| | NEW | | | | | | | -0.277 | ** | 0.013 |
| | Ln(AMOUNT) | | | | | | | 0.116 | *** | 0.000 |
| | COL | | | | | | | 0.000 | | 0.799 |
| | SPREAD | | | | | | | -0.020 | | 0.226 |
| | FIX | | | | | | | -0.093 | | 0.402 |
| | BUL | | | | | | | -0.799 | *** | 0.000 |
| | TRANS | | | | | | | 0.553 | *** | 0.000 |
| | BUILD | | | | | | | 0.257 | | 0.130 |
| Adj. $R^2$ | | 0.280 | | | 0.378 | | | 0.528 | | |
| N | | 668 | | | 668 | | | 668 | | |

Table 4: Results on the risk-maturity relation by loan type and collateral

This table reports results from OLS regression models differentiated by loan type (new vs. renewal) and collateral (unsecured vs. secured loans). Explanatory variables are dummy variables indicating the rating grades 2 (RATING2) to 5 (RATING5) with grade 1 serving as reference category, the natural logarithm of one plus the duration of the bank-borrower relationship DUR, and dummy variables indicating whether the borrower exhibits a below-median age AGE_LOW, the borrower has a checking account with the bank CHECK, the borrower is among the top 10% borrowers in the credit portfolio CLUSTER, the borrower has unlimited liability (vs. limited) LIAB. Moreover, NEW indicates new loans (vs. renewals), AMOUNT is the loan amount (as natural logarithm), COL is the percentage of collateral per loan (secured fraction of a loan), SPREAD the loan spread, and dummy variables indicating fixed-rate loans FIX (vs. floating rate loans), bullet loans BUL, transferred loans under federal development bank programs TRANS, and loans for building and construction purposes BUILD. All regressions take into account the clustering of observations at the borrower level and are based on p-values calculated from Huber-White robust standard errors. ***, **, * denote coefficients that are statistically significant at the 0.01, 0.05, and 0.10-level.

Panel: A: Results by loan type

| | | New loans | | | | | | Renewals | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (I) | | | (II) | | | (III) | | | (IV) | | |
| Dep. Var. | Ln(MATURITY) | Coeff. | | p-val. | Coeff. | | p-val. | Coeff. | | p-val. | Coeff. | | p-val. |
| | CONST | 2.406 | *** | 0.000 | 1.572 | *** | 0.000 | 3.107 | *** | 0.000 | 1.534 | * | 0.085 |
| *Borrower risk* | | | | | | | | | | | | | |
| | RATING2 | 1.135 | *** | 0.000 | 0.718 | *** | 0.000 | 0.978 | * | 0.057 | 1.240 | ** | 0.018 |
| | RATING3 | 1.115 | *** | 0.000 | 0.727 | *** | 0.000 | 1.496 | *** | 0.006 | 1.724 | *** | 0.002 |
| | RATING4 | 1.279 | *** | 0.000 | 0.733 | *** | 0.010 | 1.326 | ** | 0.013 | 1.487 | *** | 0.007 |
| | RATING5 | 1.916 | *** | 0.000 | 1.445 | *** | 0.000 | 1.692 | *** | 0.002 | 1.770 | *** | 0.001 |
| *Borrower characteristics* | | | | | | | | | | | | | |
| | Ln(1+DUR) | 0.055 | | 0.273 | 0.032 | | 0.369 | 0.029 | | 0.808 | 0.109 | | 0.381 |
| | AGE_LOW | -0.056 | | 0.484 | -0.048 | | 0.482 | 0.195 | | 0.178 | 0.166 | | 0.258 |
| | CHECK | 0.304 | *** | 0.001 | 0.240 | *** | 0.002 | -0.116 | | 0.512 | -0.078 | | 0.653 |
| | CLUSTER | -0.134 | | 0.258 | -0.177 | ** | 0.040 | 0.948 | *** | 0.000 | 0.749 | *** | 0.009 |
| | LIAB | 0.368 | *** | 0.000 | 0.404 | *** | 0.000 | 0.149 | | 0.397 | 0.107 | | 0.573 |
| *Loan contract terms* | | | | | | | | | | | | | |
| | Ln(AMOUNT) | | | | 0.120 | *** | 0.000 | | | | 0.111 | * | 0.087 |
| | COL | | | | -0.000 | | 0.644 | | | | 0.001 | | 0.506 |
| | SPREAD | | | | -0.044 | * | 0.080 | | | | -0.021 | | 0.407 |
| | FIX | | | | 0.181 | | 0.364 | | | | -0.250 | * | 0.094 |
| | BUL | | | | -0.906 | *** | 0.000 | | | | -1.273 | *** | 0.001 |
| | TRANS | | | | 0.312 | * | 0.064 | | | | 0.819 | *** | 0.000 |
| | BUILD | | | | 0.237 | | 0.212 | | | | 0.056 | | 0.863 |
| Adj. $R^2$ | | 0.397 | | | 0.562 | | | 0.196 | | | 0.298 | | |
| N | | 477 | | | 477 | | | 191 | | | 191 | | |

Table 4 (continued)

Panel: B: Results by collateral

| | | Unsecured | | | | | | Secured | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (I) | | | (II) | | | (III) | | | (IV) | | |
| Dep. Var. | Ln(MATURITY) | Coeff. | | p-val. | Coeff. | | p-val. | Coeff. | | p-val. | Coeff. | | p-val. |
| | CONST | 2.759 | *** | 0.000 | 2.098 | *** | 0.000 | 2.535 | *** | 0.000 | 2.418 | *** | 0.000 |
| *Borrower risk* | | | | | | | | | | | | | |
| | RATING2 | 0.549 | *** | 0.003 | 0.576 | ** | 0.017 | 1.387 | *** | 0.000 | 0.972 | *** | 0.000 |
| | RATING3 | 0.570 | *** | 0.002 | 0.600 | ** | 0.011 | 1.655 | *** | 0.000 | 1.230 | *** | 0.000 |
| | RATING4 | 1.203 | *** | 0.004 | 0.933 | ** | 0.013 | 1.631 | *** | 0.000 | 1.168 | *** | 0.001 |
| | RATING5 | 1.554 | *** | 0.000 | 1.406 | *** | 0.000 | 2.005 | *** | 0.000 | 1.410 | *** | 0.000 |
| *Borrower characteristics* | | | | | | | | | | | | | |
| | Ln(1+DUR) | 0.132 | ** | 0.012 | 0.065 | | 0.157 | 0.085 | | 0.200 | -0.000 | | 0.995 |
| | AGE_LOW | 0.012 | | 0.915 | 0.031 | | 0.724 | 0.062 | | 0.534 | 0.071 | | 0.448 |
| | CHECK | 0.126 | | 0.178 | 0.034 | | 0.683 | 0.146 | | 0.307 | 0.083 | | 0.565 |
| | CLUSTER | 0.052 | | 0.737 | -0.000 | | 0.999 | 0.854 | ** | 0.016 | 0.448 | * | 0.094 |
| | LIAB | 0.518 | *** | 0.000 | 0.492 | *** | 0.000 | 0.080 | | 0.547 | 0.200 | | 0.113 |
| *Loan contract terms* | | | | | | | | | | | | | |
| | NEW | | | | -0.290 | * | 0.079 | | | | -0.289 | ** | 0.038 |
| | Ln(AMOUNT) | | | | 0.107 | *** | 0.003 | | | | 0.079 | | 0.117 |
| | SPREAD | | | | 0.001 | | 0.975 | | | | -0.040 | | 0.108 |
| | FIX | | | | -0.061 | | 0.760 | | | | -0.017 | | 0.906 |
| | BUL | | | | -0.713 | ** | 0.033 | | | | -0.779 | *** | 0.000 |
| | TRANS | | | | 0.560 | ** | 0.016 | | | | 0.428 | *** | 0.000 |
| | BUILD | | | | 0.289 | | 0.401 | | | | 0.189 | | 0.296 |
| Adj. $R^2$ | | 0.352 | | | 0.459 | | | 0.441 | | | 0.555 | | |
| N | | 302 | | | 302 | | | 366 | | | 366 | | |

Table 5: The influence of asymmetric information on the risk-maturity relation

This table reports results from OLS regression models for subsamples of loans granted under low vs. high asymmetric information. Asymmetric information is proxied by ASYINFO (= SHORTDUR x ((1 – CHECK) + NEW). SHORTDUR is a dummy variable that is one if the duration of the bank-borrower relationship is below the sample median. The dependent variable is the natural logarithm of the loan maturity MATURITY. Explanatory variables are dummy variables indicating the rating grades 2 (RATING2) to 5 (RATING5) with grade 1 serving as reference category, and dummy variables indicating whether the borrower is among the top 10% borrowers in the credit portfolio CLUSTER and whether the borrower has unlimited liability (vs. limited) LIAB. Moreover, AMOUNT is the loan amount (as natural logarithm), COL is the percentage of collateral per loan (secured fraction of a loan), SPREAD the loan spread, and dummy variables indicating fixed-rate loans FIX (vs. floating rate loans), bullet loans BUL, transferred loans under federal development bank programs TRANS, and loans for building and construction purposes BUILD. All regressions take into account the clustering of observations at the borrower level and are based on p-values calculated from Huber-White robust standard errors. ***, **, * denote coefficients that are statistically significant at the 0.01, 0.05, and 0.10-level.

| | | Low asymmetric information (ASYINFO = 0) | | | | | | High asymmetric information (ASYINFO > 0) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (I) | | | (II) | | | (III) | | | (IV) | | |
| Dep. Var. | Ln(MATURITY) | Coeff. | | p-val. | Coeff. | | p-val. | Coeff. | | p-val. | Coeff. | | p-val. |
| | CONST | 3.282 | *** | 0.000 | 2.095 | *** | 0.000 | 2.080 | *** | 0.000 | 1.115 | * | 0.065 |
| *Borrower risk* | | | | | | | | | | | | | |
| | RATING2 | 0.866 | *** | 0.005 | 0.928 | *** | 0.004 | 1.390 | *** | 0.000 | 1.033 | *** | 0.000 |
| | RATING3 | 1.000 | *** | 0.002 | 1.111 | *** | 0.001 | 1.549 | *** | 0.000 | 1.114 | *** | 0.000 |
| | RATING4 | 1.132 | *** | 0.001 | 1.059 | *** | 0.004 | 1.796 | *** | 0.000 | 1.325 | *** | 0.000 |
| | RATING5 | 1.556 | *** | 0.000 | 1.415 | *** | 0.000 | 2.226 | *** | 0.000 | 2.096 | *** | 0.000 |
| *Borrower characteristics* | | | | | | | | | | | | | |
| | CLUSTER | 0.874 | *** | 0.000 | 0.570 | ** | 0.030 | -0.147 | | 0.282 | -0.103 | | 0.153 |
| | LIAB | 0.171 | | 0.129 | 0.237 | ** | 0.022 | 0.548 | *** | 0.000 | 0.502 | *** | 0.000 |
| *Loan contract terms* | | | | | | | | | | | | | |
| | Ln(AMOUNT) | | | | 0.114 | ** | 0.032 | | | | 0.073 | ** | 0.049 |
| | COL | | | | 0.000 | | 0.613 | | | | 0.001 | | 0.679 |
| | SPREAD | | | | -0.016 | | 0.442 | | | | -0.006 | | 0.846 |
| | FIX | | | | -0.264 | *** | 0.004 | | | | 0.616 | * | 0.083 |
| | BUL | | | | -1.170 | *** | 0.000 | | | | -0.635 | *** | 0.001 |
| | TRANS | | | | 0.561 | *** | 0.000 | | | | 0.719 | *** | 0.001 |
| | BUILD | | | | 0.271 | | 0.176 | | | | 0.273 | | 0.390 |
| Adj. $R^2$ | | 0.181 | | | 0.339 | | | 0.413 | | | 0.547 | | |
| N | | 333 | | | 333 | | | 335 | | | 335 | | |

## Table 6: Borrower bargaining power and the risk-maturity relation

This table reports results from OLS regression models for subsamples of loans, differentiated by borrower bargaining power. Borrower bargaining power is proxied by (i) POWERSPREAD (i. e. lower spread than the median spread of all loans in the same rating category) and (ii) POWERTOTAL (i. e. lower spread and lower collateral than the respective medians of all loans in the same rating category). The dependent variable is the natural logarithm of the loan maturity MATURITY. Explanatory variables are dummy variables indicating the rating grades 2 (RATING2) to 5 (RATING5) with grade 1 serving as reference category, whether the borrower is among the top 10% borrowers in the credit portfolio CLUSTER, whether the borrower has unlimited liability (vs. limited) LIAB. All regressions take into account the clustering of observations at the borrower level and p-values calculated from Huber-White robust standard errors. ***, **, * denote coefficients that are statistically significant at the 0.01, 0.05, and 0.10-level.

### Panel A: Results based on POWERSPREAD

| | | High asymmetric information (ASYINFO > 0) | | | | | | Low asymmetric information (ASYINFO = 0) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Low bargaining power (I) | | | High bargaining power (II) | | | Low bargaining power (III) | | | High bargaining power (IV) | | |
| Dep. Var. | Ln(MATURITY) | Coeff. | | p-val. | Coeff. | | p-val. | Coeff. | | p-val. | Coeff. | | p-val. |
| | CONST | 2.083 | *** | 0.000 | 3.352 | *** | 0.000 | 2.850 | *** | 0.000 | 3.487 | *** | 0.006 |
| *Borrower risk* | | | | | | | | | | | | | |
| | RATING2 | 1.321 | *** | 0.000 | 0.127 | | 0.855 | 1.029 | ** | 0.019 | 0.792 | *** | 0.009 |
| | RATING3 | 1.541 | *** | 0.000 | 0.271 | | 0.701 | 1.104 | ** | 0.012 | 0.938 | *** | 0.003 |
| | RATING4 | 1.686 | *** | 0.000 | 0.798 | | 0.244 | 1.357 | *** | 0.007 | 0.970 | *** | 0.005 |
| | RATING5 | 2.800 | *** | 0.000 | 0.192 | | 0.778 | 1.743 | *** | 0.000 | 1.430 | *** | 0.000 |
| *Borrower characteristics* | | | | | | | | | | | | | |
| | CLUSTER | -0.064 | | 0.497 | -0.149 | | 0.418 | (dropped) | | | 0.721 | *** | 0.001 |
| | LIAB | 0.479 | *** | 0.000 | 0.733 | *** | 0.001 | 0.287 | ** | 0.035 | 0.209 | | 0.163 |
| Adj. $R^2$ | | 0.635 | | | 0.163 | | | 0.276 | | | 0.132 | | |
| N | | 177 | | | 158 | | | 137 | | | 196 | | |

Table 6 (continued)

Panel B: Results based on POWERTOTAL

| | | High asymmetric information (ASYINFO > 0) | | | | | | Low asymmetric information (ASYINFO = 0) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Low bargaining power (I) | | | High bargaining power (II) | | | Low bargaining power (III) | | | High bargaining power (IV) | | |
| Dep. Var. | Ln(MATURITY) | Coeff. | | p-val. | Coeff. | | p-val. | Coeff. | | p-val. | Coeff. | | p-val. |
| | CONST | 1.772 | *** | 0.000 | 3.358 | *** | 0.000 | 2.372 | *** | 0.000 | 3.991 | *** | 0.000 |
| *Borrower risk* | | | | | | | | | | | | | |
| | RATING2 | 1.434 | *** | 0.000 | 0.140 | | 0.414 | 1.728 | *** | 0.002 | 0.173 | | 0.584 |
| | RATING3 | 1.900 | *** | 0.000 | 0.088 | | 0.644 | 1.854 | *** | 0.001 | 0.212 | | 0.406 |
| | RATING4 | 2.197 | *** | 0.000 | (dropped) | | | 2.180 | *** | 0.001 | 0.823 | ** | 0.014 |
| | RATING5 | (dropped) | | | (dropped) | | | 2.549 | *** | 0.000 | 1.469 | *** | 0.000 |
| *Borrower characteristics* | | | | | | | | | | | | | |
| | CLUSTER | (dropped) | | | -0.008 | | 0.922 | (dropped) | | | 0.782 | *** | 0.002 |
| | LIAB | 0.741 | *** | 0.004 | 0.737 | *** | 0.001 | 0.066 | | 0.804 | 0.009 | | 0.960 |
| Adj. $R^2$ | | 0.736 | | | 0.192 | | | 0.395 | | | 0.317 | | |
| N | | 83 | | | 115 | | | 68 | | | 63 | | |

Table 7: The relation between expected loss and loan maturity

This table reports results from OLS regression models for the entire sample. Risk measures are (i) the natural logarithm of the absolute expected loss (AEL = PD x (1 – COL/100) x AMOUNT) and (ii) the relative expected loss (REL = PD x (1- COL/100)). Further explanatory variables are the natural logarithm of one plus the duration of the bank-borrower relationship DUR, and dummy variables indicating whether the borrower exhibits a below-median age AGE_LOW, the borrower has a checking account with the bank CHECK, the borrower is among the top 10% borrowers in the credit portfolio CLUSTER, the borrower has unlimited liability (vs. limited) LIAB. All regressions take into account the clustering of observations at the borrower level and are based on p-values calculated from Huber-White robust standard errors. ***, **, * denote coefficients that are statistically significant at the 0.01, 0.05, and 0.10-level.

| | | (I) | | | (II) | | |
|---|---|---|---|---|---|---|---|
| | | Absolute expected loss | | | Relative expected loss | | |
| Dep. Var. | Ln(MATURITY) | Coeff. | | p-val. | Coeff. | | p-val. |
| | CONST | 3.030 | *** | 0.000 | 3.210 | *** | 0.000 |
| *Risk measures* | | | | | | | |
| | Log(AEL) | 0.105 | *** | 0.000 | | | |
| | REL | | | | 0.059 | *** | 0.000 |
| *Borrower characteristics* | | | | | | | |
| | Ln(1+DUR) | 0.247 | *** | 0.000 | 0.222 | *** | 0.000 |
| | AGE_LOW | -0.049 | | 0.534 | -0.019 | | 0.812 |
| | CHECK | 0.518 | *** | 0.000 | 0.528 | *** | 0.000 |
| | CLUSTER | -0.071 | | 0.595 | 0.065 | | 0.683 |
| | LIAB | 0.231 | *** | 0.003 | 0.198 | ** | 0.012 |
| Adj. $R^2$ | | 0.223 | | | 0.206 | | |
| N | | 668 | | | 668 | | |