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The dynamics in requested and granted loan terms when bank and borrower interact repeatedly

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Abstract

This paper studies how credit constraints develop over bank relationships. I analyze a unique dataset of matched loan application and loan contract information and measure credit constraints as the ratio of requested to granted loan amounts. I find that the most important determinants of receiving smaller than requested loan amounts are firm age and size at the time of the first interaction between borrower and bank. Over loan sequences, credit constraints decease most pronouncedly in the beginning of relationships and for the initially young and small firms. Moreover, the structure of the dataset allows me to disentangle the demand and supply effects behind these observed credit constraints. I find that the gap between requested and granted loan amounts decreases because both sides converge. If previous credit constraints were large, requested amounts increase more moderately, while granted amounts increase more strongly than in the case of small previous constraints. The findings are a sign of the use of dynamic incentives at the bank side to overcome information problems when contracting repeatedly with opaque borrowers. The results further suggest that, particularly in the beginning of a bank relationship, borrowers learn from their previous experience with credit constraints and adjust their demand accordingly.

Keywords: Credit constraints, relationship lending, small business lending, asymmetric information, learning

JEL classification: D82, G20, G21, G30

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1 Introduction

The nature of a bank-borrower relationship may be characterized as a "*mutual* commitment" (Boot and Marinc (2008)). Yet, while the literature has shown that banks collect and process a variety of (proprietary) information and how this may reduce credit constraints, there is surprisingly little empirical evidence on the evolution of borrowers' demand for credit and its interaction with banks' supply of credit over bank relationships. This paper makes a first step to address this interaction by investigating how requested and granted loan amounts evolve over bank relationships and how they are influenced by previous contractual outcomes in a sequence of loans.

I employ a unique dataset of matched loan applications and loan contracts that includes both requested and granted loan terms as well as borrower and relationship characteristics at the time of loan origination. The dataset consists of nearly 99,000 loans to small enterprises extended by one bank in Bulgaria over the period April 2003 to September 2007. As most of these small loans are of comparatively short maturities I am able to follow loan sequences with up to nine loans within the observation period. Analyzing chains of short-term repeat loans complements studies that focus on credit lines to assess how banks use the information they gather from multiple interactions with their borrowers (e.g. Berger and Udell (1995) and Norden and Weber (2010)).

Exploiting the structure of my dataset, I measure credit constraints as the ratio of requested to granted loan amounts and investigate not only how this ratio relates to firm characteristics but also how it evolves over sequential loan contracts. Previous papers point out that both demand and supply side factors determine credit availability and loan terms (e.g. Petersen and Rajan (1994) and Qian and Strahan (2007)). In a second step, I therefore study requested and granted loan amounts separately to gain deeper insights into the dynamic processes on both the demand and supply side and to determine the borrower's and the bank's reactions to the degree of credit constraints at the previous loan. The dynamic patterns of requested and granted loan amounts that arise when borrowers contract repeatedly with the same lender have not yet been comprehensively established.

The results show that borrowers are considerably credit constrained in the outset of their bank relationships. The most important determinants of receiving smaller than requested loan amounts are firm age and size at the time of the first interaction between borrower and bank. This indicates that the extent of (publicly) available information matters for initial differences in credit constraints between borrowers. Apart from that, a reduction in information

asymmetries resulting from repeated interactions crucially determines credit constraints. I find that observed credit constraints decrease over loan sequences with this effect being most distinct in the beginning of the relationship. This finding provides a first indication of the evolution of borrowers' requests over multiple interactions with the same lender. It rules out that borrowers overstate their demand as a reaction to previous constraints because this would not induce the observed reduction in credit constraints. I also find that the decrease in observed credit constraints over time is especially pronounced for the initially young and small firms. This is a sign for the use of dynamic incentives at the bank side to overcome information problems when contracting repeatedly with small and opaque borrowers.

Further disentangling demand from supply effects reveals that observed credit constraints decrease over a loan sequence due to a convergence of the demand and supply sides. While both borrowers' requested and the bank's granted loan amounts rise over time, they differ in their reaction to previous credit constraints. When the extent of previous credit constraints is large in the beginning of the relationship, requested amounts increase more moderately whereas granted amounts increase more strongly than in the case of small previous constraints. These findings imply that borrowers learn from previous experiences. If the feedback they get from an interaction is negative, i.e. if they receive a smaller than requested loan amount, they adjust their request at the subsequent interaction accordingly to avoid being highly constrained again. At the same time, the results confirm that the bank uses dynamic incentives to overcome information problems increasing loan sizes disproportionately after due repayment when contracting repeatedly. This is in line with arguments that bank relationships are valuable because banks are able to collect and assess information in due course and benefit borrowers by better loan terms over time.

My approach differs from earlier papers on the credit availability of small firms in two important ways. First, in contrast to previous studies relying on indirect (e.g. Petersen and Rajan (1994, 1995)) or equilibrium outcome (e.g. Ioannidou and Ongena (2010)) proxies of credit availability it provides a more comprehensive measure of credit constraints because it incorporates loan demand. Secondly, while studies analyzing the influence of relationship and firm characteristics on the likelihood of being denied credit do consider loan applications they deal with borrower rationing (e.g. Cole (1998)). My study, on the contrary, is concerned with loan size constraints for those borrowers who receive credit.[1]

[1] Keeton (1979) distinguishes between these two forms of credit constraints. If information is distributed asymmetrically, banks may ration borrowers (type I constraints) to prevent adverse selection and moral hazard which would negatively impact their profit (see Stiglitz and Weiss (1981)). Jaffee and Russell (1976) derive that granting lower than requested loan amounts (type II constraints) may serve as a sorting device because

The main contribution of this paper consists in providing first evidence on the dynamic patterns that arise when bank and borrower interact repeatedly by disentangling demand and supply effects behind observed credit constraints. Thereby, it amends existing findings on the supply side (see Ioannidou and Ongena (2010)) and adds to the very recently emerging literature that aims at distinguishing between demand and supply effects in bank lending (Brown, Kirschenmann and Ongena (2009), Puri, Rocholl and Steffen (2009), Cheng and Degryse (2010) and Jimenez, Ongena, Peydro and Saurina (2010)).

Finally, the panel structure of the employed dataset makes it possible to add to the existing literature on bank relationships from a methodological point of view by addressing the fact that borrowers non-randomly drop out of the sample. I empirically model this attrition process in a two-stage procedure that accounts for sample selection at each interaction between borrowers and bank. Cross-sectional studies may not be fully able to control for potential changes in the composition of the pool of borrowers over time (see also Ioannidou and Ongena (2010). I find that the extent of credit constraints does not seem to matter for selection, i.e. the probability to take out another loan. While the analysis reveals that there is an attrition bias in the data, the main results are robust to explicitly accounting for the attrition process.

The remainder of the paper is organized as follows. Section 2 reviews the related theoretical and empirical literature. Section 3 provides institutional details on the loan granting process and describes the data while section 4 presents the findings from the empirical analyses. Section 5 concludes.

2 Literature overview

2.1 The evolution of requested and granted loan amounts over multiple interactions

Theories of financial intermediation constitute that banks are able to accumulate extensive private information about their borrowers through screening and monitoring (Diamond (1984), Ramakrishan and Thakor (1984), Fama (1985) and Boyd and Prescott (1986)). Especially relationship lending, i.e. multiple interactions with the same borrower over time (Boot (2000)), seems well suited to provide banks with (proprietary) information on their customers. Multiple interactions with the same borrower leave room for the bank to set dynamic incentives to deal with agency problems in an environment with asymmetric

borrowers with a utility increase from defaulting are discouraged from borrowing as their benefits (i.e. larger loan sizes) decrease.

information. In the model of Bolton and Scharfstein (1990) financial constraints arise endogenously as an enforcement device to ensure repayment because the credible threat to terminate funding discourages borrowers from diverting funds. Armendariz de Aghion and Murdoch (2005) extend this model and show that the effect of dynamic incentives may be reinforced by providing increased funding upon due repayment. Furthermore, the game-theoretic structure of the two-period model in Egli (2004) explains that reputation acquisition is essential for borrowers to sustain the relationship with the bank in order to obtain further funding in the future. Expanding on this argument, Egli, Ongena and Smith (2006) highlight that relationship financing allows borrowers to benefit from better loan terms if strategic default is easy, e.g. in countries with weak accounting and judicial standards. The reason is that lenders who finance several projects up-front have to charge very high interest rates to be compensated for the risk of strategic default. Finally, Martinelli (1997) provides a rationale for the specific value of dynamic incentives in bank lending to very young firms that have not yet established a credit history or reputation.

Summarizing, dynamic incentives provide a way to test a borrower's repayment ability and willingness with small loan amounts in the beginning of the relationship. Loan amounts then gradually increase upon positive repayment behavior so that setting dynamic incentives serves as an enforcement device and enables the bank to closely monitor the borrower in early stages of the relationship.[2] Therefore, I expect granted loan amounts to increase over repeated interactions between borrowers and bank. Besides, the increase is expected to be more pronounced for informationally opaque borrowers such as young firms.

Models dealing with the borrower side in bank-borrower relationships mainly concentrate on the costs (Sharpe (1990), Rajan (1992) and von Thadden (2004)) and benefits (Boot and Thakor (1994), Chemmanur and Fulghieri (1994) and von Thadden (1995)) borrowers incur from multiple interactions with the same lender. However, multiple interactions between borrower and bank may be interpreted as a strategic game in which both actors have to learn about the game and the other player. Requested (and granted) loan amounts therefore possibly depend on previous outcomes of loan contracting.

Considering borrowers' behavior, two scenarios seem possible when borrowers approach the bank for the first time, request a certain loan amount and are granted only a lower than requested amount after the financial analysis. On the one hand, borrowers may learn which

[2] This concept of starting small is also established in the corporate finance literature (e.g. Tirole (2006)) to model so-called staged financing, in the industrial organization literature to explain the development of business partnerships in states of uncertainty (e.g. Rauch and Watson (2003)) and in the venture capital literature when venture projects are financed under uncertainty and the threat of moral hazard (e.g. Bergemann and Hege (1998) and Wang and Zhou (2004)).

projects the bank will possibly finance and which loan amounts to request when applying for further loans. Such an adaptation of requested loan amounts should reduce observed credit constraints over loan sequences. Besides, it implies that borrowers who were granted a considerably lower than requested amount at the previous interaction should place a more moderate request at the next interaction compared to borrowers who received the amount they requested. The literature on borrower behavior in the credit market is scarce. For instance, Agarwal, Driscoll, Gabaix and Laibson (2008) model and test learning dynamics in a credit card market where clients seem to learn to avoid paying future fees through negative feedback, i.e. the experience of past fees.

On the other hand, it seems plausible to assume that borrowers who received a lower than requested loan amount at the previous interaction may react by overstating the requested amount for the next loan accordingly. This implies that observed credit constraints would persist, especially in the beginning of a bank relationship, although granted loan amounts per se may increase. A parallel argument can be found in papers that investigate overbidding in the fixed-interest repo auctions the European Central Bank (ECB) used to conduct.[3] Based on the stylized repo game model of Nautz and Oechssler (2003), Ehrhart (2001) shows in an experimental study that bid sizes as well as the extent of overbidding increase over time when the planned allotment is smaller than bidders' true demand. Bidders are found to follow a myopic best-reply behavior, i.e. for the current bid they take into account the ratio of their true demand to their individual allotment at their previous bid. Nautz and Oechssler (2006) confirm these experimental findings analyzing data from the ECB and the Bundesbank.[4]

2.2 Related empirical studies

This study contributes to three strands of the empirical banking and finance literature: relationship lending, demand and supply effects in bank lending and the determinants of credit availability for small firms.

Empirical studies on relationship lending have used a variety of proxies such as the length, number, scale and scope of bank relationships to capture the intensity of the relationship and the extent of asymmetric information. Yet, it is not clear from this approach how exactly banks collect and process information. One possibility for banks to gather information over time is to observe their borrowers' usage of credit lines (Berger and Udell

[3] In these auctions, the EBC announces a repo rate and banks simply state which amount they would like to receive at this cost. If total bids exceed the planned allotment, banks are rationed proportionally to their bids.
[4] The myopic best-reply behavior may be an argument for overstated requested loan amounts at the second interaction between borrower and bank in my setting. However, the bank is likely to react to such a behavior while the repo auction procedure is purely mechanical on the central bank's side.

(1995)). While Jimenez, Lopez and Saurina (2009) examine the determinants of credit line usage, Norden and Weber (2010) find that banks indeed use the information gained from observing borrowers' credit line usage and account activity in managing their relationships. For instance, if banks receive early warning signals from limit violations, they increase credit spreads on subsequent loans made to these borrowers. Puri, Rocholl and Steffen (2010) confirm that observing the usage of credit lines provides banks with the most valuable private information.

This study complements the literature on information production in bank relationships by analyzing a chain of short-term repeat loans as another possibility for banks to gather information from multiple interactions with the same customer. Following bank and borrowers from their first interaction over several loan contracts allows me to explore how banks make use of dynamic incentives to deal with risks arising from asymmetric information and how this learning process translates into granted loan terms.

Very few recent papers examine demand and supply effects in bank lending. Cheng and Degryse (2010) find that the introduction of a public credit registry alleviates informational barriers and reduces credit rationing in the Chinese credit card market when studying demand and supply separately. Focusing on the impact of macroeconomic and financial shocks on bank lending, Jimenez, Ongena, Peydro and Saurina (2010) study how the balance-sheet strengths of Spanish banks and firms influence credit availability thus separating demand and supply effects on the probability that a loan request results in a loan granted. Concerning their relationship measures, they observe that longer and fewer bank relationships positively influence credit availability. Puri, Rocholl and Steffen (2009) examine how the US financial crisis affected retail bank lending at German savings banks. They find that demand decreases at all savings banks while savings banks that were affected by the financial crisis reject substantially more loan applications than non-affected banks. They also find that loan applications of customers with previous relationships with an affected bank are less likely to be rejected than those of new customers.

This paper extends the existing evidence on demand and supply effects in bank lending by explicitly exploiting a panel data structure and analyzing requested and granted loan amounts in a sequence of interactions between borrowers and a bank. It is, to the best of my knowledge, the first study to provide evidence of the dynamic patterns that arise on both the demand and the supply side when bank and borrowers contract repeatedly over time. In that respect, it is closest to Ioannidou and Ongena (2010). Using a panel dataset, they follow borrowers over several interactions with lenders and study contracted loan terms before and

after borrowers switch banks. Thereby they are able to establish the dynamic patterns that arise on the supply side when firms start new relationships and interact repeatedly with one lender. This paper adds the demand side to the analysis. So far, the literature has been relatively silent on how exactly loan negotiations work[5] and how bank and borrower react to previous contractual outcomes.

Finally, this study relates to the literature on the influence of bank relationships on credit availability of small firms. Existing empirical studies generally find a positive relation between various measures of relationship strength and credit availability. Petersen and Rajan (1994, 1995) use an indirect measure of credit constraints, the percentage of trade credits paid late. They find that the length and scope of the relationship and borrowing from fewer lenders positively influence credit availability. While these papers have established the value of close bank relationships on the availability of credit for small firms, they have not been able to directly observe borrowers' requests and relate them to the actual loan terms granted by the bank. Without this information, it is not clear whether the indirect proxy captures loan size constraints or borrower rationing.

Harhoff and Körting (1998) also find a positive influence of borrowing from fewer lenders on credit availability. Cole (1998) and Angelini, Di Salvo and Ferri (1998) establish that the valuable private information seems to be gathered very early in the relationship. Machauer and Weber (1998) confirm that close bank relationships are beneficial for firms since they obtain more finance when borrowing from their hausbanks, while Elsas and Krahnen (1998) find that especially risky borrowers benefit from bank relationships. Scott (2006) shows that loan officer turnover, which is connected with a loss of soft information, is positively related to the probability that banks deny credit. Finally, Bodenhorn (2007) and Ioannidou and Ongena (2010) find that bank relationships play a crucial role in obtaining larger contracted loan amounts.

This paper uses a more comprehensive measure of credit availability: the ratio of requested to granted loan amounts for those borrowers receiving credit. One caveat to this approach, however, is that it assumes requested and granted loan amounts to mirror 'real' demand and supply although both may be driven by strategic considerations. Whereas the dataset at hand does not allow me to fully resolve this issue, it takes the analysis of credit availability one step further by incorporating loan applications and shedding some first light on strategic processes.

[5] One exception are the papers studying borrower bargaining power (e.g. Uchida (2006), Santos and Winton (2009) and Grunert and Norden (2010)).

3 Data and methodology

3.1 The data and the Bank's loan granting process

The dataset used in this study comprises all annuity loans, credit lines and overdrafts to firms extended by one Bulgarian bank (henceforth called the "Bank") between April 2003 and September 2007. The Bank is a nationwide full-service bank with a large branch network in both urban and rural areas. It provides credit and other financial products (e.g. savings products, payment services, credit cards, leasing) to private and business clients with a special focus on lending to small enterprises. For each loan the dataset includes information from the borrowers' loan applications on the loan terms that were requested. I match this information with data on the actually granted loan terms as stated in the loan contracts as well as with borrower characteristics and relationship indicators at the time of loan origination. Definitions of all variables are provided in Table 1.

[Insert Table 1 here]

All observations with missing loan or firm-level data are excluded. Since the following empirical analysis focuses on the evolution of requested and granted loan sizes and their relation over a loan sequence, all loans after the ninth are excluded due to very few observations in these categories. Based on the fact that interest rate and collateral requirements are fixed for small loans whereas they are individually negotiated in the loan granting process for medium loans (loans with amounts of more than 50,000 EUR), eventually all medium loans are excluded from the main analysis. This leads to the final sample of 98,987 loans to 58,642 firms comprising 32,832 single loan clients and 25,810 repeat clients with loan sequences of up to nine loans.

At the heart of the Bank's lending technology is a thorough analysis of the borrower's debt capacity. Approaching the Bank, a borrower first of all meets a Client Advisor who assesses whether the borrower meets the Bank's basic requirements. If the borrower does so, she has to fill in a loan application form. To begin with and most importantly, she is asked to indicate her preferred loan amount, maturity and currency and the purpose of the loan. She also has to provide information about the firm, other bank relations and the amount she can spare monthly for the repayment of the loan. In a next step, the Bank's credit administration prepares information on the borrower's credit history with this Bank and other banks to check her repayment behavior and loyalty to the Bank. At the same time, the loan officer conducts

the financial analysis which includes a personal visit to the borrower's site. Eventually, the loan officer presents the customer's request and the suggested loan terms together with the information gathered during the financial analysis to the Bank's credit committee which makes the final decision on the granted loan terms. Collateral requirements and interest rates are fixed and consequently do not play a role in the individual loan contracting process for my sample of small loans (loans with amounts of up to 50,000 EUR). Therefore, I will not explicitly consider these loan terms throughout the empirical analysis.

Concentrating the analysis on small loans from one bank in an emerging market provides an ideal ground for studying the influence of bank relationships on requested and granted loan terms because informational asymmetries are presumably severe. The bank's standardized loan contracts for small loans leave only loan amount (and maturity[6]) as means for the bank to deal with borrowers' credit risks. The sample is therefore well suited to study the adjustment of these loan terms during the loan granting process. Finally, since the loan granting process is the same for all observed loans possible heterogeneity is reduced at this level.

3.2 The ratio of requested to granted loan amounts

Since I observe requested and granted loan amounts I am able to establish the extent to which borrowers receive a smaller loan amount than they requested. I denote this as observed credit constraints and measure it by the *Requested-granted ratio* (the higher the ratio the more constrained the borrower). Table 2 reveals that the Bank's decision to grant smaller than requested amounts strongly depends on the extent of asymmetric information. To clearly capture the effect of different levels of asymmetric information between borrowers and to separate it from the effect of repeated interactions over time only first loans are included in the calculations. Two proxies for firm opaqueness widely used in the banking literature are firm age (e.g. Berger, Klapper and Udell (2001)) and firm size (e.g. Berger and Udell (1995) and Petersen and Rajan (1995)). I define *Initially young* firms as those with firm age of up to two years at their first loan because such firms have not had the time to establish a public track record (see Petersen and Rajan (1994)). To define *Initially small* firms, I follow Petersen and Rajan (1995) and split the sample at the median value of firm size at the first loan. Besides, results are presented for the two subsamples of single loan vs. repeat clients to assess whether the extent of observed credit constraints influences the borrower's decision to request a further loan.

[6] Since amount and maturity are found to be complementary contract terms, the analysis mainly focuses on requested and granted loan amounts.

[Insert Table 2 here]

Table 2 shows that loan size constraints are significantly larger for the *Initially young* than for the initially old firms and that this result holds for the single loan and the repeat clients. Findings for the *Initially small* vs. initially large firms are very similar with differences between the two groups being even more pronounced. Thus, Table 2 clearly indicates that these measures of asymmetric information play an important role in the Bank's decision to grant a lower than requested amount. Interestingly, the difference-in-difference estimates (in bold) show that these differences between the initially young vs. old and initially small vs. large firms are significantly larger for the single loan clients. However, taking a closer look at the single loan vs. repeat clients in the last column of the table reveals that differences in loan size constraints between these groups are economically very small. Furthermore, it is the group of repeat clients that experiences significantly larger constraints at their first loans if they are initially older or larger. Taken these results together, the extent of observed credit constraints does not seem to (negatively) influence the incidence of borrowing repeatedly from the Bank. Therefore, I will pool all borrowers in the regression analysis.

The main measure of relationship strength is the loan number indicating how many interactions between the borrower and the Bank have taken place providing the Bank with the opportunity to monitor borrowers and to observe their repayment behavior. Figure 1 displays the *Requested-granted ratio* over the loan sequence for the subsample of repeat clients and its various subgroups based on the age and size indicators of asymmetric information.

[Insert Figure 1 here]

Figure 1 shows that observed loan size constraints decrease considerably over an average loan sequence. For the full sample, loan size constraints decrease significantly in the beginning of the loan sequence from 1.24 to 1.07 between the first and the fifth loan.[7] Thus, using this more comprehensive measure of credit constraints confirms findings from previous studies that employ indirect or equilibrium outcome measures for credit availability (e.g. Petersen and Rajan (1994) and Ioannidou and Ongena (2010)). The observed decrease in loan size constraints is a first indication of the dynamic patterns that may be at work. On the Bank side, the application of dynamic incentives, which include increasing loan amounts upon due

[7] To rule out that the observed pattern is driven by changes in the bank policy over years, I also investigate loan sequences that start in different years and find similar patterns no matter when bank relationships begin.

repayment (e.g. Armendariz de Aghion and Murdoch (2005)), lead to a reduction in observed constraints. Alternatively or simultaneously, learning from past experience on the borrower side may explain the observed pattern as well. An explanation which can be ruled out from these results is that borrowers overstate their demand as a reaction to past constraints because such a behavior would not decrease the ratio between observed requested and granted amounts during the first few interactions.

Furthermore, Figure 1 shows that all subgroups of firms experience considerable reductions in loan size constraints in the beginning of their bank relationships. This decrease is significant and particularly strong between the first two loans for the *Initially young* (from 1.32 to 1.15) and *Initially small* firms (from 1.31 to 1.16). Apart from that, the *Initially young* firms which have no or little proof of their viability available at that stage face significantly higher loan size constraints than the older firms in the beginning of their relationships which is consistent with the rationale provided by Martinelli (1997). Similarly, *Initially small* firms experience significantly higher credit constraints up to loan number five when comparing them to the initially larger firms. Note that all indicated differences are significant at the 0.01-level using a Student's t-test.

Figure 1 suggests that the information which both Bank and borrowers may gather through repeated interactions reduce observed loan size constraints with this effect being most pronounced for the first few interactions. A crucial part of the following empirical analysis will be concerned with the determinants of loan size constraints and, most importantly, the underlying dynamics on the borrower and Bank side over the course of a bank relationship.

3.3 Determinants of the ratio of requested to granted loan amounts

As a basis for the analysis of dynamic processes on both the demand and supply side, I start with studying the factors that influence the degree of observed loan size constraints in the sample in two steps. First, I estimate an OLS model for the full sample with *Requested-granted ratio*$_{i,k,t}$ as the dependent variable. With larger values indicating higher credit constraints *Requested-granted ratio*$_{i,k,t}$ is the requested loan amount as a share of the granted loan amount of loan *k* firm *i* receives in period *t*:

$$\textit{Requested-granted ratio}_{i,k,t} = a + \beta_1 A_{i,t} + \beta_2 F_{i,t} + \beta_3 L_k + \beta_4 B_t + \beta_5 T_t + e_{i,k,t} \qquad (1)$$

$A_{i,t}$ is a vector of indicators measuring the level of asymmetric information, $F_{i,t}$ is a vector that includes firm characteristics controlling for firm risk and capturing further aspects of firm

opacity, while L_k is a vector of loan characteristics. Finally, B_t and T_t are vectors of branch and time dummies accounting for the branch-specific (such as local competition) and general (such as macroeconomic and monetary conditions, the Bank's refinancing situation and the Bank's prevailing interest rate and collateral requirements for small loans) environment at the time of loan disbursement.

In a second step, I estimate outcome equation (1) as a panel model with firm fixed effects to control for any unobserved borrower heterogeneity that may have been ignored in the previous analysis and that may influence the *Requested-granted ratio*. In contrast to the OLS estimator, the fixed effects estimator only accounts for the within variation of all variables, i.e. their variation over a loan sequence for each borrower, and not for their variation between different borrowers. This concentrates the analysis on the factors that determine differences in credit constraints over the course of individual bank-borrower relationships.

Indicators of asymmetric information

The variable *Times* indicates the number of the current loan and measures the intensity of the bank-borrower relationship.[8] Most importantly, it captures the dynamic patterns that arise along a chain of interactions between borrowers and the Bank. To allow for non-linear effects I include the dummy variables *Times_2, …, Times_5* (which pools interactions number five to nine because of the fewer observations in these categories and because the descriptive analysis has displayed that most of the action happens in the beginning of the relationship) and use *Times_1* as the reference category.[9]

Martinelli (1997) suggests that young firms without a credit history or reputation are initially loan size constrained to provide them with an incentive to repay and obtain larger loan amounts in the future. I include the dummy variable *Initially young* to capture whether a firm was young, i.e. its firm age was below or equal to two years, when borrowing the first time from the Bank. To study whether dynamic incentives are indeed particularly strong for initially young firms I assess the interaction effects *Times_2*Initially young, …, Times_5*Initially young*. Similarly, the dummy variable *Initially small* indicates whether a firm was comparatively small, i.e. its size in terms of total assets was below the median firm size, when borrowing for the first time from the Bank. To assess whether there is indeed a

[8] I do not include the duration of a *Bank relationship* to measure the level of asymmetric information because it is highly correlated with *Times*. However, rerunning all regressions with *Bank relationship* instead of *Times* reveals qualitatively and quantitatively very similar results.
[9] I also test for the differences in adjacent time dummies and find that they are significant in all specifications.

differential effect of initial firm size on credit constraints over loan sequences the interaction effects *Times_2*Initially small,…, Times_5*Initially small* are included.

When a borrower applies for a loan, it is the loan officer with whom interaction takes place and who collects all the borrower-specific data necessary for the subsequent decision on whether to grant a loan and under which conditions (see Berger and Udell (2002), Stein (2002) and for empirical papers using loan officer information e.g. Liberti (2005), Scott (2004, 2006), Uchida, Udell and Yamori (2006), Beck, Behr and Güttler (2009) and Liberti and Mian (2009)). If the information gathered by the loan officer cannot fully be transmitted within the bank, which is likely for qualitative soft information, part of it is lost in case a loan officer change takes place. This loss is most extreme when the loan officer leaves the bank but might even matter when responsibilities are rescheduled within the bank.[10] The variable *Loan officer change* is included in the analysis indicating whether the loan officer has changed during the duration of the previous loan. If there was a previous change, some of the effects of a close bank-relationship on the reduction of loan size constraints may be tempered.

Firm and loan characteristics

The included firm characteristics are further indicators of asymmetric information and control for borrower risk. Sole proprietorships are more opaque than incorporated firms because they do not have to provide certified annual reports according to Bulgarian law, hence the dummy variable *Sole proprietorship* equals one if the firm is a sole proprietorship and zero otherwise. Borrowers that are highly indebted face a higher risk of default in case of external shocks to their income so that I introduce *Leverage*, the firm's total debt as share of its total assets at the disbursement date of the loan. A firm with little financial scope (*Disposable income* (measured in log euro)) to react to unforeseen cuts to its income is more vulnerable to external shocks and thus more risky because the repayment of the loan may be endangered more easily. To account for all remaining differences in firm characteristics the regressions contain seven *Industry dummies*.

One loan characteristic which raises little concern to be endogenous to the determination of all other loan contract terms is the *Fixed capital loan* variable. It indicates whether a loan is for fixed capital financing or working capital otherwise, which is induced by the purpose of the loan and thus predetermined (exogenous) to the decision on other loan terms. If a loan is

[10] The loan officer changes observed in the dataset mostly occur because loan officers are promoted within the Bank or because they leave the Bank. The Bank does not follow a policy to regularly rotate its loan officers internally to avoid too close relationships between clients and loan officers that might lead to decisions rather based upon personal considerations than objective judgements (see Hertzberg, Liberti and Paravisini (2010) for positive effects of loan officer rotation).

intended for fixed capital financing, the underlying asset may be sold in case of default lowering the risk associated with such loans. Similarly, an *Annuity loan* (dummy variable which is one if the loan is an annuity loan and zero if it is a credit line or overdraft) may be considered less risky because of its regular repayment schedule.

Finally, loan maturity is possibly endogenous to the determination of loan amount and its inclusion in the regressions would bias the estimates. Studying requested and granted loan amounts and maturities reveals that both loan terms are complements because for 67% of all loans they are adjusted into the same direction, i.e. requests for both loan terms are either higher, lower or equal to both granted loan terms. The Spearman rank correlation between the *Requested-granted ratio* and the ratio of requested to granted maturity is 0.4324 and significant (p-value <0.01) which means that the two variables are not independent. Therefore, I concentrate the main analysis on requested and granted loan amounts but will provide some further evidence on requested and granted maturities in the extensions.

3.4 Requested and granted loan amounts and their development over time

When borrowers and Bank interact repeatedly they both learn about the other party's behavior and its reaction to the own behavior which, in turn, may influence the outcome of the following interaction. These dynamic aspects are studied in a panel model with firm fixed effects because the interest lies in the factors affecting changes in requested and granted loan amounts and their relation over borrowers' loan sequences. The dependent variables are *Requested amount*$_{i,k,t}$ and *Granted amount*$_{i,k,t}$ indicating requested and granted loan amounts (in log euro) for loan *k* that firm *i* receives in period *t*:

$$\begin{aligned} \textit{Requested amount}_{i,k,t} = {} & a_i + \beta_1 \textit{Lag Requested-granted ratio}_k \\ & + \beta_2 A_{i,t} + \beta_3 F_{i,t} + \beta_4 L_k + \beta_5 T_t + e_{i,k,t} \end{aligned} \tag{2}$$

$$\begin{aligned} \textit{Granted amount}_{i,k,t} = {} & a_i + \beta_1 \textit{Lag Requested-granted ratio}_k \\ & + \beta_2 A_{i,t} + \beta_3 F_{i,t} + \beta_4 L_k + \beta_5 T_t + e_{i,k,t} \end{aligned} \tag{3}$$

In this model a_i includes the firm fixed effects, $A_{i,t}$ is a vector of indicators of asymmetric information, while $F_{i,t}$ and L_k are vectors of firm and loan characteristics. The vector T_t contains time dummies accounting for the macroeconomic environment as well as the Bank's prevailing fixed contract terms for small loans at the time of loan disbursement.

Lag Requested-granted ratio, the degree of credit constraints at the previous loan, is the key explanatory variable in these regressions accounting for the effect which the previous

experience to receive a smaller than requested loan amount has on current behavior. To capture how requested and granted loan amounts evolve over a loan sequence the variable *Times* (measured by the dummy variables *Times_3,…, Times_5* with *Times_2* serving as the reference category) is included. The interaction effects *Times_3*Lag Requested-granted ratio,…, Times_5*Lag Requested-granted ratio* are included to study whether the relation between the intensity of the bank relationship and the requested or granted loan amount differs by the extent of credit constraints experienced during previous interactions. *Loan officer change* is used as an additional measure for the extent of asymmetric information and relationship strength. It is not only expected to be negatively related to granted loan amounts due to a loss in private information but also to requested loan amounts because borrowers often follow their loan officers resorting some of their financial activities to other banks.

Requested and granted loan amounts will furthermore depend on firm and loan characteristics. *Age*, *Assets* and *Disposable income* control for credit risk, financial transparency as well as the investment opportunities of firms. Older and bigger firms are likely to plan larger investment projects thus requesting larger loan amounts. At the same time, they may also receive larger loan amounts because they are more financially experienced, less risky and more transparent. I further include *Asset growth* to control for the fact that previously loan size constrained firms may request smaller loan amounts than previously unconstrained borrowers simply because they are hampered in their growth options. *Leverage* is a measure of the firm's already exhausted debt capacity and should be negatively related to requested and granted loan amounts. Finally, *Fixed capital loan* and *Annuity loan* are expected to be associated with larger granted loan amounts due to their relatively lower credit risk. Again, *Requested maturity* and *Granted maturity* are not included because they are complements to requested and granted amount.

3.5 Summary statistics

Table 3 presents summary statistics for the indicators of asymmetric information and the loan and firm characteristics.[11] Panel A displays sample means for these variables over the loan sequence and shows that *Requested amount* and *Granted amount* increase considerably over a bank-borrower relationship nearly doubling on average between the first and the ninth loan. Early loans in a loan sequence are more likely to be used for fixed capital financing whereas later loans are more often intended for working capital purposes. Apart from that, firms tend to start their bank relationship rather with loans than other financial products

[11] The table displays the untransformed values for the variables *Requested amount*, *Granted amount*, *Requested maturity*, *Granted maturity*, *Age*, *Assets* and *Disposable income*.

having been with the bank for only 1.15 months on average when receiving their first loan. These observations indicate that bank relationships regularly start with investment loans and only later comprise other financial products such as current accounts with overdraft facilities.

Loan officer changes seem to be a frequent phenomenon so that between 23% and 38% of loans are granted by loan officers different from those that granted the previous loan. While firms show relatively low levels of indebtedness with *Leverage* not exceeding 26%, the variables *Sole proprietorship*, *Assets*, *Asset growth* and *Disposable income* indicate that firms grow substantially over time. The variable *Initially small* supports this explanation. It reveals that the proportion of loans made to firms which were comparatively small when they started to borrow is stable up to the sixth loan, which means that the very small clients do not gradually drop out of the sample. Finally, the majority of firms take out up to four loans at this Bank. Since most of these loans have comparatively short maturities, there is nevertheless a sizeable number of borrowers with loan sequences of up to nine loans despite an observation period of only 4.5 years. This justifies the use of panel methods in the empirical analysis to account for the evolution of loan terms along these chains of interactions between Bank and borrowers.

[Insert Table 3 here]

Panel B of Table 3 presents statistics for the two subsamples of unconstrained vs. constrained loans. Interestingly, column (1) shows that those firms which receive the same as or a larger than requested loan amount exhibit only a slight difference in requested and granted maturities. On the contrary, column (2) shows that firms which are credit constrained are granted equivalently shorter than requested maturities. This is a further indication that loan amount and maturity are complementary contract terms rather than substitutes. The credit constrained firms in column (2) borrow on average less often, are more likely to be young and small at their first loan, are younger in general and have shorter bank relationships than the unconstrained firms (column (1)) so that they seem to be the less experienced borrowers. They are also clearly smaller in terms of total assets and disposable income implying that the Bank may deal with their possibly greater risk by limiting granted loan sizes. A t-test confirms that these differences in firm characteristics are statistically significant at the 0.01-level when comparing the two groups. Interestingly, both groups do not significantly differ in their *Asset growth*.

4 Results

4.1 Determinants of the ratio of requested to granted loan amounts

Table 4 displays the regression results on the determinants of the *Requested-granted ratio* based on estimations for both the full sample and the panel of repeat clients. Regressions for the full sample include industry, branch and year-month dummies, but they do not include the variable *Loan officer change* because for all first loans this variable is zero by definition and thus its effect is diluted. The regression for the subsample of repeat clients includes firm fixed effects to account for unobserved firm heterogeneity and year-month dummies. The branch dummies as well as the variables *Initially young*, *Initially small* and *Sole proprietorship* are excluded from this regression due to (almost) no within-variation. Standard errors are reported in parentheses and are adjusted for clustering at the firm level.

Effects of asymmetric information indicators and firm and loan variables

Column (1) of Table 4 presents OLS estimates for the full sample. The results confirm that firms with more intense bank relationships and more transparent and less risky firms experience lower observed credit constraints.

[Insert Table 4 here]

The variables *Times_2, …, Times_5* capture the effect which the intensity of the bank-borrower relationship has on observed loan size constraints for the initially older and larger firms. The more often such a firm borrows from the Bank, the less credit constrained it is with credit constraints decreasing most distinctly between the first two interactions (3.2%). Those firms that are *Initially young* or *Initially small* experience credit constraints that are higher than those for the initially older (5.7% on average) or initially larger (5.1% on average) firms. The significantly negative coefficients for the interaction effects of *Times_2, …, Times_5* and *Initially young* and *Initially small* respectively indicate that the reduction of credit constraints over a loan sequence is more pronounced for initially younger and smaller firms. For instance, between the first two interactions *Initially young* firms experience on average an additional 4.3% decrease in loan size constraints compared to initially older firms. For *Initially small* firms this additional decrease is 5.0%.

The additional firm and loan characteristics show that observed credit constraints also depend on the general financial transparency of the firm and the observable credit risk. Larger firms in terms of *Disposable income* and firms taking out a *Fixed capital loan* are less credit constrained. Since firms with more disposable income are less vulnerable in case of external shocks to their business and since fixed capital assets may be sold in case of default these loans may be considered as less risky. Besides, investments in fixed assets may be more difficult to be split which leaves less scope for loan size constraints. At the same time, firms that show a higher *Leverage* are more constrained further indicating that the Bank is concerned with observable credit risk when constraining credit. Surprisingly, *Sole proprietorships* which are considered to be less transparent than incorporated firms face lower credit constraints. Nevertheless, the Bank may assess them to be less risky because of their owners' unlimited liability and because the firm management does not easily change.

These results provide information on the criterions that matter for observed credit constraints. While the economic impact of the additional firm characteristics is relatively small, being a young or small firm when starting the bank relationship are important factors of receiving smaller than requested loan amounts. The generally higher constraints for *Initially young* and *Initially small* firms indicate that the extent of (publicly) available information between borrowers matters for being credit constrained. Besides, the more pronounced reduction in observed credit constraints over time for the initially young and small firms implies that the positive information from due repayment is especially important for these borrower groups to reduce the *Requested-granted ratio* over multiple interactions. This complements the findings in Norden and Weber (2010) that the negative information from abnormal credit line usage leads to tighter terms on subsequent loans. In that sense, the *Requested-granted ratio* may also be interpreted as a measure of the firm's credit worthiness. Finally, these results rule out that borrowers overstate their demand as a reaction to previous constraints. Such a dynamic process would not induce the observed reduction in the *Requested-granted ratio*, especially not its distinct decline between the first and second interactions.

Repeat clients

The results from the repeat client analysis presented in column (2) are very similar to those from the full sample in column (1). Thus, when focusing on borrowers' loan sequences and controlling for unobserved borrower heterogeneity I also find that the intensity of the bank-borrower relationship and the initial firm age and size are important determinants of the

extent of observed credit constraints. A *Loan officer change* leads to higher credit constraints, but the economic effect is relatively small (2.7%). This confirms the reasoning in Berger and Udell (2002) that not all of the soft information gathered by loan officers can be transformed into common knowledge within the Bank. An alternative explanation would be that the borrower and the loan officer were colluding leading to better loan terms than the borrower risk would justify. In this case, an increase in credit constraints after a loan officer change would imply a stricter, more objective assessment of the borrower's risk and repayment capacity by the new loan officer. Furthermore, I find confirmation for the earlier result that more transparent and less risky (*Disposable income, Fixed capital loan*) borrowers are less credit constrained. Not surprisingly, *Leverage* does not play any significant role in this fixed effects regression since it varies very little over time.

4.2 Requested and granted loan amounts and their development over time

Employing a more comprehensive measure of credit constraints that incorporates loan demand has confirmed the positive relation between close bank relationships and credit availability established by previous studies that use indirect or equilibrium outcome measures of credit constraints (e.g. Petersen and Rajan (1994, 1995) and Ioannidou and Ongena (2010)). The approach so far has crucially relied on the assumption that the observed requested and granted loan amounts mirror 'real' demand and supply. Yet, they may also be mere strategic indications arising from previous experience with the same contract partner and the loan negotiation process. Therefore, I take the analysis one step further and shed light on the movements of requested and granted loan amounts over borrowers' loan sequences. The structure of the dataset enables me to disentangle whether the observed reduction in credit constraints stems from the Bank's willingness to provide more funds to more transparent borrowers as is generally assumed in the literature. Alternatively or simultaneously, the borrower might learn over time what is reasonable to request from the Bank, which would also lead to a decrease of credit constraints over loan sequences.[12]

Table 5 reports results for the determinants of requested and granted loan amounts with special focus on the influence of relationship measures and the dynamics that may drive the borrowers' and the Bank's decisions when contracting repeatedly.

[12] This does not imply that the borrower may not be credit constrained at other banks. This does also not imply that the borrower would not prefer to realize a larger loan amount if it was possible. However, the structure of the dataset allows me to observe the evolution of borrowers' requests over multiple interactions with the same lender and to draw conclusions on borrower learning from the results.

[Insert Table 5 here]

Columns (1) and (2) contain estimates for the determinants of *Requested amount*. The explanatory variable of particular interest in these regressions is *Lag Requested-granted ratio* which indicates how constrained a borrower was at the previous loan. The estimates in column (1) reveal several interesting findings. The more credit constrained a borrower was at the previous loan, the lower the requested amount at the current loan. On average, a ten percent increase in loan size constraints at the previous loan decreases the requested amount at the current loan by 2.5%. Moreover, firms generally request larger loan amounts over the loan sequence (*Times_3, …, Times_5*). For instance, requested loan amounts for the third loan are by 16.6% higher than for the second loan. One reason may be that firms grow over time and therefore need to finance larger investments. This is supported by the positive relation between firm *Age* and the requested loan amount. Nevertheless, another explanation may be that especially the larger firms in the sample stay with the Bank for more interactions. I explicitly account for this possible drop-out problem in Table 6 by relating the number of loans a firm takes out to firm characteristics.

To assess how the relation between the number of interactions between a firm and the Bank (*Times_3, ..., Times_5*) and the *Requested amount* is moderated by the experience to be credit constrained at the previous loan I introduce the interaction terms of both variables in column (2). Figure 2 illustrates the results and shows that, in the beginning of the relationship, the increase in requested loan amounts is flatter for those borrowers that experienced high credit constraints in the past. Thus, while borrowers increase their loan requests over time they seem to learn from previous credit constraints how much to reasonably request from this Bank and adapt their requested loan amounts during the first few interactions accordingly. This result is similar to the learning through negative feedback which Agarwal, Driscoll, Gabaix and Laibson (2008) find when studying customers' reactions to paying (penalty) fees in the credit card market. Importantly, this result is not driven by constrained firms requesting comparatively lower loan amounts because they experience lower growth rates. Comparing the growth rates of previously constrained vs. unconstrained borrowers shows that constrained borrowers even grow significantly more (0.56 vs. 0.49, p-val.<0.05) than unconstrained borrowers.

The firm level variables suggest that borrowers value the relationships with their loan officers. After a *Loan officer change* has occurred borrowers request considerably lower (17.7%) loan amounts. Often borrowers follow their loan officers to other banks doing some

of their banking business with the new bank but not fully leaving this Bank because they already have an account there and value the services this Bank offers. The additional firm and loan controls show that larger (*Assets*) and faster growing (*Asset growth*) borrowers with a higher monthly repayment capability (*Disposable income*) request larger loan amounts while firms with a higher *Leverage* ask for smaller loans. Finally, since they presumably finance larger investments, loans intended for fixed capital financing and loans with a regular repayment schedule (*Annuity loan*) are requested with larger amounts than working capital loans and credit lines or overdrafts.

Turning to the determinants of the Bank's granted loan amounts, columns (3) and (4) reveal that all variables show the same signs as in the regressions for the firms' requested loan amounts with the interesting exception of the variable *Lag Requested-granted ratio* and its interactions with *Times_3, ..., Times_5*. The results in column (3) show that, in accordance with borrowers requesting larger loan amounts over time, the Bank also grants larger loan amounts over a loan sequence. For instance, granted loan amounts for the third loan are by 20.4% higher than for second loans. The more credit constrained a borrower was at the previous loan the more the Bank is willing to grant at the current loan but this effect is economically small. A ten percent increase in loan size constraints at the previous loan increases the granted amount at the current loan by 0.6% on average. Although this effect is not statistically significant in column (4), the significantly positive interaction terms *Times_3*Lag Requested-granted ratio, ..., Times_5*Lag Requested-granted ratio* indicate that the Bank grants relatively more to borrowers facing high in contrast to small constraints at their previous loans when moving along the loan sequence. Figure 3 displays that this effect is most pronounced during the first few interactions and levels off afterwards.

The firm level variables reveal that granted loan amounts are considerably smaller after a *Loan officer change* with this effect being economically stronger (19.6%) than on the demand side. This may imply that indeed some proprietary information is lost when loan officers are assigned new portfolios or leave the Bank. Alternatively this finding may be a sign of previous collusion between the borrower and the loan officer leading to excessively large loan amounts. After a loan officer change, the new loan officer conducts a thorough financial analysis on which the decision about the granted loan terms are solely based. To investigate this issue more deeply, I replace the variable *Loan officer change* in all the regressions with an indicator measuring the number of loans a borrower has been with the same loan officer when taking out the current loan (results not reported here). It turns out that each additional interaction with the same loan officer increases requested loan amounts by 9% (p-val.<0.01)

and granted loan amounts by 11% (p-val.<0.01) with this effect being stronger than the average effect of the *Times* dummies. Although there are a few relationships between borrowers and loan officers for which collusion might be a possible explanation because they last up to nine interactions, the average number of interactions with a loan officer is 1.7 for repeat clients leaving little room for collusion. Therefore, it seems as if the reduction in informational asymmetries especially in the beginning of a relationship and the partial loss of the acquired information during a loan officer change is the main driver of the observed decrease in loan amounts after a loan officer change.

The other firm and loan level variables show that *Granted amount* is mainly determined by the firm's financial transparency and credit risk. Older and larger firms (*Age*, *Assets*) and firms with more *Disposable income* are granted larger amounts while more indebted firms (*Leverage*) are granted smaller amounts. Also, loans that finance a fixed asset (*Fixed capital loan*) which may be sold in case of default and *Annuity loan*s with regular repayment schedules and thus lower risk show higher granted amounts.

Summarizing, being able to disentangle the dynamic patterns that arise when borrower and bank start a relationship and interact repeatedly reveals several interesting results. First, I find that both requested and granted loan amounts increase considerably over time. Second, the gap between requested and granted loan amounts decreases especially in the beginning of the relationship due to a convergence of both sides with requested amounts increasing more moderately and granted amounts increasing more strongly when borrowers experience high vs. low previous credit constraints. And third, I observe the effects on the borrowers' side not to be driven by reduced firm growth of the credit constrained firms. These findings imply that borrowers react to the experience of receiving smaller than requested loan amounts by more moderate requests at their next loan application, thus avoiding being highly constrained again. Therefore, they seem to learn from the feedback they get from previous experiences.

This learning process is possibly accompanied by the firms' entering into other bank relationships. Although the data does not include a direct measure of the number of banks a firm deals with, comparing information on firms' total liabilities and the amounts they receive at this Bank justifies the conclusion that a large fraction of firms has more than one source of credit, especially after the first few interactions with this Bank. Therefore, it may be unproblematic for many firms to adjust their requests at this Bank obtaining funds from other lenders at the same time.[13] Nevertheless, their repayment capacity should have increased over

[13] I calculate an indicator for other bank relationships from the information I have and include it into the regressions specified in Table 5. It is significantly and positively related to both requested and granted amount while the effects of all other variables remain qualitatively unchanged. Similarly, Bharath, Dahiya, Saunders and

time according to the increased granted loan amounts at this Bank because Bulgaria has had a public credit register during the whole observation period and a private credit bureau since 2005 from which the Bank can gather information on a borrower's various loans.

At the same time, the Bank seems to make use of initial loan size constraints to overcome information and incentive problems increasing loan sizes disproportionately after due repayment when contracting repeatedly (e.g. Armendariz de Aghion and Murdoch (2005) and Martinelli (1997)). This is in line with arguments that bank relationships are valuable because banks are able to collect and assess information in due course and benefit borrowers by better loan terms over time (see e.g. Boot (2000) for an overview).

4.3 Extensions

The previous analysis did not explicitly take into account that the number of loans a borrower stays with the Bank may depend on firm characteristics or previous experience with the Bank. Moreover, it did not deal with possible loan maturity constraints which may be prevalent besides loan size constraints. The following sections report results from extensions to the previous regressions accounting for these two issues.

Sample attrition

In the dataset, there is substantial attrition meaning that borrowers do not return to the Bank for another loan after repaying the current one or, at least, wait relatively long to take out another loan so that I cannot observe their coming back. It is plausible to assume that this process is not random but depends on borrower characteristics (Bharath, Dahiya, Saunders and Srinivasan (2010)). On the one hand, borrowers may not come back to the Bank for another loan because they have generated enough internal revenues to finance future projects. Alternatively, borrowers may turn to another bank because they were highly credit constrained at this Bank or because other banks offer lower interest rates. Furthermore, borrowers may follow their loan officers to other banks because they feel that the relationship is more with the loan officer than with the bank as a whole. On the other hand, the Bank may have reasons to deny another loan to borrowers who have defaulted on their previous loan or whose repayment behavior has been inadequate. The Bank may not extend another loan if the firm's financial situation has deteriorated or if the firm has proven not to be viable.

Srinivasan (2010) find for their sample of large firms that borrowing from a prior lender leads to better granted loan terms even if borrowers have multiple sources of external financing.

Unfortunately, I can neither directly observe a borrower's decision whether to ask for another loan nor the Bank's decision to deny a loan application. However, the dataset's information on previous credit constraints, loan officer changes, firm and loan characteristics as well as borrowers' repayment behavior based on arrears allows me to deal with the attrition problem nevertheless. To account for the attrition process I follow the approach in Wooldridge (1995).[14] Firstly, I estimate probit regressions for each period (loan number) to obtain the probability of observing loan *k* based on the credit constraint and the firm and loan characteristics for loan *k-1* as well as the borrower's risk category (four categories depending on the days of arrears) at the time of repayment of loan *k-1*. Apart from that, I include two dummy variables indicating whether loan *k-1* is an add-on loan which should decrease the probability to take out even another loan and whether it is a short-term loan which should increase the probability of a further loan. Interestingly, the extent of previous credit constraints does not seem to have a major impact on the decision to apply for a further loan. The other explanatory variables display the signs as expected by the above reasoning.

Secondly, I calculate the respective inverse Mills ratios from these regressions and include them in the fixed effects regressions for the *Requested amount* and the *Granted amount*. A test of attrition bias is then a Wald test of the coefficients of the inverse Mills ratios being jointly equal to zero. Since the second-stage regressions include the inverse Mills ratios as additional regressors which depend on the first-stage probit parameter estimates I bootstrap the standard errors performing 400 replications to derive their correct values.

[Insert Table 6 here]

Table 6 reports the estimates for the determinants of *Requested amount* in columns (1) and (2) and of *Granted amount* in columns (3) and (4) after correcting for a possible attrition bias. The significant Chi²-statistics in all columns show that the null hypothesis of all Mills ratios being jointly zero can be rejected implying that there is attrition bias in the data. Nevertheless, all results from the basic regressions in Table 5 are qualitatively confirmed even after controlling for the attrition bias while the bootstrapped standard errors are somewhat larger than those adjusted for clustering at the firm level in Table 5.

[14] This approach is similar to the Heckman (1979) selection model which is widely used to account for non-random sample selection in cross-sectional studies (examples in the finance literature are Puri, Rocholl and Steffen (2010), Cerqueiro (2008) and Chakravarty and Yilmazer (2008)). Modelling non-random attrition in a panel dataset extends to estimating a selection equation for each period. In my case this means to estimate for each loan number the probability that borrowers take out a subsequent loan.

Loan maturity constraints

The importance of the loan maturity as a monitoring device and in dealing with borrower risk has been established by theoretical (e.g. Flannery (1986), Diamond (1991) and Diamond (2004)) as well as empirical papers (Berger, Espinosa-Vega, Frame and Miller (2005), Hernández-Cánovas and Koëter-Kant (2008), Ortiz-Molina and Penas (2008) and Kirschenmann and Norden (2010)). The descriptive statistics in Table 3 suggest that amount and maturity are complementary loan terms for the majority of loans. The following analysis therefore concentrates on those loans for which the Bank only adjusts one of the two loan terms to assess whether and in which cases the Bank uses maturity constraints rather than loan size constraints to deal with borrower risk and agency problems. Table 7 reports descriptive statistics for the two groups of loans for which the Bank either adjusted maturity or amount.

[Insert Table 7 here]

Columns (1) and (2) include loans for which the granted amount equals the requested amount. These loans were either granted with a shorter than requested maturity (column (1)) or a longer than requested maturity (column (2)). They show that loans with a shorter than requested maturity carry comparatively small amounts but were requested with relatively long maturities. The asymmetric information indicators display that they are loans made early in a relationship. Interestingly, the firm characteristics, especially size (*Assets*) and repayment capacity (*Disposable income*), do not differ considerably for the two groups. In contrast, columns (3) and (4) show that the adjustment of the loan size crucially depends on firm characteristics and the extent of asymmetric information in the beginning of the relationship (*Initially young*, *Initially small*). This is in line with the results from the previous regression analysis. I conclude from these findings that the incidence of receiving a shorter than requested maturity mainly occurs if borrowers apply for a maturity that is obviously too long in comparison to their requested (and granted) amount. As this seems to mostly happen in early stages of the relationship, it is another indication for learning at the borrower side.

In a next step, I assess the determinants of maturity constraints more formally.[15] I re-estimate the regressions displayed in Table 4 with the dependent variable now being the ratio of requested to granted loan maturity. I restrict the estimation sample to those loans for which requested amount equals granted amount to assess whether the Bank uses maturity constraints instead. Except for the *Time* dummies the economic relevance of all explanatory variables is

[15] Detailed regression results are available from the author upon request.

very small. Furthermore, *Initially Young*, *Initially small* and their interaction terms with the *Times* dummies are insignificant which confirms the descriptive findings in Table 7.

Finally, I re-estimate all specifications displayed in Tables 4 and 5 with the dependent variables being *Requested maturity*, *Granted maturity* or their ratio for the full sample. For the determinants of maturity constraints, it again turns out that the economic impact of the explanatory variables is relatively small with the exception of the *Times* dummies. The dynamic patterns for requested and granted maturity are qualitatively the same as in the amount regressions corroborating that amount and maturity are complementary loan terms.

5 Conclusions

This paper studies requested and granted loan amounts and their relation over a loan sequence for nearly 99,000 small loans granted by one bank in Bulgaria between April 2003 and September 2007. Unlike previous studies I observe the firm's requested loan terms from loan applications and the Bank's granted loan terms as stated in the loan contract. This allows me to disentangle demand and supply effects behind observed credit constraints and to establish the dynamic patterns that arise on both sides when bank and borrower interact repeatedly.

Analyzing a more comprehensive measure of credit constraints which incorporates requested loan amounts shows that such observed credit constraints decrease significantly over loan sequences with this effect being particularly pronounced for firms that are comparatively young or small when starting to borrow from the Bank. Loan officer changes lead to higher observed credit constraints, which seems to be driven rather by the loss of private information than by a possible collusion between borrowers and their long-time loan officers. Finally, more transparent and less risky firms are less credit constrained.

Taking the analysis one step further and studying the dynamics behind the observed reduction of credit constraints over a bank-borrower relationship I find that both requested and granted loan amounts increase over time. Interestingly, the results suggest that the gap between requested and granted loan amounts decreases in the beginning of the relationship because both sides converge. When previous credit constraints were large, requested amounts increase more moderately and granted amounts increase more strongly than in the case of small previous constraints. The Bank seems to make use of dynamic incentives to overcome information and agency problems increasing loan sizes disproportionately after due repayment when contracting repeatedly. While the Bank increases granted loan amounts when

learning about borrowers' risk and repayment behavior, borrowers seem to learn from the (negative) feedback they get from previous experiences with credit constraints at the Bank.

One question that arises concerns the transferability of these results to other environments. On the one hand, concentrating the analysis on small loans from one bank in an emerging market provides an ideal ground for studying the influence of bank relationships on requested and granted loan terms because informational asymmetries are presumably severe. Furthermore, the loan granting process is the same for all observed loans reducing possible heterogeneity at this level. On the other hand, the bank and its loan contracts that are standardized with respect to interest rates and collateral requirements may seem special. Nevertheless, it provides a natural setting that allows gaining insights into the dynamics of requested and granted loan amounts in multiple interactions between borrowers and banks. Moreover, standardizing interest rates is not uncommon in other loan categories like mortgage loans or overdrafts. Finally, my empirical procedure is applicable in many other lending contexts and should thereby contribute to a better understanding of the processes behind observed loan contracting outcomes.

The dynamic patterns found in this study complement and connect key elements of the literatures on relationship lending, demand and supply effects in bank lending and credit availability of small firms. However, the ratio of requested to granted loan amounts which I denote as observed credit constraints may as well be a measure of borrower bargaining power or capture the borrower's financial literacy. Disentangling these various aspects with more comprehensive data (e.g. on borrowers' different sources of credit - in markets with and without information sharing among lenders) and gaining deeper insights into the dynamics of bank and borrower behavior in bank lending seems to be a fruitful area of future research.

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Table 1. Variable definitions

Variable	Definition
Dependent variables	
Requested-granted ratio	Requested loan amount as a share of granted loan amount (Log)
Requested amount	Requested loan amount (Log EUR)
Granted amount	Loan amount as stated in loan contract (Log EUR)
Loan characteristics	
Requested maturity	Requested loan maturity (Log months)
Granted maturity	Loan maturity as stated in loan contract (Log months)
Fixed capital loan	Loan is for fixed capital financing (1=yes, 0=no)
Annuity loan	Loan is an annuity loan vs. credit line or overdraft (1=yes, 0=no)
Branch	Branch dummies which are one for the branch that granted the loan
Asymmetric information indicators	
Times	Number of times the client borrows from bank at current loan
Bank relationship	Months since first contact between bank and client at disbursement date
Initially young	Firm age was below or equal to two years when first borrowing from bank (1=yes, 0=no)
Initially small	Firm size (total assets) was below median firm size when first borrowing from the bank (1=yes, 0=no)
Loan officer change	Firm experienced a loan officer change during duration of previous loan (1=yes, 0=no)
Firm characteristics	
Age	Firm age at disbursement date (Log years)
Sole proprietorship	Firm is sole proprietorship (1=yes, 0=no)
Assets	Total assets of firm at disbursement date (Log EUR)
Asset growth	Difference between total assets at current and last loan disbursement as a share of total assets at last loan disbursement
Leverage	Total debt as share of total assets of firm at disbursement date
Disposable income	Total disposable income per month at disbursement date (Log EUR)
Industry	Industry dummies which are one if firm belongs to one of the following sectors: Agriculture, Construction, Manufacturing, Trade, Transport, Tourism, Other services

Table 2. Asymmetric information and observed credit constraints at first loans

This table reports the average *Requested-granted ratio* for *Single loan clients* (borrowers with only one loan) and *Repeat clients* (borrowers taking out more than one loan during the observation period), for different subsamples based on the asymmetric information indicators. *Initially young* (old) firms have a firm age below or equal to (above) two years when first borrowing from the Bank. *Initially small* (large) firms are of firm size below (equal to or above) the median firm size based on total assets when first borrowing from the Bank. The table also provides T-tests for differences between groups (*difference*) and F-tests for differences between pairs of groups (*difference-in-difference*). ***, **, * denote significance at the 0.01-, 0.05- and 0.1-level. Only first loans are included to separate the effect of the asymmetric information indicators from the effect of repeated interactions between borrowers and the Bank.

	Requested-granted ratio		
	Single loan clients	Repeat clients	Diff / **Diff-in-Diff**
N	32,832	20,350	
Initially young firms, N = 11,334	1.33	1.32	0.01
Initially old firms, N = 41,848	1.20	1.22	-0.02***
Diff / **Diff-in-Diff**	0.13***	0.10***	**0.03****
Initially small firms, N = 25,835	1.32	1.31	0.01
Initially large firms, N = 27,347	1.15	1.16	-0.01**
Diff / **Diff-in-Diff**	0.17***	0.15***	**0.02****

Table 3. Loan and firm characteristics and asymmetric information indicators: descriptive statistics

This table displays summary statistics for the loan, firm and asymmetric information variables. See Table 1 for definitions of all variables. Note that for all otherwise log-transformed variables the statistics are calculated by using the original values.

Panel A. Sample means by loan sequence

Times	1	2	3	4	5	6	7	8	9
Loan characteristics									
Requested-granted ratio	1.23	1.12	1.10	1.08	1.07	1.08	1.07	1.04	1.05
Requested amount	5,318	5,397	5,985	6,515	7,347	7,990	9,223	8,949	9,344
Granted amount	4,687	5,003	5,585	6,141	7,016	7,538	8,765	8,645	8,812
Requested maturity	32.81	30.08	29.60	29.77	30.40	29.57	28.51	25.89	24.59
Granted maturity	27.33	27.37	27.56	28.14	29.02	27.90	26.61	25.47	25.21
Fixed capital loan	0.55	0.49	0.46	0.44	0.43	0.41	0.38	0.41	0.32
Annuity loan	0.74	0.79	0.78	0.75	0.71	0.63	0.56	0.52	0.48
Asymmetric information indicators									
Bank relationship	1.15	12.01	21.79	29.65	35.98	40.07	43.52	44.54	45.67
Initially young	0.21	0.16	0.14	0.12	0.10	0.09	0.09	0.09	0.05
Initially small	0.49	0.52	0.53	0.53	0.50	0.46	0.38	0.32	0.33
Loan officer change		0.23	0.26	0.28	0.31	0.35	0.38	0.37	0.32
Firm characteristics									
Age	7.49	8.77	9.73	10.41	11.11	11.41	11.75	11.81	11.92
Sole proprietorship	0.91	0.93	0.92	0.91	0.89	0.86	0.83	0.79	0.76
Assets	28,494	32,400	37,310	42,858	52,231	64,829	73,023	90,318	91,571
Asset growth		0.62	0.45	0.38	0.31	0.33	0.16	0.13	0.15
Leverage	0.11	0.17	0.18	0.21	0.23	0.25	0.25	0.26	0.25
Disposable income	400	473	573	658	775	928	1,086	1,217	1,133
N	53,182	24,150	11,628	5,450	2,503	1,185	544	234	111

Panel B. Sample means for the subsamples of unconstrained vs. constrained loans

***, **, * denote that variables are significantly different from each other at the 0.01-, 0.05- and 0.1-level using a two-sided T-test.

	Unconstrained (1) N = 73,742	Constrained (2) N = 25,245	(1) - (2)
Loan characteristics			
Requested-granted ratio	0.98	1.74	-0.76***
Requested amount	5,033	7,255	-2,222***
Granted amount	5,187	4,763	424***
Requested maturity	29.27	37.83	-8.57***
Granted maturity	27.63	26.91	0.73***
Fixed capital loan	0.52	0.50	0.02***
Annuity loan	0.76	0.73	0.03***
Asymmetric information indicators			
Times	1.94	1.64	0.30***
Bank relationship	10.44	6.86	3.58***
Initially young	0.17	0.22	-0.05***
Initially small	0.47	0.60	-0.13***
Loan officer change	0.25	0.27	-0.02***
Firm characteristics			
Age	8.61	7.79	0.82***
Sole proprietorship	0.92	0.91	0.01
Assets	35,259	25,502	9,757***
Asset growth	0.51	0.47	0.04
Leverage	0.14	0.15	-0.01***
Disposable income	505	387	118***

Table 4. Determinants of observed credit constraints

Column (1) includes results for the full sample from an OLS regression and column (2) reports results from a fixed effects regression for the subsample of *Repeat clients* (loans disbursed to firms that take out more than one loan from the Bank during the observation period). Standard errors are reported in parentheses and account for clustering at the firm level. The dependent variable *Requested-granted ratio* is the requested loan amount as a share of the granted loan amount and indicates the extent of credit constraints. All explanatory variables are defined in Table 1. ***, **, * denote significance at the 0.01-, 0.05- and 0.1-level.

	(1) Full sample	(2) Repeat clients
Times_2	-0.032***	-0.065***
	(0.003)	(0.005)
Times_3	-0.040***	-0.090***
	(0.004)	(0.008)
Times_4	-0.043***	-0.107***
	(0.005)	(0.010)
Times_5	-0.055***	-0.141***
	(0.006)	(0.000)
Initially young	0.057***	
	(0.004)	
Times_2*Initially young	-0.043***	-0.026***
	(0.006)	(0.008)
Times_3*Initially young	-0.049***	-0.020*
	(0.008)	(0.011)
Times_4*Initially young	-0.042***	-0.021
	(0.013)	(0.016)
Times_5*Initially young	-0.071***	-0.052***
	(0.014)	(0.020)
Initially small	0.051***	
	(0.004)	
Times_2*Initially small	-0.050***	-0.049***
	(0.004)	(0.005)
Times_3*Initially small	-0.058***	-0.053***
	(0.005)	(0.007)
Times_4*Initially small	-0.079***	-0.073***
	(0.008)	(0.010)
Times_5*Initially small	-0.071***	-0.058***
	(0.008)	(0.011)
Loan officer change		0.027***
		(0.004)
Sole proprietorship	-0.029***	
	(0.004)	
Assets	-0.026***	-0.016***
	(0.001)	(0.004)
Leverage	0.065***	0.043***
	(0.006)	(0.011)
Disposable income	-0.004***	-0.013***
	(0.001)	(0.003)
Fixed capital loan	-0.018***	-0.007**
	(0.002)	(0.003)
Annuity loan	-0.003	0.000
	(0.008)	(0.011)
Constant	0.448***	0.368***
	(0.019)	(0.037)

Table 4. Determinants of observed credit constraints (cont'd)

Observations	98,987	64,075
Method	OLS	Panel FE
R^2 (adjusted / within)	0.069	0.040
Industry-fixed effects	yes	no
Firm-fixed effects	no	yes
Branch-fixed effects	yes	no
Time-fixed effects	yes	yes

Table 5. Requested and granted loan amounts over loan sequences: dynamic effects

This table reports results from fixed effects regressions for the subsample of *Repeat clients* (loans disbursed to firms that take out more than one loan from the Bank during the observation period). Standard errors are reported in parentheses and account for clustering at the firm level. The dependent variables are *Requested amount* which is the requested loan amount in log EUR in columns (1) and (2) and *Granted amount* which is the granted loan amount in log EUR in columns (3) and (4). All explanatory variables are defined in Table 1. ***, **, * denote significance at the 0.01-, 0.05- and 0.1-level.

	(1)	(2)	(3)	(4)
	Repeat clients	Repeat clients	Repeat clients	Repeat clients
Dependent variable	Requested amount	Requested amount	Granted amount	Granted amount
Lag Requested-granted ratio	-0.247***	-0.066**	0.056***	-0.029
	(0.020)	(0.027)	(0.019)	(0.027)
Times_3	0.168***	0.207***	0.204***	0.185***
	(0.015)	(0.016)	(0.014)	(0.015)
Times_4	0.301***	0.335***	0.359***	0.345***
	(0.025)	(0.025)	(0.024)	(0.025)
Times_5	0.396***	0.424***	0.474***	0.460***
	(0.037)	(0.037)	(0.036)	(0.036)
Times_3*Lag Requested-granted ratio		-0.368***		0.194***
		(0.038)		(0.036)
Times_4*Lag Requested-granted ratio		-0.316***		0.093*
		(0.055)		(0.053)
Times_5*Lag Requested-granted ratio		-0.186***		0.104*
		(0.058)		(0.055)
Loan officer change	-0.177***	-0.178***	-0.196***	-0.196***
	(0.012)	(0.012)	(0.012)	(0.012)
Age	0.130*	0.152**	0.130*	0.121*
	(0.075)	(0.075)	(0.073)	(0.072)
Assets	0.064***	0.067***	0.091***	0.090***
	(0.021)	(0.021)	(0.021)	(0.021)
Asset growth	0.055***	0.053***	0.045***	0.046***
	(0.016)	(0.016)	(0.015)	(0.015)
Leverage	-0.427***	-0.424***	-0.462***	-0.463***
	(0.041)	(0.040)	(0.040)	(0.040)
Disposable income	0.114***	0.114***	0.117***	0.117***
	(0.012)	(0.012)	(0.011)	(0.011)
Fixed capital loan	0.371***	0.372***	0.377***	0.376***
	(0.012)	(0.012)	(0.012)	(0.012)
Annuity loan	0.525***	0.523***	0.502***	0.503***
	(0.033)	(0.033)	(0.032)	(0.032)
Constant	6.061***	5.959***	5.531***	5.578***
	(0.282)	(0.277)	(0.275)	(0.277)
Observations	40,345	40,345	40,345	40,345
Method	Panel FE	Panel FE	Panel FE	Panel FE
R^2 (within)	0.224	0.228	0.243	0.244
Industry fixed effects	no	no	no	no
Firm-fixed effects	yes	yes	yes	yes
Branch fixed effects	no	no	no	no
Time-fixed effects	yes	yes	yes	yes

Table 6. Sample attrition

This table reports results from fixed effects regressions for the subsample of *Repeat clients* (loans disbursed to firms that take out more than one loan during the observation period). Standard errors (reported in parentheses) are bootstrapped to derive their correct values in the two-step procedure. In the first step (not reported) inverse Mills ratios are estimated to account for sample attrition which are included as regressors in the reported second-stage regressions. Chi²-statistics from a Wald test of the joint significance of the inverse Mills ratios are reported as well. The dependent variables are *Requested amount* which is the requested loan amount in log EUR in columns (1) and (2) and *Granted amount* which is the granted loan amount in log EUR in columns (3) and (4). All explanatory variables are defined in Table 1. ***, **, * denote significance at the 0.01-, 0.05- and 0.1-level.

	(1)	(2)	(3)	(4)
	Repeat clients	Repeat clients	Repeat clients	Repeat clients
Dependent variable	Requested amount	Requested amount	Granted amount	Granted amount
Lag Requested-granted ratio	-0.247***	-0.064**	0.059***	-0.028
	(0.019)	(0.027)	(0.019)	(0.027)
Times_3	0.303***	0.338***	0.327***	0.309***
	(0.038)	(0.038)	(0.037)	(0.037)
Times_4	0.450***	0.479***	0.507***	0.496***
	(0.044)	(0.044)	(0.043)	(0.043)
Times_5	0.601***	0.625***	0.678***	0.667***
	(0.059)	(0.059)	(0.057)	(0.057)
Times_3*Lag Requested-granted ratio		-0.363***		0.199***
		(0.036)		(0.036)
Times_4*Lag Requested-granted ratio		-0.313***		0.096*
		(0.054)		(0.052)
Times_5*Lag Requested-granted ratio		-0.202***		0.102*
		(0.056)		(0.056)
Loan officer change	-0.153***	-0.155***	-0.173***	-0.173***
	(0.013)	(0.013)	(0.013)	(0.013)
Age	0.200**	0.221***	0.189**	0.181**
	(0.085)	(0.085)	(0.083)	(0.082)
Assets	0.063***	0.066***	0.088***	0.087***
	(0.021)	(0.021)	(0.021)	(0.021)
Asset growth	0.054***	0.052***	0.046***	0.046***
	(0.015)	(0.015)	(0.015)	(0.015)
Leverage	-0.411***	-0.408***	-0.449***	-0.451***
	(0.040)	(0.040)	(0.040)	(0.040)
Disposable income	0.114***	0.114***	0.117***	0.117***
	(0.012)	(0.011)	(0.011)	(0.011)
Fixed capital loan	0.363***	0.364***	0.369***	0.368***
	(0.013)	(0.013)	(0.012)	(0.012)
Annuity loan	0.551***	0.548***	0.526***	0.528***
	(0.033)	(0.033)	(0.032)	(0.032)
Constant	6.397***	6.276***	6.040***	6.093***
	(0.277)	(0.279)	(0.277)	(0.276)
Chi²-statistic: test of joint significance of Mills ratios	50.00***	48.70***	49.10***	50.49***
Observations	40,234	40,234	40,234	40,234
R^2 (within)	0.226	0.230	0.246	0.247
Industry fixed effects	no	no	no	no
Firm-fixed effects	yes	yes	yes	yes
Branch fixed effects	no	no	no	no
Time-fixed effects	yes	yes	yes	yes

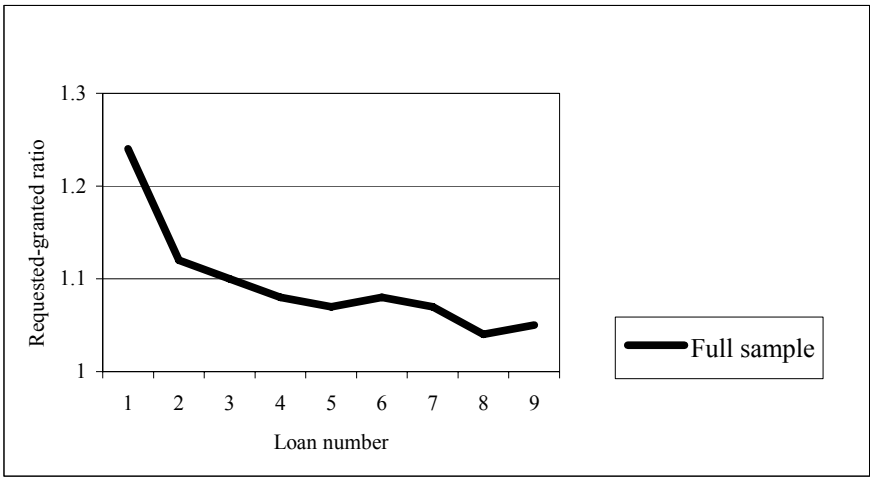
Table 7. Maturity constraints

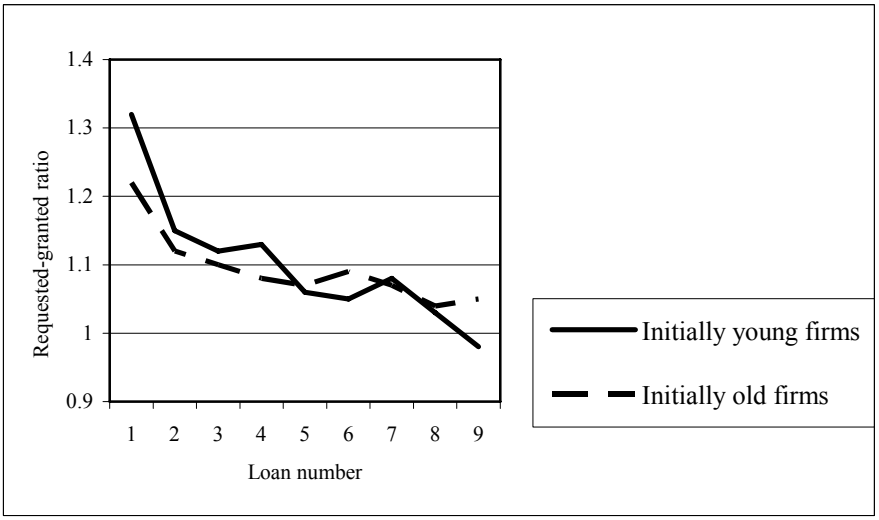
This table displays summary statistics for the loan, firm and asymmetric information variables for the two subsamples of loans for which either only maturity or only amount is adjusted in the loan granting process. See Table 1 for definitions of all variables. Note that for all otherwise log-transformed variables the statistics are calculated by using the original values.

	Requested amount = Granted amount		Requested maturity = Granted maturity	
	(1)	(2)	(3)	(4)
	Requested maturity > Granted maturity	Requested maturity < Granted maturity	Requested amount > Granted amount	Requested amount < Granted amount
Loan characteristics				
Requested amount	4,866	5,417	8,323	6,643
Granted amount	4,866	5,417	6,075	8,652
Requested maturity	37.27	20.67	30.61	34.13
Granted maturity	25.48	28.42	30.61	34.13
Fixed capital loan	0.54	0.48	0.48	0.59
Annuity loan	0.76	0.77	0.72	0.67
Asymmetric information indicators				
Times	1.65	2.02	1.83	2.08
Bank relationship	7.37	10.79	8.90	12.28
Initially young	0.18	0.17	0.20	0.15
Initially small	0.45	0.48	0.54	0.38
Loan officer change	0.25	0.25	0.27	0.27
Firm characteristics				
Age	8.25	8.60	8.20	8.92
Sole proprietorship	0.93	0.90	0.88	0.86
Assets	33,963	36,509	33,796	49,201
Asset growth	0.68	0.46	0.43	0.50
Leverage	0.13	0.16	0.17	0.18
Disposable income	491	499	484	619

Figure 1. The *Requested-granted ratio* by loan sequence

This figure displays the evolution of the *Requested-granted ratio*, the indicator for the extent of observed credit constraints, over the loan sequence for the full sample and different subsamples based on the asymmetric information indicators. *Initially young* (old) firms have a firm age below or equal to (above) two years when first borrowing from the Bank. *Initially small* (large) firms are of firm size below (equal to or above) the median firm size based on total assets when first borrowing from the Bank.





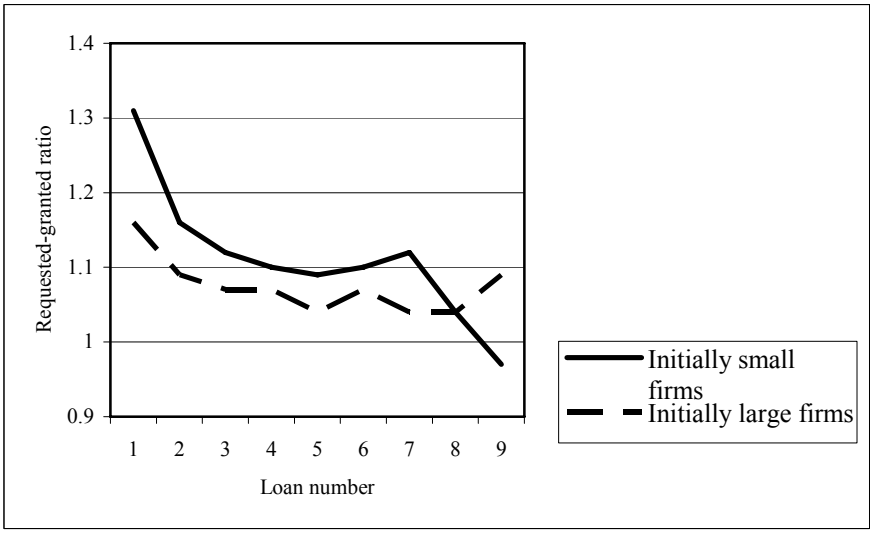


Figure 2. Requested loan amounts and the extent of previous credit constraints

This figure displays the effect of high vs. low previous credit constraints (*Lag Requested-granted ratio*) on the relation between *Requested amount* and the *Times* dummies. See Table 1 for definitions of all variables. *High* (*low*) in the figure refers to values that are one standard deviation above (below) the mean of *Lag Requested-granted ratio*.

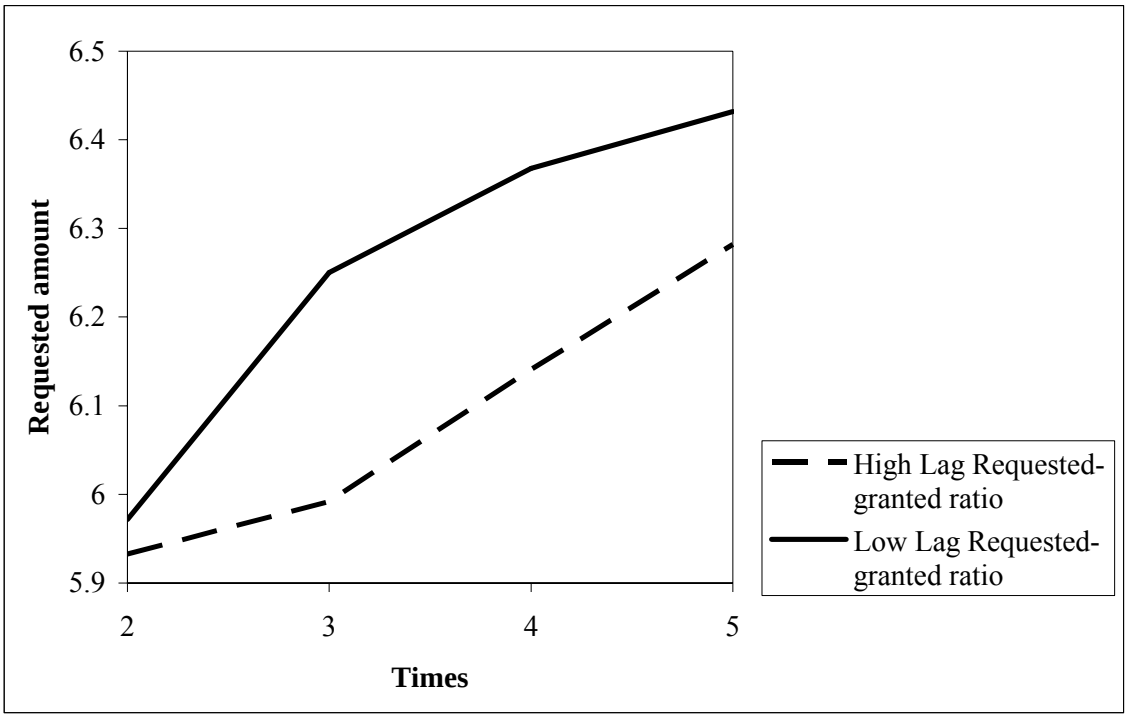


Figure 3. Granted loan amounts and the extent of previous credit constraints

This figure displays the effect of high vs. low previous credit constraints (*Lag Requested-granted ratio*) on the relation between *Granted amount* and the *Times* dummies. See Table 1 for definitions of all variables. *High* (*low*) in the figure refers to values that are one standard deviation above (below) the mean of *Lag Requested-granted ratio*.