Demand and Supply Determinants of Loan Contract Terms in Small Business Lending

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Table of contents

LIST OF TABLES VII

LIST OF FIGURES VIII

LIST OF ABBREVIATIONS IX

1 INTRODUCTION 1

2 LOAN MATURITY IN SMALL BUSINESS LENDING - THE ROLE OF BORROWER RISK, ASYMMETRIC INFORMATION AND BARGAINING POWER 11

2.1 INTRODUCTION 11

2.2 THE RISK-MATURITY RELATION IN THE LITERATURE 13

2.2.1 The borrower's maturity request and the lender's maturity offer 13

2.2.2 Empirical evidence on the risk-maturity relation in small business lending 15

2.2.3 The impact of borrower bargaining power 16

2.3 DATA AND METHODOLOGY 17

2.3.1 The dataset 17

2.3.2 The bank's loan granting process 19

2.3.3 The relation between borrower risk and loan maturity 21

2.3.4 Summary statistics 25

2.4 RESULTS 28

2.4.1 Basic results on the risk-maturity relation 28

2.4.2 The impact of asymmetric information on the risk-maturity relation 32

2.4.3 The impact of borrower bargaining power on the risk-maturity relation 38

2.4.4 Robustness test 44

2.5 CONCLUSIONS 45

3 FOREIGN CURRENCY LOANS - DEMAND OR SUPPLY DRIVEN? 47

3.1 INTRODUCTION 47

3.2 CURRENCY DENOMINATION OF FIRM DEBT: THEORY AND EVIDENCE 49

3.2.1 Theory 49

3.2.2 Empirical evidence 52

3.3 DATA AND METHODOLOGY 53

3.3.1 The dataset *53*
3.3.2 The Bank's lending technology and loan portfolio *55*
3.3.3 The firms' choice of loan currency *60*
3.3.4 The Bank's choice of loan currency *63*
3.3.5 Summary statistics *64*
3.4 RESULTS 65
3.4.1 Univariate tests *65*
3.4.2 Multivariate regressions: The firms' choice of loan currency *68*
3.4.3 Multivariate regressions: The Bank's choice of loan currency *73*
3.4.4 Switching loan currency and credit risk *79*
3.5 CONCLUSIONS 81

4 THE DYNAMICS IN REQUESTED AND GRANTED LOAN TERMS WHEN BANK AND BORROWER INTERACT REPEATEDLY 83

4.1 INTRODUCTION 83
4.2 LITERATURE OVERVIEW 86
4.2.1 The evolution of requested and granted loan amounts over multiple interactions *86*
4.2.2 Related empirical studies *88*
4.3 DATA AND METHODOLOGY 91
4.3.1 The data and the Bank's loan granting process *91*
4.3.2 The ratio of requested to granted loan amounts *93*
4.3.3 Determinants of the ratio of requested to granted loan amounts *97*
4.3.4 Requested and granted loan amounts and their development over time *100*
4.3.5 Summary statistics *102*
4.4 RESULTS 105
4.4.1 Determinants of the ratio of requested to granted loan amounts *105*
4.4.2 Requested and granted loan amounts and their development over time *109*
4.4.3 Extensions *115*
4.5 CONCLUSIONS 120

5 THE IMPACT OF THE US FINANCIAL CRISIS ON CREDIT AVAILABILITY FOR SMALL FIRMS IN CENTRAL ASIA 123

5.1 INTRODUCTION 123

5.2 LITERATURE REVIEW 126
5.3 AZERBAIJAN'S ECONOMY AND THE FINANCIAL CRISIS 129
5.4 DATA AND METHODOLOGY 131
5.4.1 The dataset 131
5.4.2 The bank's business loan portfolio 134
5.4.3 Determinants of credit availability 139
5.4.4 Summary statistics 142
5.5 RESULTS 146
5.5.1 Determinants of the likelihood that a loan application is approved 146
5.5.2 Determinants of the extent of volume constraints 150
5.6 CONCLUSIONS 153
6 CONCLUSIONS 156
REFERENCES 160

List of Tables

Table 1. Variable definitions 18
Table 2. Descriptive statistics 25
Table 3. Asymmetric information and borrower bargaining power 27
Table 4. The risk-maturity relation 30
Table 5. Intertemporal test of signaling 31
Table 6. The impact of asymmetric information 34
Table 7. The impact of borrower bargaining power 40
Table 8. Variable definitions and data sources 54
Table 9. Loan disbursements 56
Table 10. Descriptive statistics 65
Table 11. Univariate tests 66
Table 12. Foreign currency loan demand 71
Table 13. Foreign currency loan supply: Loans requested in BGN 76
Table 14. Foreign currency loan supply: Loans requested in EUR 78
Table 15. Interest rate on medium loans in EUR 81
Table 16. Variable definitions 91
Table 17. Asymmetric information and the *Requested-granted ratio* at first loans 94
Table 18. Loan and firm characteristics: descriptive statistics 104
Table 19. Relationship effects on credit constraints 106
Table 20. Requested and granted loan amounts over loan sequences 110
Table 21. Sample attrition 117
Table 22. Maturity constraints 119
Table 23. Variable definitions 134
Table 24. Lending by year and loan type 135
Table 25. Descriptive statistics 143
Table 26. Loan approvals: loan and firm determinants 149
Table 27. Share of requested loan amount that was granted by the bank: loan and firm determinants 151

List of Figures

Figure 1. The impact of borrower age on the risk-maturity relation 33
Figure 2. The impact of the bank's private information on the risk-maturity relation 36
Figure 3. The impact of borrower bargaining power on the risk-maturity relation ... 41
Figure 4. Requested vs. granted loan currency 58
Figure 5. Requested and granted currency by loan size and maturity 59
Figure 6. The *Requested-granted ratio* by loan sequence 95
Figure 7. Requested loan amounts and the extent of previous credit constraints 111
Figure 8. Granted loan amounts and the extent of previous credit constraints 114
Figure 9. Loan applications and approvals for new vs. repeat borrowers 136

List of abbreviations

AZN	Azerbaijani Manat
BGN	Bulgarian Lev
CGAP	Consultative Group to Assist the Poor
CDO	Collateralized debt obligation
EBRD	European Bank for Reconstruction and Development
ECA	Eastern Europe and Central Asia
ECB	European Central Bank
EUR	Euro
FX	Foreign currency
GDP	Gross domestic product
IFC	International Finance Corporation (World Bank Group)
KfW	Kreditanstalt für Wiederaufbau (German Development Bank)
LPM	Linear probability model
MFI	Microfinance institution
MSEs	Micro and small enterprises
MSMEs	Micro, small and medium enterprises
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary least squares
PPP	Purchasing power parity
SMEs	Small and medium enterprises
UNIDO	United Nations Industrial Development Organization
US	United States
USD	US Dollar

1 Introduction

Promoting the private sector is considered to be of key importance by politicians and policy makers all over the world and has become a priority among the economic development goals of the donor community to foster growth, employment and poverty alleviation in developing and transition countries (World Bank (2002), UNIDO-OEDC (2004), IFC (2009)). The perception that micro, small and medium enterprises (MSMEs) play a significant role in most economies has attracted a wide range of activities to overcome the obstacles that impede MSMEs in their development. However, it is by no means clear which factors actually need to be addressed to successfully achieve the intended goals. One factor often stated to be crucial for MSMEs to prosper and grow is their access to (formal) external finance. In developed as well as in developing and transition countries small firms have been found to be more hampered in their access to external finance than large firms (e.g. Galindo and Schiantarelli (2003), Beck and Demirgüç-Kunt (2006) and World Bank (2008)). Bank loans are the most essential form of external finance for MSMEs as their access to capital markets is limited (Titman and Wessels (1988)). Yet, MSMEs' bank relationships are plagued by severe informational asymmetries since they regularly do not provide audited financial statements or, in the case of very small enterprises, do not clearly separate business from household funds.

This thesis studies demand and supply determinants of loan terms in MSME lending. It largely focuses on MSME lending in transition countries where the problems arising from informational asymmetries are often aggravated because of the lack of adequate institutions and creditor protection rights. Consequently, these countries provide an ideal environment to study the impact of informational asymmetries and close bank-borrower relationships on requested and granted loan terms.

Most of the literature on bank-borrower relationships is concerned with the ability of banks to deal with informational asymmetries. Banks may gather and process information by screening and monitoring borrowers (e.g. Diamond (1984) and Ramakrishan and Thakor (1984)). Moreover, they may apply relationship lending techniques which facilitate implicit long-term contracting and intertemporal smoothing of loan contract terms (Boot (2000)). Several theoretical and empirical

papers have established the valuable influence of long-term lending relationships between borrowers and banks as a means to overcome informational asymmetries (Boot and Thakor (1994), Chemmanur and Fulghieri (1994) and von Thadden (1995) as well as Petersen and Rajan (1994) and Berger and Udell (1995) among others).[1]

However, bank-borrower relationships may actually be characterized as mutual commitments (Boot and Marinc (2008)). Also, some papers have pointed out that credit availability and loan terms are determined by both demand and supply factors (Petersen and Rajan (1994) and Qian and Strahan (2007)). Nevertheless, there is surprisingly little research on borrowers' demand for credit and how it interacts with banks' supply of credit over multiple interactions. Most likely because of lacking data there has been little attempt to empirically disentangle both sides. Accordingly, the majority of empirical studies have relied on equilibrium outcome measures, i.e. granted loan terms, to analyze how they relate to relationship measures, firm and bank characteristics or the legal and macroeconomic environment. Only very recently, a few studies on demand and supply effects in bank lending have emerged (Puri, Rocholl and Steffen (2009), Cheng and Degryse (2010) and Jimenez, Ongena, Peydro and Saurina (2010)).

Linking to this very literature, this thesis aims at broadening the understanding of small business loan contracting in general and the demand and supply processes behind observed loan terms in particular. Thereby, it offers new insights in the factors influencing MSMEs' financing and banks' lending decisions and provides various policy implications. In addition, previous research on the impact of informational asymmetries and close bank-borrower relationships on credit availability and loan contract terms has mainly focused on the US and Europe. Thus, this thesis also extends the literature by determining whether the former findings may be transferred to more information-intensive environments such as South-Eastern Europe or Central Asia.

The thesis is organized as follows. Chapter 2 deals with loan maturity, a so far under-researched topic. Although the dataset used for the analysis does not contain information from loan applications, the paper identifies two complementary situation-specific explanations for the observed positive relation between borrower

[1] There also is a strand of literature that establishes a negative impact of lending relationships on loan terms, since borrowers get captured in a hold-up situation when banks gain an informational monopoly (Sharpe (1990), Rajan (1992) and von Thadden (2004)).

risk and loan maturity. One of these explanations relates to the behavior of the demand side and the other to the supply side. Accordingly, the analysis is nevertheless able to shed some light on demand and supply effects in bank lending. Chapters 3 to 5 deal with loan currency and loan amount and are based on panel datasets consisting of matched loan application and loan contract information making it possible to directly disentangle demand from supply effects.

Chapter 2: Loan maturity in small business lending – the role of borrower risk, asymmetric information and bargaining power[2]

A loan term that has achieved less attention in the empirical literature despite its potential role as a monitoring device and in dealing with borrower risk is loan maturity. While the relation between borrower risk and credit availability, interest rates or collateral has been studied quite intensively (Petersen and Rajan (1995), Berger and Udell (1995), Elsas and Krahnen (1998) and Machauer and Weber (1998), among others), evidence on the relation between borrower risk and loan maturity is not only scarce but also mixed. As theoretical models also make mixed predictions it becomes clear that there may not be a single explanation that fits all circumstances. This study therefore amends the literature by providing two complementary explanations that explicitly account for the extent of asymmetric information and for demand vs. supply side factors. Since informational asymmetries are particularly prevalent in lending to smaller firms, estimations use information on

[2] This chapter is based on the paper "The relation between borrower risk and loan maturity in small business lending" which is joint work with Lars Norden from Erasmus University Rotterdam. The paper was presented at the Midwest Finance Association Meeting 2008 in San Antonio, the Southwestern Finance Association Meeting 2008 in Houston, the European Banking Symposium 2008 (ProBanker) in Milan, the 2008 Banking Workshop in Münster, the German Finance Association Meeting 2008 in Münster, the Swiss Conference on Banking and Financial Intermediation 2008 in Champéry, the Eastern Finance Association Meeting 2008 in St. Pete and the Washington Area Finance Association Meeting 2008 in Washington D.C. It has received a "revise and resubmit" by the Journal of Business Finance and Accounting. An older version of the paper was used by Lars Norden as part of his "Habilitationsschrift" (Norden, Lars (2009): Information and Risk in Bank Lending: Empirical Evidence, Habilitationsschrift, University of Mannheim). However, this chapter does not only differ substantially in its composition but also in the following ways: (i) the focus has been shifted to demand and supply factors that determine the relation between borrower risk and loan maturity, (ii) the literature overview is more comprehensive and additional testable predictions are derived, (iii) interaction terms are used to clearly and formally establish differences in the risk-maturity relation between various subsamples and graphs are provided to visualize the results, (iv) a broader analysis of the varying levels of asymmetric information is offered, (v) dynamic aspects to test the signaling argument are included and (vi) a broader discussion and interpretation of the findings is offered.

all new and renewed loan contracts made between SME borrowers and a German bank in 2005.

The main finding is a robust and significantly positive relation between borrower risk and loan maturity. For loans made under high informational asymmetries this may be explained by good borrowers aiming at signaling their good quality to the bank and therefore requesting short maturities (Flannery (1986)). However, if informational asymmetries are low, signaling does not provide a reasonable explanation for the observed positive risk-maturity relation because there is almost no risk of adverse selection any more. Rather can it be explained by the view that risky borrowers may benefit from renegotiations with relationship lenders (e.g. Chemmanur and Fulghieri (1994)). Relationship lenders seem to offer relaxed loan terms to those borrowers who need assistance in times of a temporary deterioration of their credit quality (see Elsas and Krahnen (1998)). They are able to do this because they have sufficient information to assess whether the borrower will recover and they may make use of intertemporal and / or cross-product income smoothing. Thus, although the dataset does not contain information from loan applications, the study offers insights in demand and supply factors driving the relation between borrower risk and loan maturity: while the signaling argument explains borrower behavior, the assistance-from-relationship-lenders argument explains bank behavior.

In addition to asymmetric information, borrower bargaining power may influence the outcome of the loan negotiation process. The results reveal that high borrower bargaining power leads to longer maturities on average and weakens the risk-maturity relation especially in the case of high informational asymmetries. This is consistent with findings that good borrowers have bigger bargaining power than risky borrowers (Uchida (2006)) and sheds further light on the demand and supply effects that may influence the risk-maturity relation. The findings imply that borrowers actually would like to borrow at longer maturities (if information asymmetries were absent) and do so when they have bargaining power. At the same time, especially the good borrowers may find it intertemporally optimal to choose short maturities if informational asymmetries are prevalent to convey their low risk to the bank and benefit from better loan terms in the future. Yet, risky borrowers benefit from their lenders' willingness to provide long maturities in the case of low asymmetric information, whether they have bargaining power or not.

Chapter 3: Foreign currency loans –demand or supply driven?[3]

Foreign currency borrowing by the private sector is a widely observed phenomenon in emerging markets. It is, for instance, seen as a major cause of the financial crises in East Asia in the 1990's (Goldstein and Turner (2002)). Since the aggravation of the current financial crisis there have been strong fears that foreign currency borrowing could jeopardize financial stability in Emerging Europe because overall credit growth, and especially the increase in foreign currency loan volumes, was substantial in these countries during the years up to the crisis. Borrowers had an incentive to request loans in euros, US dollars or Swiss franks because of their lower interest rates compared to local currency loans. At the same time, many banks in these countries are foreign owned and therefore to a large extent refinanced in foreign currency providing the lenders with an incentive to grant foreign currency loans to avoid currency mismatches on their balance sheets.

When most currencies in Emerging Europe depreciated considerably during the financial crisis, repayment difficulties and defaults arose especially in the segment of loans to private households and micro and small businesses. Obviously, many of these loans had not been hedged, for instance by borrowers' income in foreign currency. Several countries reacted quickly to discourage foreign currency loans (Rosenberg and Tirpak (2008)). The effectiveness of such measures, however, depends on whether these loans are primarily demand or supply driven. Knowing the critical risk determinants is indispensable, especially in a globally connected banking system, to find adequate policy measures to deal with the potential problems arising from foreign currency risks. This study therefore makes an important contribution to the literature by examining to what extent the currency denomination of loans is determined by demand and / or supply side factors and which are the driving factors on either side.

To this end, the chapter analyzes a unique dataset of more than one hundred thousand MSME loans granted by one Bulgarian bank between 2003 and 2007. The

[3] This chapter is based on joint work with Martin Brown from the Swiss National Bank and Steven Ongena from Tilburg University. The corresponding paper was presented at Tilburg University, the Swiss National Bank, KfW, the Sveriges Riksbank, the Bulgarian National Bank, the 2009 Banking Workshop in Münster, the conference "The Changing Geography of Money, Banking and Finance in a Post-Crisis World" in Ancona, the 6th Annual Conference of the Research Committee Development Economics of the German Economic Association in Hannover and the 2010 Annual Meeting of the Swiss Society of Economics and Statistics in Fribourg.

dataset comprises information on requested and granted loan terms as well as information on borrower characteristics and the bank's refinancing composition and currency at the time of loan disbursement. The results show that the lower interest rates on foreign currency (euro) vs. local currency (leva) loans play a role in the firms' decision to request foreign currency loans. Also, the more transparent firms, i.e. the older and larger firms and those with longer bank relationships, are more likely to request foreign currency. At the same time, firms seem to learn over time that the bank is reluctant to grant large and long-term loans in local currency and therefore request euro if they need such loans.

In contrast to previous empirical studies based on aggregate data (Basso, Calvo-Gonzales and Jurgilas (2007) and Luca and Petrova (2008)), this thesis analyses the determinants of the supply side, e.g. the type and currency of the bank's refinancing, on the loan level. The results suggest that the bank is more likely to grant foreign currency loans to borrowers who are of lower observable credit risk and less opaque to the bank. However, the bank is also more likely to turn a borrower's request for local currency into foreign currency if the loan is large or long-term and if the bank itself has more foreign currency funding. Interestingly, it turns out that foreign currency customer deposits have a stronger impact on the bank's foreign currency lending than foreign currency wholesale funding.

For the policy makers in Emerging Europe these results imply that measures aiming solely at the demand side (e.g. increased transparency by new requirements to disclose foreign currency risks to customers in Hungary and Poland) may not be enough if foreign currency lending is at least partly supply side driven. Apart from that, recent attempts by development practitioners, who aim at fostering credit access for MSMEs in developing and transition countries, to implement adequate wholesale refinancing mechanisms in local currency may not be sufficient to reduce foreign currency lending. It seems rather most important to establish a credible macroeconomic environment to encourage borrowers to save in local currency and to make banks less hesitant to make large and long-term loans in local currency.

Chapter 4: The dynamics in requested and granted loan terms when bank and borrower interact repeatedly[4]

Bank-borrower relationships and their impact on credit availability have been lively discussed in the theoretical and empirical literature. Yet, previous studies have mainly focused on banks' ability to collect and process information and how this may benefit borrowers by reduced credit constraints. The question how borrowers' demand for credit evolves over bank relationships and how this demand interacts with banks' supply of credit when borrowers repeatedly contract with the same lender has achieved surprisingly little attention. This thesis is the first to provide empirical evidence on the dynamic patterns that arise when bank and borrower interact repeatedly by disentangling demand and supply effects behind observed credit constraints and therefore extends the existing literature in an important way.

In contrast to previous studies that use either indirect (e.g. Petersen and Rajan (1994)) or equilibrium outcome measures (e.g. Ioannidou and Ongena (2010)) of credit availability, this study provides a more comprehensive measure by incorporating the demand side to identify credit constraints. Using the same Bulgarian dataset as in Chapter 3 it measures credit constraints as the ratio of requested to granted loan amounts and examines not only how this ratio relates to firm characteristics but also how it evolves over bank-borrower relationships. The results show that the extent of asymmetric information measured by firm age and size at the beginning of a bank relationship is the most important determinant of credit constraints. At the same time, credit constraints decrease significantly over loan sequences with this effect being most pronounced for the first few interactions and the initially young and small firms.

Taking the analysis one step further to separate demand from supply side processes reveals that the gap between requested and granted loan amounts decreases over loan sequences due to a convergence of both sides. Borrowers who experienced relatively high credit constraints at their previous loan increase their demand more moderately than the previously unconstrained borrowers. At the same time, the bank grants disproportionately larger loan amounts to those borrowers that were highly

[4] The paper on which this chapter is based was presented at the University of Mannheim, the 6th Annual Conference of the Research Committee Development Economics of the German Economic Association in Hannover and the 2010 Banking Workshop in Münster and has been accepted for presentation at the 37th Annual Meeting of the European Finance Association in Frankfurt.

constrained at their previous loan in comparison to the previously unconstrained borrowers. The results suggest that the bank makes use of dynamic incentives to deal with problems arising from informational asymmetries rewarding borrowers' due repayment with increasing loan amounts. This is in line with arguments that bank relationships are valuable because banks are able to collect and assess information in due course and may therefore reward borrowers by better loan terms over time. The results further imply that borrowers learn from the negative feedback they receive from being credit constrained and adjust their requested amounts to avoid being highly constrained again.

While this is first evidence for the dynamic patterns that arise both on the demand and the supply side when borrowers interact repeatedly with the same lender, focusing the analysis on only one bank makes it difficult to disentangle possible further impacts stemming from borrower bargaining power or multiple sourcing, for instance. Therefore, the study sets the stage for further research on the processes behind observed credit constraints and contracted loan terms with more comprehensive datasets.

Chapter 5: The impact of the US financial crisis on credit availability for small firms in Central Asia[5]

This chapter further extends the empirical evidence on credit availability for MSMEs in transition countries focusing on the impact of the 2007-2008 global financial and economic crisis which had its roots in the US subprime mortgage market and peaked in September 2008 with the failure of Lehman Brothers Holdings Inc. It analyzes loan application and loan contract data from Azerbaijan, a country that is vulnerable to external shocks due to its highly oil dependent economy. The bank providing the data, namely AccessBank, remained financially strong during the crisis, but it was confronted with unexpected refinancing delays in the second and third quarters of 2008 because the international capital markets were not able to provide the necessary liquidity in the prevailing situation. The chapter aims at distinguishing between increased borrower risk and the bank's refinancing delays as

[5] This chapter is based on the same-named paper with Gunhild Berg from KfW. It has been accepted for presentation at the PEGNet Conference 2010 in South Africa.

the two possible causes for reduced credit availability that arise from the effects of the financial and economic crisis.

While it seems that Eastern Europe and Central Asia are hit hardest among the emerging countries (CGAP (2009)), there is so far only anecdotal evidence on how MSME borrowers are affected by the crisis. This study is the first to provide micro-level evidence on the impact of the financial crisis on credit availability for MSMEs in an emerging market economy. Thereby it does not only offer new insights in the various channels of credit availability but it also sheds light on an important question that remains to be answered empirically: whether the risks from lending to small and medium borrowers or those arising from microenterprise loans are more worrisome to lenders during the crisis. On the one hand, microenterprises may be hit less because they often produce essential goods for the local market so that demand for their products is relatively stable even in times of crises (Littlefield and Kneiding (2009)). On the other hand, many micro entrepreneurs have accumulated debt from multiple lenders because especially in the well developed microfinance markets like Eastern Europe the boundaries between microfinance and consumer finance have become blurred (Littlefield and Rosenberg (2004)). These high debt levels may make micro clients even vulnerable to small changes in their incomes.

The study measures credit availability in two ways, first by the firms' probability to receive a loan after having applied for one and second by the share of the requested loan amount that is finally granted by the bank if the loan application was successful. The results show that credit availability for agro loans is merely affected by the crisis. Apart from that, micro compared to SME borrowers face only a moderate reduction in approval rates due to the crisis which may be explained by their lower risk. While agro and micro businesses mainly produce subsistence goods for the local market, SME borrowers' business activities may be more severely hit by the crisis so that they have to face the greatest cuts to their credit availability. A further explanation may be that it is easier and cheaper for the bank to "save" scarce refinancing funds by denying some SME in contrast to many micro loans. Finally, bank relationships are found to be valuable in times of crises because they mitigate the negative effects which the crisis has on credit availability.

Analyzing aggregate statistics allows identifying a third channel of credit availability. It turns out that the refinancing delays together with the bank's strong portfolio growth forced the bank to introduce limits on lending so that not all demand

could be met. However, the restrictions on business lending were implemented in line with a conscious tighter risk management, i.e. that in the business loan portfolio mainly SME and high-risk micro lending was limited. The results suggest that the bank discourages such (potential) borrowers from requesting new or additional loans during the period of refinancing difficulties in the second and third quarters of 2008. Thus, both the refinancing delays as well as borrowers' increased credit risk during the crisis seem to matter for the observed reduction in the availability of SME and high-risk micro loans.

The results in this chapter contrast with anecdotal evidence from Eastern Europe which suggests that banks mainly worry about their lending to high-risk micro clients and have limited their exposure in that segment because many of these clients carry high levels of (consumer) debt. Whether there are fundamental regional differences or whether the analysis in this chapter underestimates the negative impact of the crisis on micro lending because it can only partially account for the number of potential borrowers that is deterred from requesting a loan during the times of refinancing difficulties and after the Lehman failure remains to be investigated by future research.

The results have implications for development practitioners aiming at sustainably fostering credit access for micro, small and medium businesses in developing and transition countries. First, supporting MFIs in building up diversified credit portfolios that include various loan categories with respect to size and industry may increase banks' stability in times of a global financial and economic crisis as the current one. While the strong performance of AccessBank and the low default rates of its borrowers during the crisis provide some support for this argument, of course, further research on how different banks' portfolio quality is affected by such a crisis would be needed to verify this aspect. Second, broadening MFIs' refinancing basis to achieve greater resilience against external shocks remains an important topic. Recent attempts to create adequate refinancing instruments in local currency therefore seem to be a crucial step to help MFIs to overcome refinancing problems. This bends a bow to Chapter 3 in which a bank's refinancing composition and currency were found to determine its foreign currency lending.

2 Loan Maturity in Small Business Lending - The Role of Borrower Risk, Asymmetric Information and Bargaining Power

2.1 Introduction

In financial contracting, lenders face potential problems arising from an asymmetric distribution of information. Banks can overcome these problems of adverse selection and moral hazard by collecting private information through screening and monitoring and by using debt contract terms (e.g. maturity, collateral, covenants). Loan maturity may play an especially important role in small business lending where the enforcement of covenants is difficult because firms regularly do not provide audited financial statements. While theory predicts covenants to be strictest for high-risk borrowers (e.g. Berlin and Mester (1992)), banks may similarly use short maturities to assert regular renegotiations with risky borrowers when lending to small firms. This so-called debt contracting view (Ortiz-Molina and Penas (2008)) suggests a negative relation between borrower risk and loan maturity.

Yet, there are several demand and supply factors that interfere with this intuitive hypothesis on the nature of the risk-maturity relation. For instance, if the interest rate curve is steep, borrowers have a cost incentive to request short maturities. At the same time, they may favor borrowing at longer maturities because this reduces the need to frequently roll over short-term debt so that borrowers are expected to trade-off these aspects. In addition, relationship lenders' willingness to assist risky borrowers, borrower bargaining power as well as the need for good borrowers to signal their low risk to the bank by choosing short maturities in the presence of asymmetric information may influence the risk-maturity relation. Models that are based on signaling to overcome the adverse selection problem arising from asymmetric information suggest a positive and monotonic relation (Flannery (1986)) or a non-monotonic relation (Diamond (1991)).

This paper provides a comprehensive analysis of the relation between borrower risk and loan maturity in small business lending taking into account the various demand and supply side factors that may influence this relation. For this purpose, we employ detailed data on all loans made to SMEs by a German universal bank in

2005. Germany represents a particularly interesting case because it is a bank-based financial system, small firms heavily rely on borrowing from relationship lenders and, most importantly, German banks typically do not use covenants in small business lending (Elsas and Krahnen (1998), Machauer and Weber (1998)). Therefore, loan maturity may be particularly important because the debt contracting literature suggests that it can be used as a (restrictive) substitute for covenants.

Our results, however, do not confirm this conjecture. We rather find a robust, significantly positive and monotonic risk-maturity relation in the full sample. Our findings thus provide evidence in favor of two complementary explanations, one relating to the behavior of the demand side and one to that of the supply side.

The signaling argument implies that low-risk firms *choose* shorter maturities. This seems to be reasonable in the case of small informationally opaque firms because the risk of adverse selection is relatively high (García-Teruel and Martínez-Solano (2008)). At the same time, relationship lending may provide a very different explanation for a positive risk-maturity relation. Theory suggests that risky borrowers can particularly benefit from borrowing from informed relationship lenders (e.g. Chemmanur and Fulghieri (1994)). It is noteworthy that we observe particularly long maturities in the case of loans made to risky borrowers under relatively low asymmetric information. This result indicates that the bank has intensified its monitoring efforts which, in turn, can be beneficial for the borrowers, resulting in relatively long loan maturities. In other words, relationship lenders *offer* relaxed loan terms to those borrowers that are most likely to need assistance.

Conditioning our analysis on the impact of borrower bargaining power in addition to the extent of asymmetric information enables us to gain further insights in demand and supply effects that may influence the risk-maturity relation. Our results reveal that the risk-maturity relation is weakened in the presence of borrower bargaining power with this effect being especially pronounced when asymmetric information is high. Overall, these findings imply that borrowers would actually like to borrow at longer maturities (if informational asymmetries were absent) and do so when they have bargaining power. Yet, if informational asymmetries are prevalent the good borrowers resort to choosing (cheaper) short-term loans to convey their good quality to the bank. If informational asymmetries are low, risky borrowers benefit from their lenders' willingness to provide long maturities whether they have bargaining power

or not. Finally, our results are also consistent with findings that good borrowers have bigger bargaining power than risky borrowers (Uchida (2006)).

The remainder of this paper is organized as follows. Section 2.2 reviews the related literature while Section 2.3 provides institutional details on the loan granting process and describes the data. Section 2.4 reports the findings from the empirical analyses. Section 2.5 concludes.

2.2 The risk-maturity relation in the literature

In this section, we briefly outline theoretical models on borrowers' and lenders' maturity choices to establish the relation between borrower risk and debt maturity under high vs. low levels of asymmetric information.[6] Then we present empirical studies on the risk-maturity relation that focus on small business lending before turning to the role of borrower bargaining power in bank lending.

2.2.1 The borrower's maturity request and the lender's maturity offer

Flannery (1986) considers a situation in which firm insiders are better informed about the project they want to carry out than the market. If short-term debt is cheaper than long-term debt and if transactions costs to roll over debt are high enough to prevent bad firms (those with unfavorable private information) from imitating good firms (those with favorable private information), a separating equilibrium may occur with good firms borrowing short-term and rolling over debt at a relatively low interest rate and bad firms borrowing long-term at a higher rate. Flannery (1986) thus predicts a positive and monotonic relation between borrower risk and debt maturity based on *borrowers' maturity choices*. Bad firms choose to borrow long-term to avoid transactions costs and a presumably high interest rate when having to roll over short-term debt. Good firms, in contrast, benefit from transactions costs because they may signal their low risk to the market by choosing short debt maturity.

[6] We concentrate on potential problems due to adverse selection since these are relatively more important in comparison to moral hazard in small business lending. If the risk of moral hazard is prevalent, the debt contracting view predicts a negative relation between borrower risk and loan maturity (Ortiz-Molina and Penas (2008)) with short maturities serving as a substitute for strict covenants. Interestingly, there is evidence for a negative relation between borrower risk and loan maturity in lending to *big* firms (e.g. Guedes and Opler (1996)) where the scale and scope of moral hazard can be substantial. However, Strahan (1999), pp. 20-21, also finds that non-investment grade and unrated firms "borrow on a longer term basis than investment grade firms", which is explained with demand-side factors and consistent with our results.

In the model of Diamond (1991), the *firms' debt maturity choice* is based on a trade-off between the preference for short-term debt due to an expected better credit rating in the future and the risk of liquidation, i. e. the inability to roll over short-term debt. In this model, lenders may distinguish firms in the beginning by their credit ratings but they do not know whether firms have positive or negative NPV projects. As a result, low-risk borrowers choose short-term debt because their probability of a downgrade is low and they thus can refinance at favorable terms when good news arrives. At the same time, medium-risk borrowers prefer long-term debt at a higher interest rate as they must fear liquidation when rolling over short-term debt. However, high-risk borrowers may have no choice but only get short-term debt by the lender. Consequently, Diamond (1991) predicts a nonmonotonic, inversely U-shaped relation between borrower risk and debt maturity based on demand-side choices in case of the low- and medium-risk borrowers and supply-side choices in case of the high-risk borrowers.

In contrast, close bank-firm relationships lead to the prediction that relationship *lenders* are more willing to *provide long-term funding* to risky borrowers than arm's length lenders to help these borrowers through times of economic problems. Chemmanur and Fulghieri (1994) model a situation in which firms face liquidity risk arising from financial distress. Firms have private information about their probability of financial distress and can choose between bank and publicly traded debt. If financial distress occurs, the lender has to decide whether to liquidate or renegotiate its debt. Since banks strive for a reputation as good decision makers that provide financial flexibility, they have an endogenous incentive to devote more resources than bondholders to evaluate borrowers and come to an adequate decision about liquidation vs. renegotiation. Thus, this model provides an argument why relatively risky firms benefit most from financing relationships with banks.[7] This benefit may come in the form of extended maturities for risky borrowers as a renegotiation outcome or a preemptive device to avoid financial distress. It remains, however, an empirical question whether this means that risky borrowers actually receive longer maturities than low-risk borrowers.

[7] For instance, Elsas and Krahnen (1998) provide evidence for implicit liquidity insurance for relationship borrowers whose credit quality has temporarily deteriorated. Coleman, Esho and Sharpe (2006) report a direct relation between banks' monitoring ability and loan maturity.

2.2.2 Empirical evidence on the risk-maturity relation in small business lending

Related empirical studies on the relation between borrower risk and the maturity of new loans[8] does not provide a clear picture, one reason being that the studies are based on different data sets and different methodologies. Berger, Espinosa-Vega, Frame and Miller (2005) test the implications of the above described signaling models with data from commercial and industrial loans granted to small US firms in 1997. They consider bank risk ratings to proxy for borrower risk, which allows a joint test of the positive and monotonic versus the nonmonotonic relation in one empirical model. They find evidence in favor of a positive relation between risk and loan maturity, which is in line with Flannery (1986) and partially consistent with Diamond (1991) for low and medium-risk borrowers. In contrast, in their sample of new credit lines to small US firms Ortiz-Molina and Penas (2008) find a negative and monotonic relation between borrower risk and loan maturity relying on an accounting measure (firm and owner delinquency) to proxy for firm risk. Their finding is in line with the view that short maturities serve as a substitute for debt covenants in small business lending.

To account for the influence of the degree of asymmetric information between borrower and lender on loan maturity, Ortiz-Molina and Penas (2008) control for firm age and firm size and detect a positive relation between these inverse proxies for asymmetric information and loan maturity. They also investigate the impact of the duration of the bank-firm relationship on loan maturity but cannot find a statistically significant effect. Using survey data from several European countries, Hernández-Cánovas and Koëter-Kant (2008) examine the number of bank relationships and the provision of soft information to proxy for asymmetric information. They find that the number of bank relationships influences loan maturity negatively on average but the results heavily depend on country characteristics.

Berger, Espinosa-Vega, Frame and Miller (2005) take a different approach and test how the *risk-maturity relation* is influenced by different levels of asymmetric information. They use the fact whether a bank utilizes Small Business Credit Scoring (SBCS) as part of its lending technology as a proxy for asymmetric information. It is

[8] Consistent with the theory we focus on *incremental* financing decisions and do not follow the literature on debt maturity *structure* (e.g. Scherr and Hulburt (2001), Heyman, Deloof and Ooghe (2008)). This approach has the advantage that contract terms are more easily identified and the problem of averaging all outstanding debt financing decisions over time and across contract types is avoided (Dennis, Nandy and Sharpe (2000)).

assumed that banks which do not use SBCS face higher informational asymmetries in comparison to banks that use SBCS. It turns out that low-risk borrowers have significantly longer maturities when informational asymmetries are smaller, which is consistent with the implications of Flannery (1986) and Diamond (1991).

2.2.3 The impact of borrower bargaining power

The respective bargaining power of the bank and the borrower is an important factor influencing the outcome of the loan contracting process. In the model of Rajan (1992) firms may finance their investment projects with short-term or long-term debt from informed banks or with bonds from arm's-length lenders. It predicts a negative relation between a firm's bargaining power and its desire for long-term debt. The reason for this is that under long-term debt the bank may only renegotiate the loan when it gives up some of its control rents so that long-term debt constrains the bank's bargaining power.

Studies examining the impact of bargaining power on loan contract terms have focused on credit availability and loan rates. Petersen and Rajan (1995) measure the market power of banks by way of market concentration. They find empirical confirmation for their model's prediction that more firms of lower credit quality receive financing if the bank has market power because this enables the bank to extract future rents. Wu and Wu (2007) find that the changes in price premiums over the course of bank-borrower relationships vary with relative borrower bargaining power. Finally, Santos and Winton (2009) use a borrower's level of cash flows to proxy for borrower bargaining power and find that bargaining power (i.e. high cash flows) helps borrowers to mitigate the tendency of low capital banks to charge higher rates to their borrowers.

A few studies have provided evidence on the determinants of borrower bargaining power. Analyzing survey data from Japanese SMEs, Uchida (2006) finds that extensive lender competition and good borrower performance increase borrower bargaining power while the length of the bank relationship has a negative impact on borrower bargaining power. The latter may imply that the bank can accumulate proprietary information over time obtaining an informational monopoly and capturing the borrower. Otherwise, the influence of asymmetric information is found to be very weak. Only the frequent flow of hard information decreases borrower

bargaining power somewhat. This is in contrast to the results of Grunert and Norden (2010), who find that soft information represents an important determinant of borrower bargaining power.

In this study, we are concerned with the impact of borrower bargaining power on the risk-maturity relation in addition to asymmetric information, i.e. the effects from the interplay between asymmetric information and borrower bargaining power. Based on the signaling literature outlined in section 2.2.1, we can derive the following implications for the impact of borrower bargaining power on the risk-maturity relation. First, when informational asymmetries are high the signaling literature predicts that good borrowers request short maturities to relay their low risk to the bank and benefit from better loan terms such as longer maturities in the future. We hypothesize that low-risk firms with bargaining power (which would like to borrow long-term in a world without asymmetric information and the need for signaling) are more likely to increase their loan maturities than high-risk firms with bargaining power (who have already long maturities without bargaining power). This implies that the risk-maturity relation should be weaker if borrower bargaining power is high.

Second, in case of low asymmetric information signaling does not play a role so that we expect to find low-risk as well as high-risk borrowers with bargaining power to have longer maturities compared to borrowers without bargaining power because all borrowers would like to have longer maturities (in a world without asymmetric information).[9]

Finally, we should find good borrowers to be able to negotiate a relatively larger increase in loan maturities than riskier borrowers independent of the extent of asymmetric information because Uchida (2006) concludes that "creditworthy borrowers have bigger bargaining power" (p. 9).

2.3 Data and methodology

2.3.1 The dataset

Our data set consists of all commercial and industrial loans made to SME borrowers by a German universal bank during 2005. The total volume of these loans

[9] Graham and Harvey (2001) and Bancel and Mittoo (2004) provide survey evidence that managers of large firms in Europe and the US indeed prefer longer maturities because of their fear of having to refinance in bad times.

amounts to 86.1 million EUR which corresponds to approximately 10% of the bank's entire commercial lending portfolio. The data set includes information on the borrower risk, further borrower characteristics, and loan contract terms. Definitions of all variables are provided in Table 1.

Table 1. Variable definitions

Variable	Definition
Dependent variable	
Maturity	Loan maturity (Log months)
Borrower characteristics	
Rating	Bank internal credit rating ranging from 1 (best) to 5 (worst)
Young	Age of borrower or firm is below respective median age (1=yes, 0=no)
Bank relationship	Duration of the bank-borrower relationship (Log years)
Short bank relationship	Duration of the bank-borrower relationship is shorter than median duration in the sample (1=yes, 0=no)
Checking account	Borrower has a checking account at time of loan disbursement (1=yes, 0=no)
Unlimited liability	Borrower has unlimited liability (1=yes, 0=no)
Bargaining power_Spread	*Loan spread* is below mean loan spread in the same rating category (1=yes, 0=no)
Bargaining power_Collateral	*Collateral* is below mean collateral in the same rating category (1=yes, 0=no)
Bargaining power_Spread and collateral	*Loan spread* is below mean loan spread and *Collateral* is below mean collateral in the same rating category (1=yes, 0=no)
Loan characteristics	
New loan	Loan is a new loan vs. renewal (1=yes, 0=no)
Amount	Loan amount (Log EUR)
Collateral	Value of collateral relative to loan amount (%)
Secured	Loan is secured by collateral (1=yes, 0=no)
Spread	Maturity-adjusted loan spread (percentage points)
Fixed interest	Loan rate is fixed vs. floating (1=yes, 0=no)
Bullet loan	Loan for which the entire principal is due in one balloon payment at the end of the loan term (1=yes, 0=no)
Transferred loan	Loan is a start-up, development or special purpose loan initiated under a federal development bank program (1=yes, 0=no)
Building loan	Loan is for building or construction purposes (1=yes, 0=no)
Info asymmetry	Indicator of extent of asymmetric information at loan disbursement calculated as [*Short duration* + (1-*Checking account*)] (2= very high, 1=medium, 0=low)
High info asymmetry	Loan was made under high asymmetric information, i.e. *Info asymmetry* > 1 (1=yes, 0=no)

We exclude all consumer loans and all observations with missing data. This procedure leads to a final sample of 668 loans, hereof 297 new and 139 renewed loans to small businesses with unlimited liability as well as 180 new and 52 renewed

loans to SMEs with limited liability. Our sample is representative for all firms in the German economy with respect to firm size and ownership (see Federal Statistical Office (2006)). For instance, 94.9% of firms in Germany have annual sales below two million Euros, while this statistic is 91.6% in our subsample of firms for which we have this information. In addition, 64.8% of all German firms are sole proprietorships, whereas 65.3% of firms in our sample have unlimited liability with most of these firms being sole proprietorships. Furthermore, our sample is comparable in terms of size to Brick and Palia (2007) who analyze data on 766 credit lines from the 1993 National Survey of Small Business Finances (NSSBF). However, we do not analyze credit lines and loan commitments because their nominal maturity is typically either short term (e.g. 6 or 12 months) or not specified whereas the effective maturity may be relatively long since credit lines are frequently rolled over. Concentrating the analysis on one bank has the advantage that the lending behavior is relatively homogeneous so that we do not need to control for bank characteristics. This is a standard problem when using the NSSBF data because neither the identity nor the characteristics of the lending institutions are included.

2.3.2 The bank's loan granting process

When a borrower approaches the bank, having in mind the purpose of the loan, she may ask for a specific loan amount and maturity. The loan officer, first of all, assigns an internal credit rating to the borrower. These credit ratings, which are updated every year and not subject to negotiations, are based on hard and, if available, private and soft information (see Elsas and Krahnen (1998), Treacy and Carey (2000), Grunert, Norden and Weber (2005) and Grunert and Norden (2010)). Hard information includes measures of profitability, leverage and liquidity. Soft information comprises an assessment of the firm's product market position and the skills of its management such as competence, education, leadership and credibility. Internal credit ratings do not include potential information from the requested loan terms. They also do not include checking account information, but loan officers make discretionary use of this information in negotiations on loan terms and loan monitoring. To account for the bank's usage of checking account information, we include the fact whether a borrower has a checking account with the bank or not in our proxy of asymmetric information.

The loan officer then may compare the risk assessment reflected by the internal credit rating with the borrower's demanded maturity. Consequently, the requested maturity can be seen as an external signal in this stage of the negotiations and may allow the loan officer to update the decisions about the other loan contract terms. Importantly, loan officers at this bank do have the discretionary power to exploit the signal from the borrower's maturity request. Such bank behavior is consistent with Cerqueiro, Degryse and Ongena (2007) who find that loan officers have more discretion in the loan-pricing process if firms are small, risky and difficult to monitor. Finally, the loan officer negotiates with the borrower on collateral and both parties agree on the loan rate.

In addition, the bargaining power of the borrower is an important factor that may influence the outcomes for the various loan contract terms. Directly measuring bargaining power is difficult but we believe that the price of a loan (the loan spread) represents a potential indirect ex-post indicator of a borrower's bargaining power for the following reasons. First, the spread usually represents the *last* contract feature to be determined in loan negotiations. The main reason for this is that the loan spread is initially based on the borrower risk reflected by the internal credit rating only and then adjusted conditional on the amount of collateral that is pledged by the borrower. Second, the loan spread allows for negotiation in both directions and borrowers are less constrained in bargaining on interest rates than in bargaining on collateral. Frequently, there is little or no room for small businesses to pledge additional collateral to obtain a lower interest rate simply because all available collateral has already been pledged to banks. Third, competition in bank lending is typically based on loan rates and volumes but not on other lending terms like maturity and collateral. Fourth, interest payments affect the financial statements of firms and, for example, the interest coverage represents an important financial ratio that affects the bank's loan approval decision. Consequently, borrowers with a relatively high bargaining power are expected to get relatively low loan spreads (and/or to pledge little collateral). We will condition our empirical analysis of the relation between borrower risk and loan maturity on three measures of borrower bargaining power that are based on the above reasoning.

2.3.3 The relation between borrower risk and loan maturity

To analyze the relation between borrower risk and loan maturity, we estimate an OLS model with $Maturity_{i,k}$ (measured in log months) of loan *k* that firm *i* takes out as the dependent variable:

$$Maturity_{i,k} = \alpha + \beta_1 R_i + \beta_2 F_i + \beta_3 L_k + \varepsilon_{i,k} \quad (1)$$

In this model R_i is a measure of the borrower's credit risk and F_i and L_k are vectors of further borrower and loan characteristics respectively. The relative costs of short-term vs. long-term debt should also be an important determinant of borrowers' loan maturity requests as there may be a trade-off between the desire for longer maturities and their higher costs in the case of a steep interest rate curve. Nevertheless, we do not include a proxy for the structure of the interest rate curve in our regressions because we only observe loans made within one year. In 2005, the term structure of interest rates in Germany was relatively flat (estimated yields for 1 year: 2.27%, 5 years: 2.91%, 10 years: 3.47%, source: Deutsche Bundesbank) rendering cost aspects less important. In addition, the interest rate curve changed only slightly towards an even flatter structure so that there is not much variation which we could exploit in our analysis.

Borrowers' credit risk and further borrower characteristics

We measure borrower risk by the bank's internal credit *Rating*. The bank's internal credit rating system consists of 5 rating categories which range from category 1 indicating the highest creditworthiness to category 5 including borrowers in financial distress (the borrower is 90 days past due on any of her obligations, the bank has established a specific loan loss provision or the borrower has filed for bankruptcy). We consider category 5 borrowers in our analysis because the fact that these firms have been granted new loans or renewals indicates that the bank is engaged in a restructuring process and that it expects recovery from distress in the medium-term. To allow for non-linear effects, we derive the dummy variables *Rating_2, ..., Rating_5* and use *Rating_1* as the baseline category. Taking the internal credit rating as a measure of borrower risk has the advantage that the rating can be

seen as exogenous to loan maturity because it is assigned before the bank negotiates the loan contract terms with the customer.[10]

Our additional borrower characteristics control for the extent of asymmetric information between borrowers and the bank. A widely-used measure for firm opaqueness is firm age since there may be more information publicly available on older borrowers (e.g. Blackwell and Winters (1997) and Berger, Klapper and Udell (2001)). As our dataset reports firm age if the borrower is a firm but the age of the individual if the borrower is a craftsman or pursues a liberal profession, we use *Young*. It is a dummy variable indicating whether the age of the firm or the age of the borrower is below the respective median age in the two subsamples of firms and individuals. As the bank may gain private information about borrowers over the course of bank-borrower relationships (see Boot (2000) and Ongena and Smith (2000)), we include the variable *Bank relationship* which indicates the length of the bank-borrower relationship in log years. Observing checking account activity has been found to provide banks with useful information to monitor their borrowers (Mester, Nakamura and Renault (2007), Norden and Weber (2010b)). The dummy variable *Checking account* is therefore one if the borrower has a checking account with the bank and zero otherwise. As a decrease in informational asymmetries reduces agency problems and thus the need for signaling, we expect maturities to be longer if the extent of asymmetric information is smaller (given that borrowers would like to have longer maturities in a world without asymmetric information). Finally, to capture remaining differences in borrower characteristics, the regressions contain a dummy variable indicating whether the borrower has *Unlimited liability* in contrast to limited liability.

Loan characteristics

A loan-level indicator of the extent of asymmetric information is the dummy variable *New loan* which is one if the loan is new and zero for renewals. Since for new loans there has not been any interaction between the bank and the borrower on the financing of this specific project, asymmetric information is likely to be higher for these loans.

[10] Similarly, Dennis, Nandy and Sharpe (2000) use Altman's Z-score as a predetermined variable.

We include several loan contract terms in some of our analyses as they may influence the choice of loan maturity. However, it is possible that these additional contract terms are determined simultaneously with loan maturity and we will consider possible endogeneity problems in the empirical analysis. *Amount* is the size of the loan in log euro and *Collateral* is the value of the collateral relative to the loan amount (the secured percentage of the loan). If a borrower pledges more collateral, the credit risk of the loan may be reduced considerably. Consequently, the bank does no longer need to consider loan maturity as a contracting device to discriminate between high-risk and low-risk borrowers. This mechanism can also be derived from the agency literature (e.g. Myers (1977), Smith and Warner (1979)). Either a short maturity or collateral pledges help to mitigate agency problems between equity holders and debtors. Therefore, collateral and maturity should be positively related.

Finally, we consider the following additional contract terms to account for remaining differences in loan characteristics. *Spread* is the maturity adjusted credit spread for each loan while *Fixed interest* is a dummy variable that equals one if the loan's interest rate is fixed and zero if it is floating. *Bullet loan* captures the repayment schedule of the loan and is one if the entire principal is due at the end of the loan term and zero otherwise. *Transferred loan* is a dummy variable which indicates whether the loan is a start up, development or special purpose loan initiated under a federal development bank program and *Building loan* is a dummy variable indicating whether the loan is used for building and construction purposes.

Indicators of asymmetric information and borrower bargaining power

To shed some light on the demand and supply side effects influencing the risk-maturity relation, we differentiate our analysis by varying levels of asymmetric information and borrower bargaining power. For this purpose, we derive indicators of the extent of asymmetric information and borrower bargaining power from our explanatory variables.

First, to capture the various dimensions of asymmetric information, we construct an additive indicator from the variables *Bank relationship* (the duration of the bank-borrower relationship) and *Checking account*. The usefulness of a long bank-borrower relationship for the bank to gather information on the borrower may be considerably increased if the borrower has a checking account with the bank since this information has been found to be particularly valuable for monitoring existing

borrowers (Puri, Rocholl and Steffen (2010)). The main advantage of this approach is that we can condition our analysis on a compact measure that is based on two input factors instead of reporting univariate relationships.

Specifically, we calculate *Info asymmetry* as the sum of an indicator variable for *Short bank relationship* (a dummy variable which is one if the duration of the bank-borrower relationship is shorter than the median duration in our sample) and an indicator for no checking accounts:

$$\textit{Info asymmetry} = \textit{Short bank relationship} + (1 - \textit{Checking account}) \quad (2)$$

Info asymmetry can take values of 0, 1, and 2, and higher values indicate a higher extent of asymmetric information. The rank correlation between the input variables is 0.37 indicating a positive but not a perfect correlation. Lacking quantitative information on the relative importance of these factors, we apply equal weights.

Second, the general or deal-specific bargaining power of the borrower may be a further factor influencing the strength of the risk-maturity relation. We believe the loan spread to be an indirect ex-post measure of borrower bargaining power that at least captures partial effects from bargaining in loan contracting. We therefore construct the dummy variable *Bargaining power_Spread* that is one if the (maturity adjusted) credit spread of a certain loan is below the mean loan spread of all loans in the same rating category, and zero otherwise. In addition, we calculate *Bargaining power_Collateral* which is one if the value of *Collateral* of a certain loan is below the mean of *Collateral* of all loans in the same rating category. Finally, we study the extreme case by combining these two measures to derive *Bargaining power_Spread and collateral*. This variable differentiates between loans with below-mean spreads and below-mean collateral in the same rating category (very high bargaining power) vs. loans with above-mean spreads and above-mean collateral in the same rating category (very low bargaining power).

[11] Note that *Info asymmetry* is based on variables that are not (directly) included in the bank's internal credit ratings so that we can assess the impact of the bank's information over and above the public and private information that enters into the credit ratings. We have also defined more complex additive and multi-attributive indices that contain the loan-level variable *New loan*. Conditioning the risk-maturity relation on these indices leads to similar results and does not change our conclusions.

2.3.4 Summary statistics

Table 2 reports summary statistics for our borrower and loan characteristics.

Table 2. Descriptive statistics

This table displays summary statistics for the borrower and loan characteristics. 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.

	Mean	SD	Min	Median	Max	N
Borrower characteristics						
Rating	2.58	1.02	1	3	5	668
Young	0.49	0.5	0	0	1	668
Bank relationship	5.43	7.36	0	2.16	57.42	668
Checking account	0.52	0.50	0	1	1	668
Unlimited liability	0.65	0.48	0	1	1	668
Loan characteristics						
Maturity	82.84	83.71	3	55	396	668
New loan	0.71	0.45	0	1	1	668
Amount	129,044	290,948	508	30,187	3,137,496	668
Collateral	45.71	45.20	0	42.68	100.80	668
Spread	2.48	2.08	-3.26	2.25	16.76	668
Fixed interest	0.78	0.41	0	1	1	668
Bullet loan	0.11	0.31	0	0	1	668
Transferred loan	0.10	0.30	0	0	1	668
Building loan	0.06	0.23	0	0	1	668

It shows that the firms in our sample receive a mean internal credit rating of 2.58 from the bank. The average duration of the *Bank relationship* at loan disbursement is 5.4 years. More than half of the loans are granted to borrowers having a *Checking account* with the bank and 65% of the loans in our sample are granted to small firms with *Unlimited liability*. The mean loan *Maturity* amounts to 83 months (6.9 years) while the maximum maturity is more than 30 years. The average loan *Amount* is 129,044 EUR (maximum of 3.1 million EUR) which is comparable to the mean loan size of 43,580 USD (for loans < 100,000 USD) and 183,720 USD (for loans < 250,000 USD) in the US data set analyzed by Berger, Espinosa-Vega, Frame and Miller (2005). On average, 46% of a loan amount is secured with collateral (the maximum is slightly above 100% because in some cases the bank has collateral that exceeds the loan amount). Finally, the mean loan spread is 2.48 percentage points

above the bank's same-maturity refinancing costs (while there are a few loans that actually exhibit negative spreads).[12]

Asymmetric information has been shown in the literature to be an important determinant of loan maturity and the relation between loan maturity and borrower risk. As argued before, reduced informational asymmetries should lead to longer maturities on average because the need for signaling has vanished. Borrower bargaining power may be prevalent in high and low states of asymmetric information and should increase average maturities if (low-risk) borrowers actually prefer longer maturities. The question then is how exactly loan maturity, borrower risk and their relation vary between the four possible combinations of the extent of asymmetric information and borrower bargaining power.

We use difference-in-difference estimates to study how borrower bargaining power influences loan maturity and borrower risk in states of high vs. low asymmetric information. Panel A of Table 3 reveals that observed loan maturities and, to a lesser extent, borrower risk are considerably influenced by both asymmetric information and borrower bargaining power.

Panel A of Table 3 shows that the average loan *Maturity* is significantly longer if informational asymmetries are low which is consistent with the implications of the signaling models. The difference-in-difference estimate (in bold) indicates that this difference in loan maturities between states of high and low asymmetric information is significantly higher by around 31 months in case of high borrower bargaining power. Taking a closer look at the impact of borrower bargaining power in the last column of the table shows that high bargaining power increases average loan maturities significantly. If informational asymmetries are low, this increase is nearly 63 months and with that twice as large as in the case of high informational asymmetries. It seems that in case of low asymmetric information the two effects from a reduced need for signaling and from borrowers successfully realizing their preferences for longer maturities intensify each other. In contrast, signaling might still play some role when informational asymmetries are high even if the borrower has the power to negotiate for longer maturities.

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

Turning to the risk ratings, we observe that borrowers are, on average, significantly more risky if informational asymmetries are low compared to high. This difference is with 83 percentage points especially pronounced in the case of low borrower bargaining power and significantly larger than in the case of high bargaining power as indicated by the difference-in-difference estimate (in bold). Interestingly, there is no difference in the average risk *Rating* for borrowers with low vs. high bargaining power if informational asymmetries are low.

Table 3. Asymmetric information and borrower bargaining power

Panel A. Impact on loan maturity and borrower risk

This table reports average *Maturity* and *Rating* for states of low (*Bargaining power_Spread* = 0) and high (*Bargaining power_Spread* = 1) bargaining power, for the two subsamples of loans made under high (*Info asymmetry* > 0) and low asymmetric information (*Info asymmetry* = 0). 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. Definitions of all variables are provided in Table 1.

	Maturity		
	High bargaining power N = 354	Low bargaining power N = 314	Diff / **Diff-in-Diff**
Low info asymmetry, N = 232	138.31	75.63	62.69***
High info asymmetry, N = 436	83.14	51.67	31.48***
Diff / **Diff-in-Diff**	55.17***	23.96***	**31.21****

	Rating		
Low info asymmetry, N = 232	2.90	2.92	-0.02
High info asymmetry, N = 436	2.71	2.09	0.62***
Diff / **Diff-in-Diff**	0.19*	0.83***	**-0.64*****

Panel B. Impact on the risk-maturity relation

This table displays Spearman rank correlation coefficients between *Maturity* and *Rating* for states of low (*Bargaining power_Spread* = 0) and high (*Bargaining power_Spread* = 1) bargaining power, for the two subsamples of loans made under high (*Info asymmetry* > 0) and low asymmetric information (*Info asymmetry* = 0). ***, **, * denote significance at the 0.01-, 0.05- and 0.1-level. Definitions of all variables are provided in Table 1.

	Spearman rank correlation coefficients between *Maturity* and *Rating*	
	Low bargaining power N = 314	High bargaining power N = 354
High info asymmetry, N = 436	0.70***	0.05
Low info asymmetry, N = 232	0.41***	0.29**

In Panel B of Table 3 we analyze the risk-maturity relation by assessing the Spearman rank correlation between *Maturity* and *Rating*. It turns out that high borrower bargaining power weakens the risk-maturity relation more when the extent of asymmetric information is high than when it is low.[13] This confirms our reasoning that in the case of high asymmetric information the good borrowers are more likely to increase their loan maturities than the risky borrowers who already receive long maturities without having bargaining power. Together with the previous finding that average maturities are longer if bargaining power is high, this is consistent with the results in Uchida (2006) that good borrowers have bigger bargaining power than risky borrowers. In the case of high informational asymmetries and high borrower bargaining power, the risk-maturity relation even vanishes implying that all borrowers manage to receive similar maturities.

Summarizing, the findings in Table 3 establish several interesting insights. First, they show that the risk-maturity relation is strongest if informational asymmetries are high and borrower bargaining power is low which is consistent with the signaling literature. Second, on average borrowers are more risky and obtain longer maturities if informational asymmetries are low which confirms the argument that especially risky borrowers can benefit from borrowing from relationship lenders. And third, borrower bargaining power weakens the risk-maturity relation implying that the good borrowers with bargaining power are able to increase maturities more than the risky borrowers with bargaining power.

2.4 Results

2.4.1 Basic results on the risk-maturity relation

Table 4 displays OLS regression results for the relation between borrower risk and loan maturity. Standard errors are reported in parentheses and are adjusted for clustering at the borrower level.

Column (1) indicates that there is a significantly positive and monotonic relation between borrower risk, measured by the *Rating* dummies, and loan *Maturity* with the increase in loan maturity being most pronounced between rating categories 1 and 2.

[13] In the case of high informational asymmetries and high borrower bargaining power, the risk-maturity relation even vanishes implying that all borrowers manage to receive similar maturities. However, this finding may also be driven by the fact that most observations are in rating categories 2 or 3, while there are few observations with rating 1, 4 or 5.

Column (2) which additionally includes our borrower characteristics as control variables confirms these findings. The borrower characteristics reveal that our measure for the extent of publicly available information, *Young*, does not influence loan maturity. In contrast, our measures for the bank's possibility to gather private information show that a longer *Bank relationship* and the fact that the borrower has a *Checking account* lead to longer loan maturities. This result is consistent with the signaling literature because the need for good firms to relay their low risk by choosing short maturities decreases when the bank's knowledge about the firms increases. Finally, borrowers with *Unlimited liability* have longer maturity loans because they may be considered safer by the bank than borrowers of limited liability.

In column (3) we extend the analysis by including further loan characteristics that may influence loan maturity. While the regressions in columns (1) and (2) may thus suffer from an omitted variable bias, including further loan characteristics may introduce endogeneity problems due to the simultaneous negotiation of various loan contract terms. The estimates in column (3) should therefore be seen as a robustness check of our main results established in column (2). This strategy has been adopted by previous papers on loan contracting (e.g. Berger and Udell (1995), Berger, Espinosa-Vega, Frame and Miller (2005) and Ortiz-Molina and Penas (2008)). Apart from that, for the loan amount it seems plausible to assume that it is already defined at the beginning of the negotiations, which makes it a predetermined variable that may be treated exogenously. We refrain from estimating a simultaneous equation model because in the case of loan contracting it is very difficult to find adequate and reliable instrumental variables in cross-sectional studies.

The estimates in column (3) reveal that our main findings are robust to the inclusion of further loan contract terms with the exception of *Bank relationship* which loses its impact due to the correlation with further loan contract terms. Most importantly, we observe that the significantly positive risk-maturity relation persists. The additional loan characteristics show that *New loan*s have shorter maturities than renewals. One possible explanation may be that informational asymmetries are higher for new loans because the bank has not had the possibility to gather information on the specific project so far. While larger loans (*Amount*) carry longer maturities, *Collateral* and *Spread* do not influence loan maturity. This may be explained by a prevalent order in the negotiation of contract terms and implies that loan maturity is negotiated before collateral and spread.

Table 4. The risk-maturity relation

This table reports results from OLS regression models for the entire sample of loans. The dependent variable is the natural logarithm of the loan *Maturity*. Standard errors are reported in parentheses and account for clustering at the borrower level. All explanatory variables are defined in Table 1. ***, **, * denote significance at the 0.01-, 0.05- and 0.1-level.

	(1)	(2)	(3)
Rating_2	1.115***	1.117***	0.864***
	(0.155)	(0.164)	(0.211)
Rating_3	1.223***	1.188***	0.963***
	(0.182)	(0.170)	(0.214)
Rating_4	1.669***	1.458***	1.030***
	(0.200)	(0.236)	(0.286)
Rating_5	2.056***	1.829***	1.364***
	(0.169)	(0.226)	(0.279)
Young		0.021	0.057
		(0.078)	(0.061)
Bank relationship		0.144***	0.037
		(0.051)	(0.047)
Checking account		0.311***	0.157**
		(0.090)	(0.073)
Unlimited liability		0.399***	0.414***
		(0.092)	(0.066)
New loan			-0.277**
			(0.110)
Amount			0.116***
			(0.029)
Collateral			0.000
			(0.001)
Spread			-0.020
			(0.016)
Fixed interest			-0.093
			(0.110)
Bullet loan			-0.799***
			(0.160)
Transferred loan			0.553***
			(0.108)
Building loan			0.257
			(0.169)
Constant	2.886***	2.293***	1.825***
	(0.116)	(0.146)	(0.330)
Observations	668	668	668
Adjusted R^2	0.280	0.379	0.528

Finally, to examine the signaling hypothesis from a different perspective, we analyze whether the maturity of new loans granted in 2005 relates to the future credit quality of the borrowers. Since loan maturity is not an input factor of the bank's credit ratings, including an indicator variable for future rating upgrades should not lead to endogeneity problems. Instead, the signaling models are based on the conjecture that borrowers have private information about their credit quality and that

the borrowers' maturity choice reveals this private information. Borrowers who have favorable private information choose short maturities to signal this to the bank.

Table 5. Intertemporal test of signaling

This table reports results from OLS regression models for the subsample of loans for which we have information on subsequent ratings. The dependent variable is the natural logarithm of the loan *Maturity*. *Upgrade* is a dummy variable which is one if the borrower received a rating upgrade within the subsequent year, and zero otherwise. P-values are reported in brackets. All explanatory variables are defined in Table 1. ***, **, * denote significance at the 0.01-, 0.05- and 0.1-level.

	(1)	(2)
Rating_2	0.348	0.629***
	[0.107]	[0.002]
Rating_3	0.508**	0.732***
	[0.020]	[0.000]
Rating_4	0.831***	0.937***
	[0.001]	[0.000]
Rating_5	1.099***	0.967***
	[0.001]	[0.004]
Upgrade	-0.417***	-0.171**
	[0.001]	[0.056]
Young	0.095	0.054
	[0.417]	[0.579]
Bank relationship	0.090*	0.037
	[0.058]	[0.401]
Checking account	0.295***	0.083
	[0.010]	[0.349]
Unlimited liability	0.312**	0.367***
	[0.013]	[0.000]
New loan		-0.331**
		[0.030]
Amount		0.172***
		[0.000]
Collateral		0
		[0.992]
Spread		0.003
		[0.850]
Fixed interest		-0.066
		[0.661]
Bullet loan		-1.03***
		[0.000]
Transferred loan		0.588***
		[0.000]
Building loan		0.177
		[0.384]
Constant	3.111***	1.554***
	[0.000]	[0.000]
Observations	437	437
Adjusted R^2	0.237	0.438

We expect to find that borrowers who take out a short-term loan in 2005 have a higher probability to experience a rating upgrade in the subsequent year. We can only conduct this analysis for a restricted sample in which we have information on subsequent credit ratings (n=437 borrowers). It turns out that firms borrowing at relatively short maturities (below the median maturity of 55 months) exhibit, on average, a significantly higher probability of experiencing an upgrade of their initial credit rating within one year (20%) than firms borrowing long-term (2%). To test for this intertemporal aspect of signaling, we include a "look-ahead" indicator variable for future rating upgrades (*Upgrade*) which captures borrowers' private knowledge about their credit quality in our baseline regression model. Table 5 reports the regression results. We find a highly significant and negative effect of *Upgrade* on maturity which confirms that those borrowers with future rating upgrades borrow short-term in 2005. Besides, the positive and monotonic risk-maturity relation remains unchanged. This analysis provides evidence for the signaling argument and shows that loan maturity is not only related to borrower risk in the cross-section but also over time.

2.4.2 The impact of asymmetric information on the risk-maturity relation

In a next step, we extend the analysis and investigate the risk-maturity relation under varying levels of asymmetric information to disentangle the effects on maturity due to borrower risk (internal credit rating) and asymmetric information. The main goal here is to distinguish between situations in which the loan maturity choice is demand-driven (high asymmetric information, signaling) and situations in which it is supply-driven (low asymmetric information, assistance from relationship lenders). Unlike Berger, Espinosa-Vega, Frame and Miller (2005) who measure differences in asymmetric information between banks we investigate how varying informational asymmetries between different borrowers of the same bank influence the risk-maturity relation.

In Table 6 we present the regression results for varying levels of the extent of publicly available as well as private information. We re-estimate the basic regressions from Table 4 and examine whether there are significant differences in the risk-maturity relation dependent on the extent of asymmetric information.

Panel A contains the results from our analysis of the impact of the extent of publicly available information, measured by *Young*, on the risk-maturity relation. We assess whether there are significant differences in the *Rating* coefficients by introducing the interaction terms *Rating_2*Young, ..., Rating_5*Young*. Columns (1-2) and (3-4) present estimates from single OLS regressions, with the main effects of the *Rating* dummies reported in columns (1) and (3) and interaction terms with *Young* reported in columns (2) and (4).

The estimates for the *Rating* dummies in column (1) show that there is a significantly positive and monotonic (except for *Rating_3*) relation between borrower risk and loan maturity for the relatively older borrowers for whom more information should be available. Both the variable *Young* and its interaction terms with the *Rating* dummies are insignificant which means that there is no significant difference in the risk-maturity relation for older vs. younger borrowers. This is also illustrated in Figure 1. Controlling for the additional loan contract terms in columns (3-4) confirms these findings. Thus, asymmetric information measured by the borrower's age merely seems to influence the risk-maturity relation.

Figure 1. The impact of borrower age on the risk-maturity relation

This figure displays the effect of high vs. low asymmetric information measured by borrower age (*Young*) on the relation between *Maturity* and the *Rating* dummies. See Table 1 for definitions of all variables.

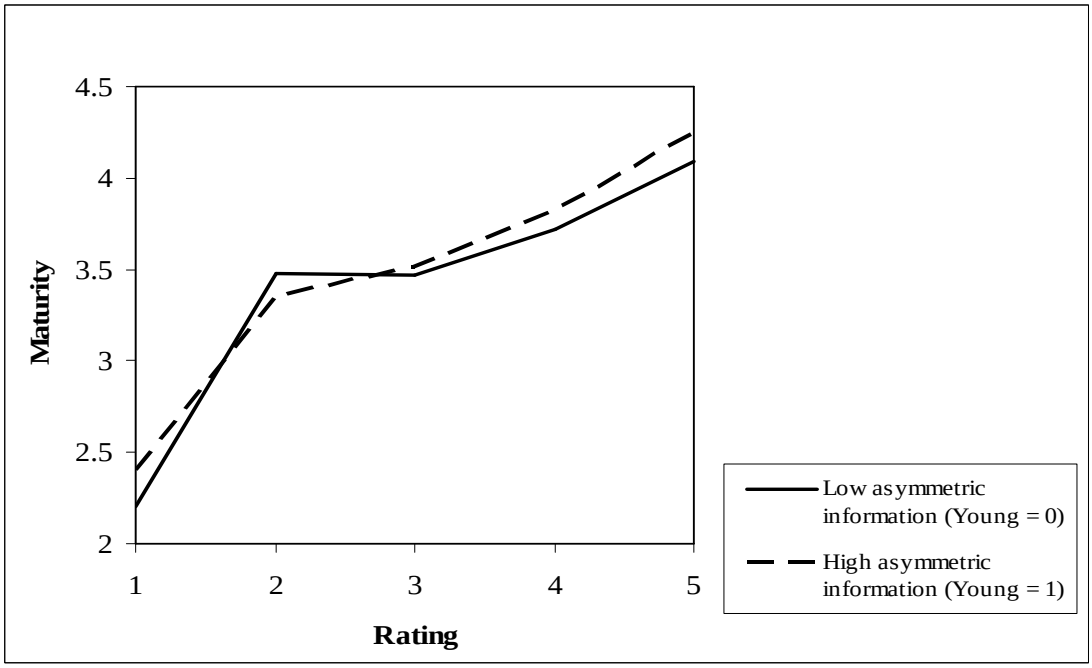


Table 6. The impact of asymmetric information

This table reports results from OLS regression models for the entire sample of loans. The dependent variable is the natural logarithm of the loan *Maturity*. All explanatory variables are defined in Table 1. Standard errors are reported in parentheses and account for clustering at the borrower level. ***, **, * denote significance at the 0.01-, 0.05- and 0.1-level.

Panel A. The extent of publicly available information

	(1)	(2)	(3)	(4)
Coefficients	Main effects	Interactions with *Young*	Main effects	Interactions
Rating_2	1.279***	-0.321	1.001***	-0.263
	(0.238)	(0.279)	(0.315)	(0.289)
Rating_3	1.270***	-0.152	1.101***	-0.259
	(0.251)	(0.290)	(0.318)	(0.287)
Rating_4	1.519***	-0.096	1.118***	-0.143
	(0.310)	(0.395)	(0.378)	(0.363)
Rating_5	1.893***	-0.040	1.426***	0.031
	(0.293)	(0.359)	(0.372)	(0.330)
Young	0.197		0.258	
	(0.248)		(0.249)	
Bank relationship	0.144***		0.034	
	(0.050)		(0.048)	
Checking account	0.320***		0.165**	
	(0.088)		(0.070)	
Unlimited liability	0.388***		0.410***	
	(0.092)		(0.066)	
New loan			-0.280***	
			(0.108)	
Amount			0.115***	
			(0.030)	
Collateral			0.000	
			(0.001)	
Spread			-0.021	
			(0.016)	
Fixed interest			-0.086	
			(0.109)	
Bullet loan			-0.805***	
			(0.157)	
Transferred loan			0.550***	
			(0.109)	
Building loan			0.267	
			(0.167)	
Constant	2.201***		1.731***	
	(0.201)		(0.332)	
Observations	668		668	
Adjusted R^2	0.378		0.529	

Panel B. The extent of private information

	(1)	(2)	(3)	(4)	(5)
			Info asymmetry = 2	Info asymmetry = 1	Info asymmetry = 0
Coefficients	Main effects	Interactions with *Relatively high info asymmetry*	Main effects	Main effects	Main effects
Rating_2	1.051**	0.204	1.340***	0.343	0.976**
	(0.533)	(0.553)	(0.135)	(0.273)	(0.472)
Rating_3	1.013*	0.384	1.283***	0.679***	1.039**
	(0.534)	(0.556)	(0.145)	(0.254)	(0.477)
Rating_4	1.369**	0.366		0.630*	1.294***
	(0.554)	(0.614)		(0.350)	(0.493)
Rating_5	1.606***	0.740		1.232***	1.582***
	(0.544)	(0.583)		(0.311)	(0.487)
Relatively high info asymmetry	-0.627				
	(0.539)				
Young	-0.016		-0.007	-0.231*	0.238*
	(0.094)		(0.063)	(0.123)	(0.121)
Unlimited liability	0.459***		0.457***	0.303*	0.122
	(0.113)		(0.128)	(0.172)	(0.135)
Constant	2.984***		2.109***	3.645***	3.138***
	(0.525)		(0.146)	(0.341)	(0.455)
Observations	668		226	210	232
Adjusted R^2	0.357		0.445	0.153	0.155

Turning to the influence of the extent of private information gathered by the bank over time and / or from the usage of checking accounts, we first calculate some descriptive statistics conditional on our indicator for this kind of asymmetric information, *Info asymmetry*. We find that the loan maturity is shorter in case of loans made under relatively high (*Info asymmetry* > 0) asymmetric information (means: 68 vs. 111 months, medians: 47 vs. 64 months) and that this result is highly significant ($p<0.01$, Wilcoxon rank sum test). In addition, the Spearman rank correlation coefficient between the internal credit rating and loan maturity amounts to 0.30 for *Info asymmetry* = 0 and 0.44 for *Info asymmetry* > 0, indicating a stronger association for loans made under relatively high asymmetric information. Panel B of Table 6 reports regression results for the effect of *Info asymmetry* on the risk-maturity relation.

Columns (1) and (2) present estimates from a single OLS estimation of the full sample, with the main effects of the *Rating* dummies reported in column (1) and interaction terms with *Relatively high info asymmetry* (a dummy variable that equals 1 if *Info asymmetry* > 0 and zero otherwise) reported in column (2). Again, we find a

significantly positive risk-maturity relation for loans made under low asymmetric information as well as for loans made under high asymmetric information. Although the interaction terms are not statistically significant, looking at their economic relevance in column (2) and the illustration of the results in Figure 2 suggests that the impact of our additive indicator of asymmetric information on the risk-maturity relation is stronger than that of borrower age.

Figure 2. The impact of the bank's private information on the risk-maturity relation

This figure displays the effect of high (*Info asymmetry* > 0) vs. low (*Info asymmetry* = 0) asymmetric information measured by the bank's possibility to gather private information from its borrowers on the relation between *Maturity* and the *Rating* dummies. See Table 1 for definitions of all variables.

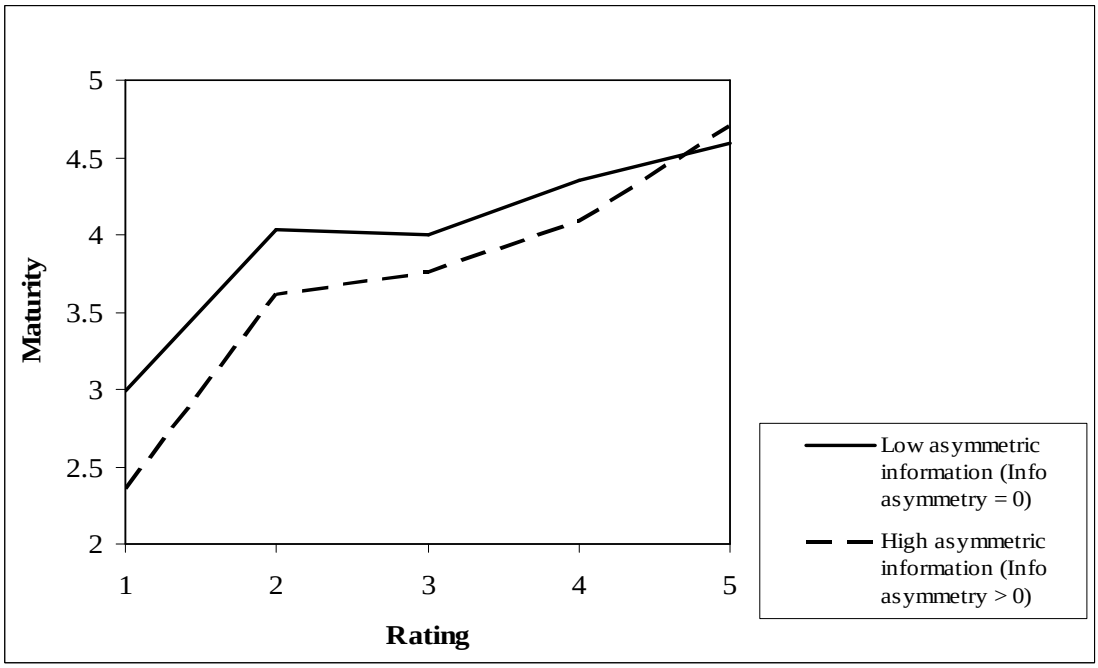


Figure 2 further displays that the risk-maturity relation is stronger in the case of high asymmetric information which confirms that loan maturity is an important contracting device if the risk of adverse selection is prevalent. In case of high asymmetric information, our results are therefore in line with the predictions of Flannery (1986) suggesting that the fear of low-risk borrowers to be pooled together with high-risk borrowers provides them with an incentive to choose short maturities to signal their good quality to the bank.

Moreover, Figure 2 shows that loan maturities are longer if the asymmetric information is low and that the difference in loan maturities between states of high and low asymmetric information decreases with borrower risk. This is in line with the implications of the signaling literature that good borrowers benefit from a reduction in informational asymmetries by longer loan maturities because they need no longer signal their good quality to the bank by choosing short maturities.

Nevertheless, we still observe a significantly positive and monotonic risk-maturity relation under low asymmetric information. This finding can be explained by the assistance-by-relationship-lenders argument implying that relationship lenders may be willing to provide more favorable loan terms to risky borrowers to help them through times of economic problems (e.g. Chemmanur and Fulghieri (1994)). The long maturities which we observe for borrowers that are at the edge of financial distress (rating category 4) or already in default (rating category 5) can be interpreted as preemptive actions or restructuring efforts in that longer maturities eases the repayment pressure for these firms. In that sense, our result for loan maturities is similar to Elsas and Krahnen (1998) who find that borrowers whose credit quality has deteriorated temporarily get more financing (an increase of credit lines) from Hausbanks which is interpreted as evidence for an implicit liquidity insurance. There are at least three main reasons why relationship lenders, as opposed to arm's-length lenders, are able to provide these favorable lending terms to risky borrowers: (i) as informational asymmetries are low banks are better able to assess the success of their restructuring efforts, (ii) banks have tighter control rights such as extraordinary cancellation rights, and (iii) intertemporal and cross-product income smoothing make it possible for banks to help borrowers through difficult times because they may be compensated with future earnings. Finally, this bank behavior implies that loan maturity is *not* used as a (restrictive) covenant to reduce the risk of moral hazard because the latter would result in a negative risk-maturity relation.

To gain deeper insights in the effects of information asymmetries, we extend our analysis and study the risk-maturity relation separately in the three states of very high, medium and low asymmetric information which our additive indicator *Info asymmetry* can take on. The results are reported in columns (3) to (5) in Panel B of Table 6.

Column (3) displays regression results for the case of very high asymmetric information (*Info asymmetry* = 2), i.e. that the borrower has a relatively short *Bank*

relationship and no *Checking account*. There are no loans made to risky borrowers in rating categories 4 and 5 if the extent of asymmetric information is very high. Most borrowers in this group are very likely to be first time borrowers and thus can by definition not be of rating 5.[14] We find that borrowers with rating 2 and 3 have significantly longer maturities than borrowers with rating 1, however, borrowers with *Rating_3* have, on average, shorter maturities than *Rating_2* borrowers but a t-test shows that this difference is not statistically significant. Nevertheless, our findings provide further evidence for the signaling argument with the very good borrowers choosing the shortest maturities.

Turning to the results for the medium state of informational asymmetries (*Info asymmetry* = 1) in column (4), we find a significantly positive, yet not fully monotonic, relation between risk and maturity. The constant which captures the average maturity for the borrowers with rating 1 is substantially larger than in column (3). Taking both findings together implies that signaling plays a less important but still crucial role under medium informational asymmetries. At the same time, the relationship effect is already prevalent with riskier borrowers having longer maturities. Finally, column (5) reveals that there is a positive and monotonic risk-maturity relation under low asymmetric information confirming our previous findings and the conjecture that risky borrowers benefit from relationship lending.

Summarizing, we find evidence for two complementary rationales that both imply a positive risk-maturity relation but in different stages of the bank-borrower relationship. In case of high informational asymmetries, demand-side factors provide an explanation with good borrowers choosing short maturities while supply-side considerations explain the long maturities for risky borrowers in case of low informational asymmetries. To shed more light on the issue of demand vs. supply factors driving the risk-maturity relation we study the impact of borrower bargaining power in the next section.

2.4.3 The impact of borrower bargaining power on the risk-maturity relation

We analyze the influence of borrower bargaining power on the risk-maturity relation in addition to effects arising from asymmetric information. For that purpose we rely on three empirical ex post measures of borrower bargaining power that are

[14] Only 4% of borrowers in the whole sample are in rating category 4 so that it might be just by chance that we do not observe borrowers of rating category 4 in this case.

based on outcomes of the loan contracting process. Analyzing data from one single bank has the advantage that we do not need to deal with heterogeneity in the bargaining behavior between banks.

Our first indicator, *Bargaining power_Spread*, proxies borrower bargaining power by a relatively low loan spread compared to the mean spread in the respective rating category and equals one for 354 loans. Interestingly, the average maturity is 104 months for borrowers with high bargaining power and 59 months for borrowers with low bargaining power. This difference is highly significant (p-val. < 0.01-level, Wilcoxon rank sum test) and rules out that high bargaining power borrowers get lower loan spreads because they demand shorter maturities[15] – on the contrary, we observe longer maturities for these borrowers. Furthermore, the rank correlation between borrower risk and loan maturity is 0.65 for *Bargaining power_Spread* = 0 and 0.18 for *Bargaining power_Spread* = 1, indicating that the positive risk-maturity relation is substantially reduced if borrowers have high bargaining power. We now turn to the multivariate analysis of the impact of bargaining power on the risk-maturity relation. Table 7 summarizes the regression results.

Columns (1) to (4) proxy for borrower bargaining power by a relatively low loan spread compared to the mean spread in the respective rating category (*Bargaining power_Spread*). Columns (1-2) report estimates from a single OLS regression for those loans made under relatively high asymmetric information (*Info asymmetry* > 0) with main effects reported in column (1) and interaction effects with *Bargaining power_Spread* displayed in column (2). The main effects show that there is a significantly positive and monotonic relation between borrower risk and loan maturity when borrower bargaining power is low. The significant effect of *Bargaining power_Spread* indicates that loan maturity is longer for borrowers of rating 1 if borrower bargaining power is high than when it is low. Moreover, we find that the risk-maturity relation is weaker if borrower bargaining power is high because the interaction coefficients in column (2) are significantly negative.

[15] Since the term structure of interest rates in Germany was normal (but relatively flat) in the year 2005, loans with a longer maturity exhibit higher loan rates (risk-free rate plus loan spread) than short-term loans on average.

Table 7. The impact of borrower bargaining power

This table reports results from OLS regression models for subsamples of loans differentiated by borrower bargaining power and the extent of asymmetric information. The dependent variable is the natural logarithm of the loan *Maturity*. Columns (2) and (4) contain coefficients from interactions of the rating dummies with *Bargaining power_Spread* and columns (6) and (8) from interactions of the rating dummies with *Bargaining power_Spread and collateral*. Standard errors are reported in parentheses and account for clustering at the borrower level. All explanatory variables are defined in Table 1. ***, **, * denote significance at the 0.01-, 0.05- and 0.1-level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Bargaining power_Spread				Bargaining power_Spread and collateral			
	High asymmetric information		Low asymmetric information		High asymmetric information		Low asymmetric information	
Coefficients	Main effects	Interactions	Main effects	Interactions	Main effects	Interactions	Main effects	Interactions
Rating_2	1.380***	-1.125***	1.500***	-0.578	1.446***	-1.622***	1.999***	-1.540***
	(0.143)	(0.388)	(0.459)	(0.460)	(0.155)	(0.323)	(0.276)	(0.456)
Rating_3	1.504***	-1.100***	1.687***	-0.792*	1.850***	-2.069***	2.113***	-1.904***
	(0.128)	(0.393)	(0.462)	(0.453)	(0.215)	(0.332)	(0.257)	(0.353)
Rating_4	2.163***	-1.861***	1.355***	-0.115	2.622***		1.743***	-0.808**
	(0.270)	(0.556)	(0.466)	(0.476)	(0.193)		(0.266)	(0.392)
Rating_5	2.341***	-1.150**	2.321***	-0.960*	2.742***	-2.002***	2.654***	-0.912**
	(0.273)	(0.503)	(0.479)	(0.505)	(0.046)	(0.411)	(0.350)	(0.435)
Bargaining power_Spread	1.329***		1.228***					
	(0.367)		(0.426)					
Bargaining power_Spread and collateral					1.855***		1.925***	
					(0.259)		(0.293)	
Young	-0.082		0.272**		-0.070		0.390***	
	(0.105)		(0.107)		(0.074)		(0.145)	
Unlimited liability	0.719***		0.207*		0.709***		0.133	
	(0.113)		(0.118)		(0.117)		(0.160)	
Constant	2.009***		2.185***		1.876***		1.884***	
	(0.182)		(0.453)		(0.137)		(0.262)	
Observations	436		232		236		93	
Adjusted R^2	0.449		0.257		0.646		0.472	

Figure 3A illustrates these findings and provides clear support for a mitigating role of borrower bargaining power on the risk-maturity relation. This confirms the evidence in Uchida (2006) that good borrowers have relatively bigger bargaining power so that they manage to increase their loan maturities more than the riskier borrowers in the case of high borrower bargaining power. Interestingly, these findings also reveal that the good borrowers actually would like to borrow at longer maturities (in a world without asymmetric information) and do so once they have bargaining power.

Figure 3. The impact of borrower bargaining power on the risk-maturity relation

This figure displays the effect of high (*Bargaining power_Spread* = 1) vs. low (*Bargaining power_Spread* = 0) borrower bargaining power on the relation between *Maturity* and the *Rating* dummies for state of high (Figure 3A) vs. low asymmetric information (Figure 3B). See Table 1 for definitions of all variables.

Figure 3A. High asymmetric information

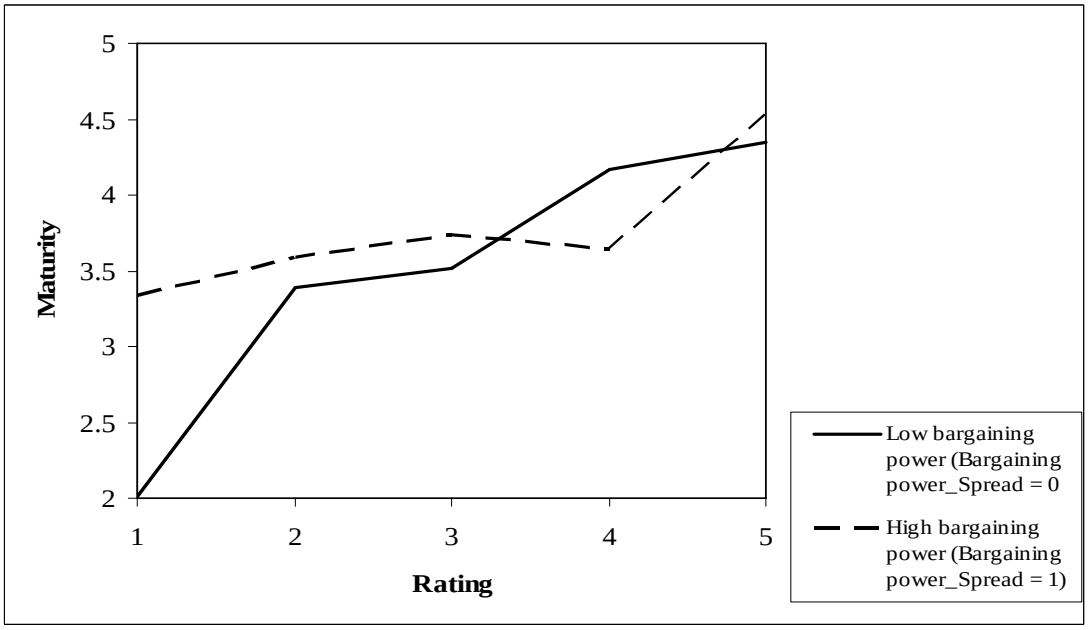
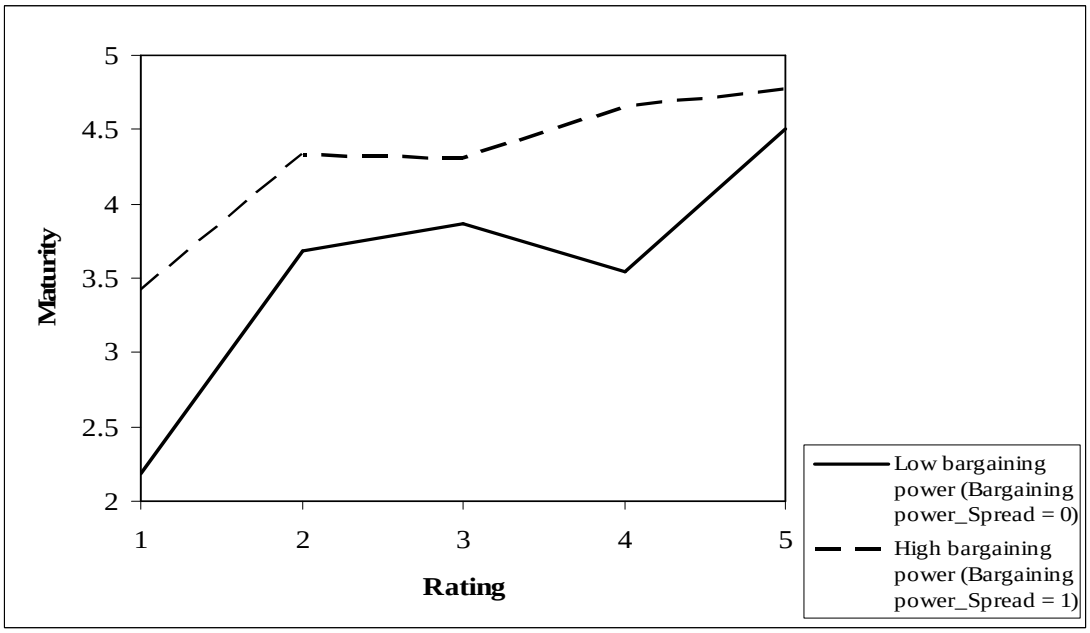


Figure 3B. Low asymmetric information



Columns (3-4) in Table 7 report estimates from a single OLS regression for those loans made under low asymmetric information (*Info asymmetry* = 0) with main effects reported in column (3) and interaction effects with *Bargaining power_Spread* displayed in column (4). In contrast to the case of relatively high asymmetric information we find that all borrowers display an increase in loan maturities leading to an upward shift of the regression line which is illustrated in Figure 3B. However, again the very good borrowers with bargaining power achieve a larger increase in their average loan maturities than the riskiest borrowers with bargaining power.

We conclude that for the case of high information asymmetries we mainly observe a demand-side effect with good borrowers with bargaining power achieving longer maturities because their need for signaling is reduced by their bargaining power. In the case of low asymmetric information, we seem to observe a combination of a demand-side effect with all borrowers with bargaining power achieving longer maturities and a supply-side effect with relationship lenders being actually willing to provide the longest maturities to risky borrowers (with and without bargaining power). Finally, the fact that we still observe good borrowers having shorter maturities than the very risky borrowers even if they have bargaining power may be explained by good borrowers trading-off their wish for longer maturities against the lower costs of shorter-term loans while risky borrowers may not have equivalent room for such choices.

In columns (5) to (8) of Table 7 we use a combined measure of borrower bargaining power (*Bargaining power_Spread and collateral*) to study an extreme case: borrowers with a very strong bargaining power (relatively low loan spread and low collateral, n = 178) versus borrowers with a very weak bargaining power (relatively high loan spreads and high collateral, n = 151), controlling for credit ratings. When studying the two underlying indicators of borrower bargaining power which are based on spread and collateral respectively, we find that the rank correlation between *Bargaining power_Spread* and *Bargaining power_Collateral* is -0.02 which is statistically not different from zero (p-val. = 0.67), i.e. the proxies can be seen as *independent* (both variables exhibit the same value for 329 loans but opposite values for 339 loans). This finding also sheds light on the discussion whether loan spreads and collateral are substitutes or complementary contract terms (see Brick and Palia (2007)). Our data provides evidence that, conditional on the borrower's credit rating, loan spread and collateral are in roughly 50% of all cases substitutes (loans with low spreads display high collateral and vice versa) and in the other 50% complementary, mutually reinforcing contract terms (loans with low spreads display low collateral and loans with high spreads display high collateral). Thus, to proxy borrower bargaining power by the variable *Bargaining power_Spread and collateral* has the advantage that it rules out the possibility that the loan contract terms collateral and spread have been traded-off (i.e. are used as substitutes).

The regression analysis in columns (5-6) and (7-8) leads to qualitatively similar results and confirms the above conclusions.[16]

Summarizing, our analysis of borrower bargaining power in addition to the extent of asymmetric information provides support for the argument that good borrowers have bigger bargaining power than risky borrowers (Uchida (2006); however, bargaining power is measured differently in our study). In addition, our findings imply that borrowers actually would like to borrow at longer maturities and do so when they have the bargaining power but that especially the good borrowers resort to choosing short maturities to convey their good quality to the bank if informational asymmetries are prevalent. Finally, under low asymmetric information risky borrowers benefit from long maturities whether they have bargaining power or not.

[16] Results are somewhat less reliable due to the small number of observations in each single rating category. Furthermore, in the case of high borrower bargaining power and high information asymmetry there are no observations at all with rating 4.

2.4.4 Robustness test

In this section, we briefly summarize results (without tables, detailed results are available from the authors upon request) from (i) an analysis carried out at the borrower level (instead of at the loan level), (ii) the influence of extreme rating categories and (iii) from using a different dependent variable (duration instead of the nominal loan maturity).

First, in all previous regression analyses at the loan level we have controlled for clustering at the borrower level (668 loans from 471 borrowers). We now study the sensitivity of our results by repeating all steps with aggregate variables at the borrower level. The latter are calculated as means and loan amount-weighted means for all variables that refer to the loan level (loan contract terms like maturity, amount, collateral, spread). Essentially, we obtain results that are highly similar to Sections 2.4.1 – 2.4.3 indicating that the correction of standard errors for the clustering of observations on borrowers in the loan-level analysis was adequate.

Second, we test whether our basic results are driven by the extreme rating categories 1 and 5. We start with using rating category 3 (intermediate credit quality) as a reference category for the rating dummy variables and still find a significantly positive and monotonic relation between borrower risk and loan maturity. The only noteworthy difference is that we obtain a non-significant coefficient for rating 2, indicating that loan maturities are not significantly different in rating categories 2 and 3, which is consistent with Section 2.4.1. Then we exclude all observations with rating 1 or 5 and re-estimate our basic regressions on the risk-maturity relation. Again, we find a significantly positive and monotonic risk-maturity relation with rating categories 2 and 3 not being significantly different and rating category 4 showing a significantly longer maturity.

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

2.5 Conclusions

The maturity of corporate debt represents an important contractual element for borrowers and lenders. In this paper, we employ a dataset comprising all loans made to SMEs by a German bank in 2005 and empirically analyze the relation between borrower risk and loan maturity in small business lending. Small business lending provides an especially interesting case compared to lending to large firms because theoretical models on adverse selection are more applicable and borrowing from relationship lenders is more common for SMEs in most countries around the world.

Our analyses reveal a robust, significantly positive and monotonic relation between borrower risk and loan maturity. This positive risk-maturity relation is prevalent in the case of high and in the case of low asymmetric information. Furthermore, we find that loans made under low asymmetric information exhibit longer maturities and the positive risk-maturity relation is weaker for these loans. Thus, to the best of our knowledge, we are the first to provide evidence in favor of two complementary explanations for the positive risk-maturity relation that explicitly account for the environment in which the loan is made. Thereby, we are also able to shed some light on the demand and supply-side factors that drive the loan maturity choice. If informational asymmetries are high, the signaling literature explains borrowers' maturity choices while the view that relationship lenders are willing to provide assistance to their risky borrowers explain the positive risk-maturity relation if informational asymmetries are low.

Furthermore, conditioning our analysis on the impact of borrower bargaining power in addition to the extent of asymmetric information allows us gaining further insights in demand and supply effects that may influence loan contracting and thus the risk-maturity relation. Our results reveal that borrower bargaining power leads to longer average maturities and that the risk-maturity relation is weakened in the presence of borrower bargaining power. The latter effect is especially strong if the extent of asymmetric information is high. These findings provide support for the argument that good borrowers have bigger bargaining power than risky borrowers.

Bringing the various arguments eventually together, our findings imply that borrowers would like to borrow long-term (in a world without asymmetric information) and actually do so if they have bargaining power but that especially the good borrowers resort to (cheaper) short-term loans to convey their good quality to

the bank if informational asymmetries are prevalent. Yet, risky borrowers benefit from their lender's willingness to provide long maturities in the case of low asymmetric information, whether they have bargaining power or not. Consequently, in contrast to arm's-length lending close ties with relationship lenders seem particularly valuable for relatively risky borrowers because the need for favorable lending terms is most urgent for these firms.

On the one hand, our study confirms previous findings of a positive risk-maturity relation and an increase in loan maturities, especially for the good borrowers, when informational asymmetries are reduced (Berger, Espinosa-Vega, Frame and Miller (2005)). It is also in line with the strand of the literature showing that borrowers may benefit from close bank relationships (see Boot (2000) and Degryse, Kim and Ongena (2009) for thorough overviews). On the other hand, it goes beyond previous studies by adding to the question how demand and supply factors drive loan contracting outcomes. Since we do not directly observe demand and supply, this opens up room for future research with more comprehensive datasets that include information on requested and granted loan terms to gain a better understanding of the interaction between the two sides and the role of close bank relationships.

3 Foreign Currency Loans - Demand or Supply Driven?

3.1 Introduction

Firms in emerging markets often borrow in a foreign rather than the domestic currency. Unhedged foreign currency borrowing by the private sector is seen as a major cause of the financial crisis in East Asia in the 1990's (Goldstein and Turner (2002)). Since the outbreak of the current financial crisis there have been strong fears that foreign currency borrowing again jeopardizes financial stability, this time in Emerging Europe. And indeed, financial stability has suffered and has led to repercussions for several Western European banks which dominate lending in many of these countries.

The risks arising from foreign currency borrowing in countries like Poland, Hungary, Romania and Bulgaria are particularly worrying, as these loans are predominantly held by retail clients, i.e. households and small firms. "*The point to grasp about Eastern Europe is that … the debt is plagued by currency mismatches because in recent years households (and to a lesser extent, corporates) have increasingly chosen to borrow in low-interest currencies …it has shades of the Asian tigers back in 1997."* (Financial Times, 29/9/2007).

Existing evidence for the region examines the motivation for firms (Brown, Ongena and Yesin (2009)) and households (Beer, Ongena and Peter (2010)) to *choose* a loan in a foreign rather than the local currency. However, the currency denomination of loans depends not only on the firms' preferred currency, but also on the loan menu which banks *offer* to them. For example if the future value of the domestic currency is unpredictable and banks are risk-averse they may be wary of extending credit, in particular long-term credit, in the local currency (Luca and Petrova (2008)). Banks' supply of foreign currency loans may also depend on their own access to foreign currency refinancing (Basso, Calvo-Gonzales and Jurgilas (2007)). Due to their foreign ownership many banks in Emerging Europe have substantial liabilities in euro. Limited by prudential regulations in their currency exposure, and limited by weakly developed forward markets in instruments to hedge foreign currency positions, banks may lend in foreign currencies to prevent currency mismatches on their own balance sheets (Luca and Petrova (2008), Sorsa, Bakker, Duenwald, Machler and Tiffin (2007)). So far, there exists no empirical evidence that

establishes whether it is the demand or the supply side that actually drives foreign currency lending. Disentangling demand from supply side factors would, however, be crucial to find adequate mechanisms to deal with the risks arising from foreign currency lending.

In this paper we therefore examine how the currency denomination of loans is determined in the negotiation process that takes place between small firms and one retail bank in Bulgaria. Our analysis is based on information for 105,589 business loans granted to over sixty-thousand firms during the period 2003-2007. In contrast to previous studies, we observe not only the currency as stated in the loan contract but also the borrower's requested currency. Thus, we are able to examine to what extent the currency denomination of loans is determined by the demand and / or supply side and which are the driving factors on either side.

In Bulgaria, as in other Eastern European countries, foreign currencies and especially the euro play an important role for domestic financial transactions. On average, in the region 40% of customer deposits are held in foreign currency and 52% of loans are made in foreign currencies with the euro being by far the most important currency (see e.g. European Central Bank (2007)). Bulgaria is representative of this "eurization" of the banking sector with 40% of deposits and 47% of loans denominated in euro.

The bank at the heart of our analysis is focused on retail lending making it an interesting object of study, since especially retail clients seem to have been most involved in foreign currency transactions throughout Eastern Europe. As with the majority of banks in the region, the bank is mainly foreign owned and has substantial wholesale funding in foreign currency. Similar to other retail banks in Bulgaria and the Eastern European region as a whole, loans in foreign currency make up a substantial share (27%) of the bank's portfolio.

In line with theoretical predictions (see e.g. Cowan (2006)), our results show that a firm in our sample is more likely to request a loan in foreign currency (euro) compared to the local currency (Bulgarian lev) if interest rates on foreign currency loans are lower, if the firm has foreign currency income, and if it faces lower distress costs in case of default. We also find that larger firms, older firms and less opaque firms, i.e. those with a longer relationship with the bank are more likely to request a euro loan. We, however, also find that firms which need larger loans, long-term loans and mortgage loans are more likely to request a foreign currency loan. This result

seems to be partly driven by firms anticipating the reluctance of the bank to extend large or long-term loans in local currency. Indeed, an analysis of panel data for repeat clients of the bank suggests that firms learn over time that long-term and mortgage loans are more likely to be granted in foreign currency.

Comparing the requested and granted currencies of loans in our sample we find that almost one-third of the loans disbursed by the bank in foreign currency were initially requested by the firm in local currency. We find that the bank is more likely to grant euro if the firm is of lower observable credit risk and less opaque to the bank. However, we also find that the bank is hesitant to offer large and long-term loans in local currency and is more likely to lend in euro when it has more funding in euro.

In sum, our results show that foreign currency lending is not only driven by borrowers who try to benefit from lower interest rates. We find that a substantial share of foreign currency retail loans in Eastern Europe is supply-driven, with banks hesitant to lend long-term in local currency and eager to match the currency structure of their assets and liabilities.

The rest of the paper is organized as follows. Section 3.2 reviews the existing theoretical and empirical literature. Section 3.3 describes our data while section 3.4 reports results from univariate and multivariate analyses. Section 3.5 concludes.

3.2 Currency Denomination of Firm Debt: Theory and Evidence

In this section we review existing theoretical and empirical studies on the currency denomination of firm debt, establishing the hypotheses for our empirical analysis and clarifying our contribution to the literature.

3.2.1 Theory

Looking at firms' demand for foreign currency loans, Goswami and Shrikhande (2001) show that firms may use foreign currency debt as a hedging instrument for the exchange rate exposure of their revenues.[17] Goswami and Shrikhande (2001) assume

[17] Economic exposure to foreign currency can also be managed with foreign exchange derivatives. See Brown (2001) and Mian (1996) for a broad discussion of the corporate hedging instruments.

that the uncovered interest rate parity holds,[18] and therefore interest rate differentials do not motivate foreign currency borrowing in their model. However, a wide body of evidence suggests that this parity does not hold for many currencies (see e.g. Froot and Thaler (1990) or Isard (2006)). Cowan (2006) and Brown, Ongena and Yesin (2009) consider firms' choices of loan currency in models where the cost of foreign currency debt is lower than the cost of local currency debt. Cowan (2006) shows that firms will be more likely to choose foreign currency debt the higher the interest rate differential, the larger their share of income in foreign currency and the lower their distress costs in case of default. The incentive to take foreign currency loans is weaker when the volatility of the exchange rate is higher, as this increases the default risk on unhedged loans.

Brown, Ongena and Yesin (2009) show that not only firms with foreign currency income, but also firms with high income in local currency (compared to their debt service burden) will be more likely to choose cheaper foreign currency loans, because they are better able to cushion exchange rate movements. Brown, Ongena and Yesin (2009) also examine the impact of bank-firm information asymmetries on loan currency choice.[19] They show that when lenders are imperfectly informed about the currency or level of firm revenue, local currency earners may be more likely to choose foreign currency loans. The reason is that in a pooling "equilibrium" these borrowers are not fully charged for the credit risk involved in taking these unhedged loans.

The supply of foreign currency loans should be higher for firms with lower corresponding credit risk such as firms with income in foreign currency or high income to debt ratios. Following Stiglitz and Weiss (1981) banks may ration foreign currency lending in the face of adverse selection. This could imply that banks supply foreign currency only to clients who are financially transparent and who they know have foreign currency income.

In countries, where forward markets for foreign exchange are not complete, banks may behave averse towards exchange rate exposure on their balance sheet. Luca and

[18] This means that the differences in the nominal interest rates between currencies are cancelled out by the changes in their exchange rate so that the costs of foreign and local currency borrowing are identical.

[19] Banks may not be able to verify the income sources of small, non-incorporated firms which do not keep detailed and audited financial records (Berger and Udell (1998)). This information asymmetry may be particularly pressing in countries with weak corporate governance (Brown, Jappelli and Pagano (2009)) and for foreign banks which have less knowledge about local firms (Detragiache, Tressel and Gupta (2008)).

Petrova (2008) examine a model of credit dollarization in which risk-averse banks and firms choose an optimal portfolio of foreign currency and local currency loans. In line with other portfolio-choice models of foreign currency debt (Ize and Levy-Yeyati (2003)) they predict that banks will offer more foreign currency loans when the volatility of domestic inflation is high and the volatility of the real exchange rate is low. Thus, in countries where the monetary authority has not established a credible reputation for pursuing price stability this could imply that banks prefer to make loans in foreign currency. This tendency may be stronger for long-term loans than for short-term loans as long-term monetary policy may be particularly unpredictable.[20]

Banks are typically limited by prudential regulation in the foreign currency exposure they can take. In a country with underdeveloped derivative markets for foreign currency exchange, as in Bulgaria, this regulation implies that banks' supply of loans in foreign currency will be partly determined by their liabilities in these currencies. Basso, Calvo-Gonzales and Jurgilas (2007) suggest that banks' supply of foreign currency loans will depend on their access to foreign currency debt through financial markets or from parent-banks abroad. Similarly, Luca and Petrova (2008) suggest that increases in banks' access to foreign currency deposits will lead them to offer more foreign currency loans.[21]

Summarizing the theoretical predictions regarding the supply and demand of foreign currency loans, we expect both demand and supply to be higher for firms with foreign currency income and high income in local currency (compared to their debt service burden). Information asymmetries about a firm's income structure may increase foreign currency loan demand but could also reduce its supply. Demand for foreign currency loans should be higher for firms with lower distress costs in case of default. Lenders should be more willing to offer foreign currency loans when they have increased access to foreign currency liabilities in the form of wholesale funds or customer deposits. At the macroeconomic level, firms will be more likely to request foreign currency loans if the interest rate differential between local currency and foreign currency credit is high and the volatility of the exchange rate is low. Low

[20] Note that this argument is not identical to that in the "original sin" literature (Eichengreen and Hausman (1999), Hausmann and Panizza (2003)), where it is argued that countries cannot finance themselves long-term in local currency because of moral hazard, i.e. they have the possibility to affect the value of their own currency.

[21] For a discussion of deposit dollarization see De Nicoló, Honohan and Ize (2005).

credibility of domestic monetary policy may make banks reluctant to lend in local currency, especially at longer maturities.

3.2.2 Empirical evidence

Several recent studies examine *aggregate dollarization of credit* in developing and transition countries. Most recently, Luca and Petrova (2008) analyze the aggregate share of foreign currency loans for 21 transition countries of Eastern Europe and the former Soviet Union between 1990 and 2003. They find that the aggregate share of foreign currency loans is positively related to aggregate export activity, interest rate differentials, domestic monetary volatility and deposit dollarization, while it is negatively related to the volatility of the exchange rate. They also find that dollarization is lower in countries with more developed foreign exchange markets, and that credit dollarization is affected by prudential regulations which stipulate tighter open position limits.

Basso, Calvo-Gonzales and Jurgilas (2007) examine aggregate credit dollarization for 24 transition countries for the period 2000 – 2006. They find that countries in which banks have a higher share of foreign funding display a higher share of loans in foreign currency. Earlier work by Arteta (2005) on a broad sample of low-income countries as well as Barajas and Morales (2003) on Latin America confirm the hypothesis that higher exchange rate volatility reduces aggregate credit dollarization.

Most firm-level studies focus on the *currency denomination of debt for large firms*, using financial statement data. Kedia and Mozumdar (2003) find that large US corporations match loan currencies to those of their sales confirming the results in Keloharju and Niskanen (2001) for large Finnish corporations. Martínez and Werner (2002) and Gelos (2003) show that large Mexican firms which export, and thus earn foreign currency income, use foreign currency loans as a natural hedge to economic exposure. Benavente, Johnson and Morande (2003) as well as Cowan, Hansen and Herrera (2005) find a similar result for Chilean firms. Interest rate differentials as well as asset type are found to explain the use of foreign currency debt in East-Asian corporations (Allayannis, Brown and Klapper (2003)) as well as in large Latin American firms (Cowan (2006)).

To our knowledge there is only one paper to date which studies loan currency denomination using *loan-level data*. Brown, Ongena and Yesin (2009) examine the

currency denomination of the most recent loan received by 3,105 small firms in 24 transition countries based on responses to the 2005 EBRD *Business Environment and Enterprise Performance Survey*. At the firm level they find strong evidence that the choice of a foreign currency loan is related to foreign currency cash flow. In contrast, they find only weak evidence that foreign currency borrowing is affected by the distress costs firms face in case of default or by their financial opaqueness. At the macroeconomic level the authors find no evidence that interest rate differentials and exchange rate volatility explain differences in foreign currency borrowing in their sample.

In contrast to existing studies, our data allows us to examine to what extent the currency denomination of a loan is determined by the clients and / or the bank. As we observe not only the currency denomination of the actual loan extended, but also the firms' currency requests, we are able to identify how clients' demand for foreign currency loans and the bank's supply of such loans are related to firm characteristics, other loan characteristics, macroeconomic conditions and the bank's liability structure. Finally, our dataset allows us to examine the factors that influence the bank's decision to alter a borrower's currency request gaining insights into the bank's weighing of taking on currency vs. credit risks.

3.3 Data and Methodology

3.3.1 The dataset

Our dataset covers all annuity loans, credit lines and overdrafts extended to firms by one Bulgarian bank (henceforth called "the Bank") between April 2003 and September 2007.

Table 8. Variable definitions and data sources

Variable	Definition	Source
Dependent variables		
EUR requested	Firm requested EUR loan (1=yes, 0=no)	Bank
EUR granted	Bank granted EUR loan (1=yes, 0=no)	Bank
Firm characteristics (at loan disbursement date)		
EUR account	Firm holds EUR savings or term account (1=yes, 0=no)	Bank
Disposable income	Total disposable income per month (log EUR)	Bank
Leverage	Total debt as share of total assets of firm (%)	Bank
Sole proprietorship	Firm is sole proprietorship (1=yes, 0=no)	Bank
Bank relationship	Time since first contact between bank and client (log months)	
Assets	Total assets of firm (log EUR)	Bank
Age	Firm age (log years)	Bank
Industry	Industry dummies which are one if firm belongs to one of the following sectors: Construction, Manufacturing, Trade, Transport, Tourism, Other services. Baseline industry is Agriculture	Bank
Loan characteristics		
Requested amount	Requested loan amount (log EUR)	Bank
Requested maturity	Requested loan maturity (log months)	Bank
Mortgage loan	Loan is a mortgage loan (1=yes, 0=no)	Bank
Amount	Granted loan amount (log EUR)	Bank
Maturity	Granted loan maturity (log months)	Bank
Annuity loan	Loan is an annuity loan vs. credit line or overdraft (1=annuity, 0=credit line or overdraft)	Bank
Interest rate	Interest rate per annum (%)	Bank
Later loan	Loan is non-initial loan for repeat clients (1=yes, 0=no)	Bank
Branch	Branch dummies which equal 1 for the branch that granted the loan	Bank
Macroeconomic conditions (in month of loan disbursement)		
Interest differential	Household deposit rate (12-24 months) in BGN minus rate in EUR (%)	BNB
Spread differential	Intermeditaion spread (short-term lending rate minus household deposit rate) in EUR minus spread in BGN (%)	BNB
EU announcement	Loan was extended after the official announcement (26 September 2006) that Bulgaria would definitively join the EU in January 2007 (1=yes, 0=no)	Bank
Inflation volatility	Variance of monthly changes in the consumer price index over 12 months prior to beginning of the quarter in which loan is disbursed (%)	IFS
Aggregate FX loans	Share of foreign currency loans to corporations in total banking system	BNB
Bank funding (at end of month prior to loan disbursement)		
EUR wholesale funding	EUR non-customer funding as share of bank's total liabilities	Bank
EUR customer funding	EUR customer funding (deposits) as share of bank's total liabilities	Bank

Sources: IFS: International Financial Statistics of the International Monetary Fund. BNB: Bulgarian National Bank.

In total the Bank extended 106,091 loans during this period. For each disbursed loan we have information on the loan conditions requested by the firm, the actual loan conditions granted, as well as firm characteristics at the time of the loan disbursement. Crucially for our analysis we know whether the loan was requested

and/or granted in Bulgarian lev (henceforth we use the currency's ISO 4217 alphabetic code, i.e. BGN) or euro (henceforth EUR). We exclude all observations with missing loan-level or firm-level data leaving us with 105,589 loans to 61,494 different firms. Our dataset also includes monthly indicators of the Bank's liability structure as well as indicators of macroeconomic conditions obtained from the Bulgarian National Bank (BNB) and the International Monetary Fund (IMF). Definitions and sources of all variables are provided in Table 8.

The Bank is a nationwide bank which focuses on lending to small and medium enterprises. Compared to the aggregate banking system, where only 41% of assets are loans to enterprises, 70% of the assets at the Bank are enterprise loans. The volume of outstanding enterprise loans in foreign currency at the Bank equals approximately 40% and hence is similar to that of many retail banks in Central and Eastern Europe. As with the majority of banks in Bulgaria and the rest of the region, foreign strategic investors hold a controlling share in the Bank.[22]

3.3.2 The Bank's lending technology and loan portfolio

At the heart of the Bank's lending technology is a personnel-intensive analysis of the borrower's debt capacity.[23] A prospective borrower first meets a client advisor who assesses whether the borrower meets the Bank's basic requirements. If this is the case, the client fills in a loan application form. On this form the client indicates her preferred loan amount, maturity and *currency* as well as the purpose of the loan. The client also has to provide information about the firm ownership, other bank relations and the free cash flow available 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.[24] At the same time, the loan officer conducts a financial analysis of the firm including a personal visit to the firm to confirm its financial situation. The loan officer presents the customer's demand and the suggested loan terms together with the information gathered during the financial analysis to the Bank's credit committee, which then makes the final

[22] In 2007 82% of bank assets in Bulgaria were in the hands of institutions with majority foreign ownership. In Central and Eastern Europe the average share of foreign bank assets in 2007 was 80%.
[23] To gain insights into the usual loan granting process, we have conducted informal interviews with loan officers and training staff from the Bank's head office.
[24] Enterprise loans in Bulgaria are covered both by the public credit registry and a private credit bureau (see www.doingbusiness.org).

decision on the loan terms granted. Since the borrower's repayment capacity is the core figure in the analysis, loan size (amount and *currency*) and maturity are determined first.

The setting of interest rates and collateral requirements depends on the loan size. For small loans (up to 50,000 EUR) collateral requirements and interest rates are standardized, i.e. not negotiated on an individual basis. For medium-sized loans (above 50,000 EUR) interest rates and collateral requirements are negotiated individually. Given the different lending technologies applied to small versus medium loans we treat these two loan types separately throughout our analysis.

Table 9. Loan disbursements

This table displays statistics on the bank's loan portfolio. Results are provided for the full sample and the following subsamples: *Small loans*: Loans with an amount up to 50,000 EUR. *Medium loans*: Loans with an amount over 50,000 EUR. *Repeat clients*: Loans disbursed to firms that take out more than one loan from the bank during the observation period.

Panel A. Number of loans disbursed

	Full sample	Small loans	Medium loans	Repeat clients
2003	10,780	10,564	216	7,571
2004	18,643	18,261	373	14,296
2005	23,243	22,706	537	17,759
2006	28,269	27,670	599	18,642
2007	24,663	24,160	503	11,025
Total	105,589	103,361	2,228	69,293

Panel B. Volume of loans disbursed (in million EUR)

	Full sample	Small loans	Medium loans	Repeat clients
2003	69	43	26	49
2004	123	78	46	96
2005	189	121	67	145
2006	222	153	69	161
2007	213	153	60	118
Total	816	547	269	569

Table 9. cont.

Panel C. Share of loan volume disbursed in EUR (%)

	Full sample	Small loans	Medium loans	Repeat clients
2003	44.0	23.8	76.9	44.7
2004	42.2	21.1	78.3	42.0
2005	37.6	16.3	76.0	36.9
2006	34.3	15.4	75.8	37.4
2007	33.6	19.0	70.7	42.4
Total	36.9	18.1	75.2	39.7

Table 9 provides an overview of the Bank's lending activities during our observation period. Panel A and B display the number and volume of disbursed loans by year. The overwhelming number of loans in our sample (98%) are small loans, i.e. loans with an amount less than 50,000 EUR. However, considering the volume of lending, medium loans (33%) are of sizeable importance in the Bank's loan portfolio. Panel A shows that almost two-thirds of the Bank's loans are disbursed to repeat clients, i.e. borrowers who take out more than one loan during our observation period. The subsample of loans to *repeat clients* will be important throughout our empirical exercise as it allows us to control for unobserved (time-invariant) firm-level characteristics.

Panel C of Table 9 shows that a substantial share of the Bank's lending is in foreign currency rather than in BGN. Loans denominated in EUR account for 37% of the loan volume disbursed during our observation period.[25] This share decreased considerably between 2003 and 2007, but even at the end of our observation period one-third of the disbursed loan volume was in EUR. Panel C further reveals that the share of EUR loans varies substantially by loan size. EUR loans make up a moderate share of small loans, whereas they dominate medium-sized loans.

As we have information on the firms' requested currency as well as the actual currency of the loan granted, we are able to establish if the requested currency coincides with the granted currency, and how often the Bank changes the loan currency. Figure 4 shows that overall 32% of the loans (23% of the loan volume) disbursed in EUR were loans initially requested in BGN by the borrower. Looking at it from the borrowers' side, 12% of the loan volume which was requested in local currency (69 Mio EUR out of 578 Mio EUR) was actually disbursed in foreign

[25] We focus our analysis on foreign currency loans denominated EUR, since they account for 97.5% of the bank's total foreign currency lending.

currency. This finding already suggests that a substantial share of foreign currency lending by the Bank is not demand, but supply driven. By contrast, we find that a negligible share of the number and volume of loans disbursed in local currency were requested in foreign currency.

Figure 4. Requested vs. granted loan currency

This figure displays share of requested and granted loan currencies in number of loans and volume of loans disbursed.

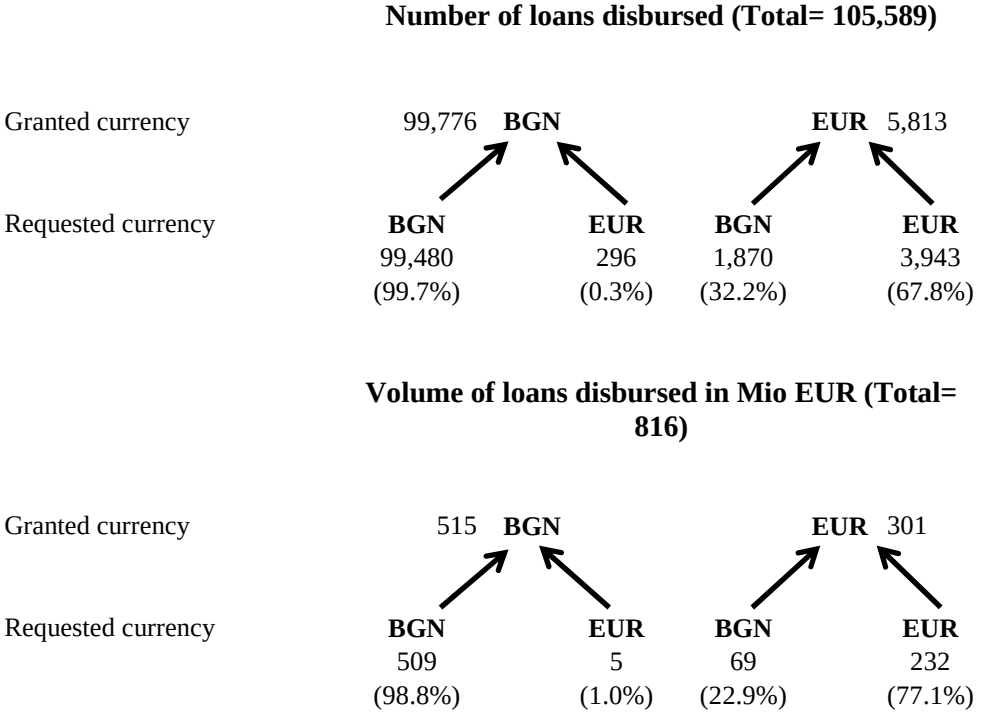


Figure 5 shows that the propensity of firms to request and of the Bank to grant EUR loans is strongly related to requested loan size and maturity. The analysis by requested amount in Figure 5A reveals that the share of loans which is requested and granted in EUR actually increases steadily with requested loan size. As this share is very low for loans with requested amounts of up to 5,000 EUR but more than half of the loans fall within this category, we will conduct all our regression analyses not only for the full sample but also for the subsample of loans with requested amounts of more than 5,000 EUR to make sure that our results are not mainly driven by these very small loans. Interestingly, the share of loans requested and granted in EUR is very low for loans with requested maturities of up to 60 months and then increases rapidly. This may be explained by the fact that the housing market in Bulgaria and therefore mortgage loans are predominantly denominated in EUR. We will consider

this in our regression analysis and separately study the subsample of non-mortgage loans.

Figure 5. Requested and granted currency by loan size and maturity

Figure 5A. Share of loans requested and granted in EUR

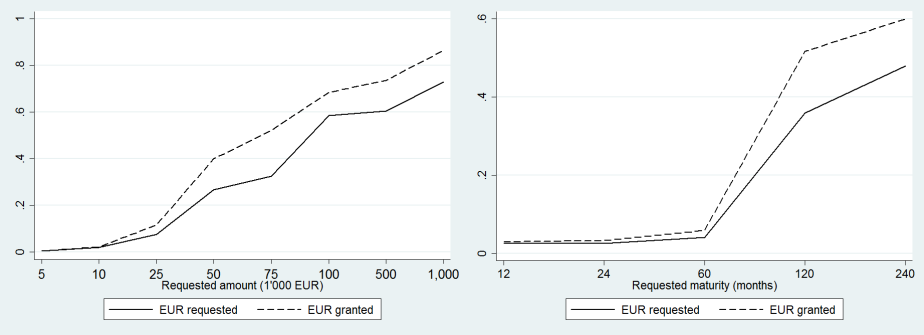


Figure 5B. Probability of being granted EUR

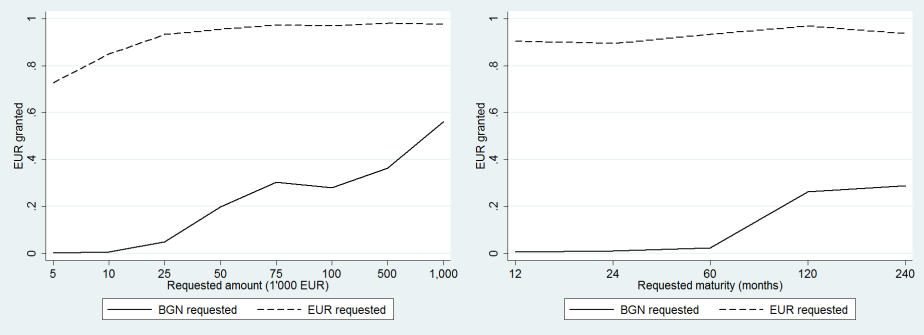


Figure 5B displays the probability of a firm receiving a loan in EUR conditional on its requested currency, loan size and maturity. The figure shows that the probability to receive a EUR loan after requesting a BGN loan increases steadily with the requested loan size and sharply when the requested maturity exceeds 60 months. By contrast, independent of their requested loan size or maturity, loans requested in EUR are almost exclusively granted in EUR. Only for the very small loans this share is below 90%. The supply analysis will therefore mainly deal with the factors that affect the Bank's decision to switch a request for local currency into EUR.

3.3.3 The firms' choice of loan currency

We first examine a model in which the dependent variable Pr(*EUR requested*)$_{i,k,t}$ is the probability that a firm *i* that is taking out a loan *k* in period *t* requests a EUR loan:

$$\Pr(\textit{EUR requested})_{i,k,t} = \alpha + \beta_1 F_{i,t} + \beta_2 L_k + \beta_3 M_t + \varepsilon_{i,k,t} \quad (3)$$

In this model $F_{i,t}$ and L_k are vectors of firm characteristics and other requested loan characteristics while M_t is a vector of the macroeconomic conditions at the time of loan disbursement.

Firm characteristics

Based on the theory reviewed in section 3.2.1 we expect that firms with revenue in foreign currency, higher income levels (and thus ceteris paribus higher income to debt service ratios), low distress costs as well as financially opaque firms will be more likely to demand foreign currency loans. As we lack information on the currency of firms' income, our proxy for foreign currency revenue is the dummy variable *EUR account* which equals one if the firm has a savings or term account in EUR at the disbursement date of the loan, and equals zero otherwise. Our proxy for the firm's income level is the variable *Disposable income* which measures the firm's monthly free cash flow (in log EUR) at loan disbursement. We include two indictors of firm-level distress costs. Our first indicator is *Leverage*, which measures the firm's total liabilities as a share of its total assets. Being highly levered increases the likelihood to default which, in turn, leads to higher costs since it is very costly for firms to obtain emergency financing when facing default. Our second indicator of a firm's distress costs is *Sole proprietorship*, which equals one if the firm is a sole proprietorship and zero otherwise, because firms in which the owners have higher private values of continuing their business face higher distress costs in the case of default (Froot, Scharfstein and Stein (1993)).

We include one indicator for the degree of information asymmetry between the firm and the Bank. The variable *Bank relationship* measures the length of the bank-borrower relationship in months since their first contact. We expect that the Bank can gain private information about the firm's revenue potential by observing the firm's past repayment behavior or it's usage of other bank products.

As larger and older firms are more likely to have export income, less likely to default due to a given foreign currency loan and more likely to be financially transparent than smaller and younger firms, we include the log of total firm *Assets* (measured in EUR) as well as firm *Age* (log of age in years) as firm-level control variables.

To capture remaining differences in firm characteristics our regressions contain seven *Industry dummies*, which indicate the industry of the firms' main activity, and 33 *Branch dummies* which capture the location of the branch where the firm applied for the loan. In particular, the industry and branch dummies control for potential foreign currency earnings since foreign currency income is more likely in certain industries (e. g. trade, tourism or transport) and locations[26] (trade and tourist centers such as Sofia or Varna).

Other loan terms

Other requested loan terms, such as loan size and loan maturity may affect the firms' currency request in both directions. As argued by Brown, Ongena and Yesin (2009) firms with higher income-to-debt ratios are less likely to risk default due to exchange rate changes. Thus firms with larger loans and shorter maturities (and therefore ceteris paribus higher installments and lower income-to-debt ratios) may be less likely to borrow in foreign currency. However, firms with larger loans might also be more likely to borrow in foreign currency since the absolute interest rate advantage of borrowing in foreign currency is higher for larger loans. Similarly, the risk of experiencing sharp exchange rate fluctuations may be lower for shorter loans, suggesting that firms with shorter loans might as well be more likely to borrow in foreign currency. To control for these effects we include *Requested amount* and *Requested maturity* which measure the log of the requested loan amount (measured in EUR) and the log of the requested loan maturity (in months) respectively.

The dummy variable *Mortgage loan* equals one if the loan is collateralized by a mortgage, and equals zero otherwise. Since the underlying property may be liquidated in case of default, distress costs for firms (e.g. the volume of required emergency funding) may be lower for these loans. Moreover, as the Bulgarian real

[26] As we do not have information on the location of the firm we use the available information on branch location. Since decision rules and loan procedures as well as the applied credit technology are the same in all branches and all bank staff is trained accordingly, we do not expect these factors to vary considerably across branches.

estate market is mainly denominated in EUR, firms should be more likely to request loans that finance real estate in EUR.

Macroeconomic conditions

Based on existing theory we expect that firms are more likely to request foreign currency loans if the interest rate differential on foreign currency loans is high and the expected exchange rate volatility is low. In our analysis of firms' currency choices we control for the prevailing monetary conditions at the time of loan disbursement[27] with three indicators based on data obtained from the Bulgarian National Bank and the International Monetary Fund.

For each month during our observation period we calculate the *Interest differential* by subtracting the (12-24 month) household deposit rate in EUR from the deposit rate in BGN. We use this deposit based measure of interest rate differentials rather than a measure based on interbank rates because the interbank market plays a minor role in funding banks in Bulgaria.[28] Our measure of expected exchange rate volatility is the dummy variable *EU announcement* which is one for all loans disbursed after the announcement (on 26 September 2006) that Bulgaria would definitely join the EU in January 2007. As a new accession country to the EU, Bulgaria was from that date on committed to joining the euro zone at some future date, which may have lowered expected exchange rate volatility.[29]

Furthermore, we expect that (risk-averse) firms are more likely to request foreign currency loans if domestic inflation volatility is high (see Ize and Levy-Yeyati (2003)).We measure *Inflation volatility* as the variance of monthly changes in the consumer price index over the twelve months prior to the month in which the loan was disbursed. Finally, we expect that the demand for foreign currency loans at the

[27] The firm's request for a loan and thus the currency choice is naturally prior to the date of loan disbursement. Since the Bank's loan granting procedure is well established and clear-cut, the time span between loan application and disbursement is normally short and macroeconomic conditions should not have changed considerably in the meantime.

[28] Note that this measure of the interest differential captures the interest advantage over time to account for the fact that not only its magnitude at the time of loan disbursement is important but also its development over time.

[29] Bulgaria introduced a currency board in July 1997 which fixed the exchange rate towards the EUR. This currency board held throughout our observation period, so that there was almost no actual exchange rate volatility. However, this by no means implies that firms or banks in Bulgaria were confident that a depreciation of the BGN would not happen. Indeed, Carlson and Valev (2008) report survey evidence suggesting that in 2004 14% of the Bulgarians believed the currency board might collapse with a sharp devaluation within the next twelve months. Considering a period of five years more than 25% of respondents expected the currency board to collapse with a sharp devaluation.

Bank may depend on the possibilities of firms getting similar loans at other banks. We control for the firms' possibilities to obtain foreign currency loans from alternative providers with the variable *Aggregate FX loans* which measures in each month the share of corporate loans in the entire Bulgarian banking system which are denominated in foreign currency.

3.3.4 The Bank's choice of loan currency

Our dependent variable $\Pr(\textit{EUR granted})_{i,k,t}$ is the probability that the Bank grants a loan *k* to firm *i* in period *t* in EUR rather than BGN. In our empirical model the vectors L_k, $F_{i,t}$ and M_t again include firm and loan characteristics as well as indicators of macroeconomic conditions, while the vector B_t captures indicators of the Bank's funding structure at the time when a loan is disbursed.

$$\Pr(\textit{EUR granted})_{i,k,t} = \alpha + \beta_1 F_{i,t} + \beta_2 L_k + \beta_3 M_t + \beta_4 B_t + \varepsilon_{i,k,t} \qquad (4)$$

As discussed in section 3.2.1, the Bank's decision to grant a loan in local or foreign currency will depend on the expected credit risk for either type of loan. We use our above mentioned indicators *EUR account*, *Disposable income*, *Leverage*, *Sole proprietorship*, *Bank relationship*, *Assets*, *Age*, *Mortgage loan* as well as the *Industry dummies* and *Branch dummies* to control for observable firm-level credit risk.

Existing theory predicts that banks will offer more foreign currency loans when the volatility of the real exchange rate is low and the volatility of domestic inflation is high. To capture this we include the variables *EU announcement* and *Inflation volatility*. If banks do mistrust domestic monetary policy they will be more hesitant to grant large and especially long-term loans in local currency. We therefore include the requested loan terms (*Requested amount*, *Requested maturity*) as explanatory variables in our supply regression.[30]

We expect increased access to foreign currency funding to lead to more foreign currency loans. To control for the level and the potential composition effect of the Bank's foreign currency liabilities, we introduce two bank funding variables. *EUR*

[30] As described in section 3.3.2, the Bank's currency decision is jointly determined with the loan amount and loan maturity. To circumvent the endogeneity of the loan currency to the granted loan amount and loan maturity we use the predetermined requested loan size and maturity.

wholesale funding measures the Bank's funding sourced from financial institutions or capital markets denominated in EUR as a share of its total liabilities. *EUR customer funding* measures the Banks' funding obtained from customer deposits denominated in EUR as a share of its total liabilities. Both indicators of the Bank's funding structure are calculated using balance sheet information from the month prior to a loan disbursement.

The Bank's currency decision should further depend on the macroeconomic conditions at the time of loan disbursement. We therefore include the variable *Spread differential* which measures the difference between the intermediation spread in EUR and BGN to control for the mark-up it can earn by lending in either currency. The intermediation spreads are calculated as the short-term lending rates minus the household term deposit rates in EUR or BGN respectively. Finally, we include the variable *Aggregate FX loans*, which captures the share of foreign currency loans to corporate borrowers in the entire banking system as a measure of the competition the Bank faces in the foreign currency loan market. All variables are calculated with values from in the month of the loan disbursement

3.3.5 Summary statistics

Table 10 provides summary statistics for our explanatory variables. The table shows that firms in our sample are predominantly sole proprietorships with mean assets of less than 60,000 EUR and an average age of less than ten years. The loans they receive are on average smaller than 10,000 EUR, with no loan in the sample exceeding 1 million EUR. The average loan maturity is less than three years, while the maximum maturity is twenty years.

The summary statistics for the macroeconomic conditions show that the *Interest differential* was positive throughout our observation period confirming that firms did have a cost-incentive to demand EUR loans. The *Spread differential* between EUR and BGN funds ranged from -2.4% to 2.1% during our observation period suggesting no clear pattern which currency was more profitable for banks. The variables *EUR wholesale funding* and *EUR customer funding* show that a substantial share of the Bank's funding is in foreign currency. Not surprising for a bank with a strategic foreign investor, wholesale funding in EUR is twice as important as retail funding in EUR.

Table 10. Descriptive statistics

This table reports summary statistics for all explanatory variables. See Table 8 for definitions and sources of the variables. For all log-transformed variables the statistics are calculated by using the original values.

	N	Mean	Minimum	Maximum
Firm characteristics				
EUR account	105,589	0.01	0	1
Disposable income	105,589	850	0	1,154,455
Leverage	105,589	0.15	0	1
Sole proprietorship	105,589	0.90	0	1
Bank relationship	105,589	9.86	0	71
Assets	105,589	57,528	2	12,835,983
Age	105,589	8.45	0	107
Loan characteristics				
Requested amount	105,589	8,671	51	1,700,000
Requested maturity	105,589	32	1	240
Mortgage loan	105,589	0.09	0	1
Amount	105,589	7,727	61	1,000,000
Maturity	105,589	27.77	1	240
Annuity loan	105,589	0.74	0	1
Interest rate	105,589	14.66	5.75	19.88
Macroeconomic conditions				
Interest differential	54	1.36	0.36	3.22
EU announcement	54	0.22	0	1
Inflation volatility	54	0.98	0.45	1.71
Spread differential	54	-0.36	-2.40	2.08
Aggregate FX loans	54	0.63	0.54	0.68
Bank funding				
EUR wholesale funding	54	0.26	0.12	0.35
EUR customer funding	54	0.13	0.04	0.24

3.4 Results

3.4.1 Univariate tests

The characteristics of those firms which request local currency loans differ strongly from those which request foreign currency loans. Columns (1) and (2) of Table 11 display sample means by requested currency, while column (3) displays results of difference tests between the two sub-samples for each variable. The table supports the hypothesis that firms which request foreign currency loans are more likely to have foreign currency income (*EUR account*) and face lower distress costs in case they default (not *Sole proprietorship).* We also find that firms which request EUR loans have higher income (*Disposable income*), are more transparent towards the bank (*Bank relationship*), and are larger (*Assets*) and older (*Age*).

Firms which request EUR loans also differ from firms requesting BGN loans concerning other loan terms. They request larger loans (*Requested amount*), longer-term loans (*Requested maturity*) and are more likely to request a *Mortgage loan*. These findings suggest that absolute interest rate advantages (on large loans) and the anticipation of the Bank's reluctance to provide long-term loans in local currency may be driving requested loan currency.

Table 11. Univariate tests

This table reports univariate tests for our explanatory variables. Columns (1,2,4,5,7,8) report subsample means fore each variable. For all log-transformed variables the statistics are calculated by using the original values. Columns (3,6,9) report the results of two-sided t-tests. ***, **, and * indicate significance at the 0.01, 0.05, and 0.10-level. See Table 8 for definitions and sources of all variables.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Requested currency	BGN	EUR		BGN			EUR		
Granted currency				BGN	EUR		BGN	EUR	
Observations	101,350	4,239		99,480	1,870		296	3,943	
Firm characteristics									
EUR account	0.01	0.02	***	0.01	0.02	***	0.02	0.02	
Disposable income	688	4,720	***	647	2,854	***	2,284	4,903	*
Leverage	0.15	0.22	***	0.14	0.22	***	0.19	0.22	***
Sole proprietorship	0.91	0.46	***	0.92	0.54	***	0.65	0.44	***
Bank relationship	9.55	17.22	***	9.47	14.20	***	13.77	17.48	***
Assets	43,579	390,439	***	40,196	223,398	***	193,155	405,268	***
Age	8.41	9.19	***	8.40	8.97	***	8.80	9.21	
Loan application									
Requested amount	6,318	64,929	***	5,699	39,261	***	27,896	67,709	***
Requested maturity	31.08	50.94	***	30.64	54.40	***	39.96	51.76	***
Mortgage loan	0.07	0.68	***	0.06	0.54	***	0.27	0.71	***
Macroeconomic conditions									
Interest differential	1.25	1.28	***	1.25	1.25		1.17	1.29	***
EU announcement	0.31	0.26	***	0.31	0.59	***	0.31	0.26	*
Inflation volatility	0.93	0.94	**	0.93	0.90	***	0.93	0.94	
Spread differential	-0.24	-0.28	***	-0.24	0.04	***	-0.24	-0.28	
Aggregate FX loans	0.63	0.63	***	0.63	0.64	***	0.64	0.63	
Bank funding									
EUR wholesale funding	0.25	0.26	***	0.25	0.22	***	0.25	0.26	*
EUR customer funding	0.15	0.14	***	0.15	0.17	***	0.15	0.14	**

At the macroeconomic level we find that firms are more likely to request EUR loans when the *Interest differential* is higher. Surprisingly, we find that firms are less likely to request EUR loans after the *EU announcement*, suggesting that this announcement may have not only reduced expected exchange rate volatility, but also increased the credibility of future domestic monetary policy. Finally, we find that the

Bank's liability structure (*EUR wholesale funding*, *EUR customer funding*) has very little impact on the firms' currency requests. This supports our model building above where we include proxies for the Bank's refinancing structure to explain the foreign currency choice only on the supply side.

In Table 11 we also report univariate tests comparing those firms which were *granted* foreign currency loans to those which were granted BGN loans. Columns (4-6) present statistics and tests for loans requested in BGN, while columns (7-9) present statistics and tests for loans requested in EUR.

From columns (4-6) we see that the Bank's decision to alter the loan currency from BGN to EUR seems to be correlated with lower observable credit risk and greater financial transparency of the firm (*EUR account*, *Disposable income*, *Bank relationship*, *Assets*, *Age*). However, we also see that in those instances where the Bank altered the currency from BGN to EUR, the requested loan amount and maturity are higher than in those cases where BGN was granted. While the first observation (larger requested amount) may be in line with the firms' objective of achieving greater (absolute) interest savings, the longer maturity for loans switched to EUR suggests that the Bank may be shifting exchange rate risk to its clients.

Comparing the macroeconomic conditions and bank-funding at the time when loans are disbursed, we find that the Bank is more likely to switch a loan from BGN to EUR after the *EU announcement* and when the *Spread differential*, i.e. its earnings on intermediating EUR funds, is higher. Moreover, we find that the Bank is more likely to switch a loan from BGN to EUR in periods where it has more funding in EUR from depositors *(EUR customer funding*) and less EUR financing from financial institutions or the capital market (*EUR wholesale funding*).

For firms which request EUR, columns (7-9) of Table 11 show that firms which are switched to BGN can be characterized by higher credit risk and lower financial transparency. These firms are smaller, have less disposable income, are more often sole proprietorships and have shorter relationships with the Bank than firms who requested and received EUR. Confirming our findings above, in cases where the Bank alters loan currency from EUR to BGN the requested loan size is smaller and the requested maturity is shorter.

3.4.2 Multivariate regressions: The firms' choice of loan currency

Table 12 displays our regression results for firms' decisions to request foreign currency (EUR) rather than local currency (BGN) loans based on estimations for both the full sample and the panel of repeat clients. All estimations include industry and branch dummies. Standard errors are presented in brackets and for regressions with the full sample are adjusted for clustering at the industry-branch level. Estimations for repeat clients include firm-level random effects to account for unobserved firm heterogeneity.[31]

Full sample effects of firm-, loan- and macroeconomic variables

Column (1) of Table 12 presents marginal effects from a logit estimation for the full sample. The results confirm our main hypotheses: firms are more likely to request EUR loans if the interest rate advantage on EUR loans is higher, if they have foreign income, and if they have lower distress costs.

The request for a foreign currency loan is positively related to our indicator of foreign currency revenue, *EUR account*. Also, the impact of firm-level distress costs is in line with theoretical predictions. Firms with higher potential distress cost (higher *Leverage*, *Sole proprietorship*) are less likely to demand EUR loans. Further supporting this result we find that larger firms (higher *Assets*) are more likely to demand foreign currency loans.

Contrary to our expectations, firms with higher debt-service to income ratios (lower *Disposable income* and higher *Requested amount*) are more likely to demand foreign currency loans. An explanation for this result could be that firms with lower disposable incomes are less able to afford the higher interest rates on local currency loans, and that the *absolute* interest rate savings from borrowing in foreign currency increases with loan size.

Our results do not support the conjecture that opaqueness in the bank-firm relationship encourages (local currency earning) firms to request foreign currency loans. The significantly positive coefficient of *Bank relationship* suggests that more transparent firms (to the Bank) are more likely to request a foreign currency loan. This finding confirms the results of Brown, Ongena and Yesin (2009) and may be

[31] We use firm random effects rather than fixed effects so as not to exclude the firms which request the same currency for each of their loans. In our analysis of the subsample of repeat clients we drop *Age* as it increases parallel to *Bank relationship* over a sequence of several loans.

explained by firms' anticipation that banks may only offer foreign currency loans to firms they know well.

Our *Industry dummies* show that firms operating in industries that are likely to have foreign currency earnings such as trade, transport and tourism display a larger likelihood to request EUR loans than borrowers from other industries like services or agriculture (not reported in the table). This provides further evidence that foreign currency income increases a firm's likelihood to request a foreign currency loan. The *Branch dummies* (not reported in the table) confirm these findings showing that firms located in Sofia as well as in the touristic and industrial centers of the country (e.g. Varna, Burgas, Ruse) are more likely to request EUR loans than firms in other areas.

We find that firms with a longer *Requested maturity* are more likely to request foreign currency loans. This result is surprising, given that the risk of adverse exchange-rate movements is likely to be higher in the long run. One explanation for this finding is that firms anticipate that the Bank may be reluctant to offer long-term loans in local currency. Also, longer-term loans may be particularly used for financing real estate, a market which is mainly transacting in EUR. This is confirmed by the finding that firms requesting a *Mortgage loan* are more likely to request EUR.

At the macroeconomic level we find that firms are more likely to request EUR loans when the *Interest rate differential* is higher. However, we do not find that lower expected exchange rate volatility as measured by *EU announcement* increases foreign currency loan demand. This result may be driven by the fact that the announcement to join the EU also stabilized expectations about domestic monetary policy. While *Inflation volatility* does not influence currency requests, the possibility to get foreign currency loans from other financial institutions (*Aggregate FX loans*) reduces firms' likelihood to request EUR loans at this Bank.

Subsamples of loans with amount over 5,000 EUR, medium loans and *non-mortgage loans*

Our descriptive statistics in Table 9 show that small loans (below 50,000 EUR) make up the overwhelming share (98%) of our observations. As discussed in section 3.3.2, loans of this size are standardized products with fixed loan conditions (interest rate, collateral requirements). Thus, foreign currency demand among small loans may not only be driven by firm characteristics, but also by the expectations of entrepreneurs that they do not meet the Bank's fixed criteria for such loans. As a

result, the full-sample results presented in column (1) may be dominated by the large number of small loans, for which firm characteristics, other loan terms and macroeconomic conditions may have less influence on requested currency. Column (2) of Table 12 therefore displays results for the subsample of medium loans (above 50,000 EUR) only. The results in this column reveal that a firm's foreign currency income (*EUR account*) and distress costs (*Leverage*, *Sole proprietorship*) as well as the macroeconomic environment (with the exception of the *EU announcement*) do not play a role in the currency decision of firms requesting medium loans. By contrast, the effects of firm transparency, size and income (*Bank relationship*, *Assets*, *Disposable income*) as well as other requested loan terms (*Requested amount*, *Requested maturity*) are stronger when only considering medium loans. We conclude that while our quantitative results vary for several explanatory variables, our qualitative results from the full-sample regressions seem to be robust for both loan types.

Figure 5 shows that firms hardly request foreign currency when they want loans with a volume below 5,000 EUR. The full-sample results presented in column (1) of Table 12 may thus be weakened by the large share of such loans in our sample. Column (3) of Table 12 examines whether the determinants of requested loan currency differ for the subsample of loans with amounts over 5,000 EUR. The results displayed in this column confirm those of our full-sample qualitatively. However, the economic effect of all explanatory variables is stronger confirming our conjecture that the full sample results are somewhat weakened by the large number of very small loans.

Figure 5 further shows that long-term loans (loans exceeding 5 years in maturity) have a high probability to be requested and granted in EUR. These long-term loans are to a large extent mortgage loans. Thus the observed relation between maturity and foreign currency denomination of loans may be driven by the fact that the Bulgarian housing market is denominated in EUR. Column (4) displays regression results for the subsample of non-mortgage loans and shows that the majority of previous findings also qualitatively holds in this subsample. However, as conjectured we find that *Requested maturity* does not seem to influence the firms' currency request when we exclude mortgage loans.

Table 12. Foreign currency loan demand

The dependent variable *EUR requested* equals one if the firm requested a EUR loan and equals zero otherwise, while all explanatory variables are defined in Table 8. Columns (1) to (4) report marginal effects from logit estimations and columns (5) and (6) report OLS estimates. Standard errors are reported in brackets and account for clustering at the branch-industry level. ***, **, * denote significance at the 0.01, 0.05 and 0.10-level.

	(1)	(2)	(3)	(4)	(5)	(6)
	All clients				Repeat clients	
	Full sample	Medium loans	Amount > 5.000 EUR	Without mortgages	Including interaction terms with *Later loan*	
Coefficients	Main effects	Main effects	Main effects	Main effects	Main effects	Interactions
EUR account	0.011***	0.041	0.052***	0.002	0.069***	-0.038*
	[0.004]	[0.100]	[0.016]	[0.002]	[0.020]	[0.020]
Disposable income	-0.001***	-0.082***	-0.006***	-0.000***	-0.004***	-0.000
	[0.000]	[0.013]	[0.001]	[0.000]	[0.001]	[0.001]
Leverage	-0.002***	-0.099	-0.008**	-0.002*	-0.000	-0.000
	[0.001]	[0.064]	[0.004]	[0.001]	[0.007]	[0.008]
Sole proprietorship	-0.002***	0.040	-0.012***	-0.002***	-0.100***	0.002
	[0.000]	[0.034]	[0.002]	[0.000]	[0.005]	[0.005]
Bank relationship	0.000***	0.002**	0.000***	0.000**	0.001**	-0.000
	[0.000]	[0.001]	[0.000]	[0.000]	[0.000]	[0.000]
Assets	0.003***	0.075***	0.014***	0.002***	0.007***	0.007***
	[0.000]	[0.014]	[0.001]	[0.000]	[0.001]	[0.001]
Age	0.000	-0.063**	0.000	0.000		
	[0.000]	[0.031]	[0.001]	[0.000]		
Requested amount	0.006***	0.228***	0.030***	0.003***	0.029***	-0.003
	[0.000]	[0.024]	[0.001]	[0.000]	[0.002]	[0.002]
Requested maturity	0.003***	0.178***	0.016***	0.000	0.004	0.016***
	[0.000]	[0.018]	[0.002]	[0.000]	[0.002]	[0.003]
Mortgage loan	0.013***	0.130	0.056***		0.103***	0.093***
	[0.002]	[0.080]	[0.005]		[0.004]	[0.005]
Interest differential	0.001***	0.027	0.004**	0.000*	0.004*	-0.002
	[0.000]	[0.023]	[0.002]	[0.000]	[0.002]	[0.003]
EU announcement	-0.002***	-0.083***	-0.012***	-0.002***	0.001	-0.006
	[0.000]	[0.032]	[0.002]	[0.000]	[0.005]	[0.005]
Inflation volatility	-0.000	0.054	-0.002	-0.000	-0.008	-0.006
	[0.001]	[0.085]	[0.005]	[0.001]	[0.009]	[0.010]
Aggregate FX loans	-0.023***	0.219	-0.166***	-0.023***	-0.120*	-0.096
	[0.009]	[0.889]	[0.044]	[0.006]	[0.070]	[0.084]
Later loan					-0.043	
					[0.063]	
Observations	105,107	2,218	40,395	95,146		69,178
Method	Logit	Logit	Logit	Logit		OLS
R^2 (pseudo/overall)	0.446	0.187	0.383	0.320		0.273
Branch fixed effects	yes	yes	yes	yes		yes
Industry fixed effects	yes	yes	yes	yes		yes
Firm random effects	no	no	no	no		yes

First loans versus *later loans* of repeat clients

Firms' anticipations about the willingness of the Bank to provide foreign or local currency loans may influence their requested loan currency. This raises doubts about whether our data allows us really to analyze the firm's "pure" demand for foreign currency loans at all. Our full sample results in column (1) actually suggest that the loan currency request by firms may be partly driven by their anticipation of the Bank's behavior: This may explain why more transparent firms and firms with longer requested maturity are more likely to request foreign currency loans.

We use our panel data of repeat clients to study whether "anticipation effects" may be driving the requested loan currency of firms. We conjecture that anticipation effects should be stronger if the firm is actually familiar with the Bank's loan supply behavior. If this is the case we should see differences in the determinants of requested loan currency for the first loan of a firm compared to its later loans with the Bank. In columns (5) and (6) of Table 12 we examine whether the determinants of requested loan currency differ between first loans and later loans for our panel of repeat clients. The two columns present estimates from a single OLS estimation,[32] with the main effects of all explanatory variables reported in column (5) and interaction terms with *Later loan* reported in column (6).

The interaction terms in column (6) suggest that the anticipation effect may affect our results for loan characteristics more than those for the firm characteristics and macroeconomic conditions. The interaction terms of *Later loan* with *Requested maturity* and *Mortgage loan* are significantly positive suggesting that firms learn over time that longer-term and mortgage loans are more likely to be granted in foreign currency. This learning effect is especially strong for the maturity request because *Requested maturity* does not at all influence a firm's currency request at the first loan. In contrast, besides a weaker effect for our indicator of firms' foreign currency earnings and a stronger effect for firm size, there are no significant differences in the firm-level and macroeconomic determinants of requested loan currency between first and later loans.

[32] We resort to OLS estimation because of the difficulties in interpreting marginal effects of interaction terms in non-linear models (Ai and Norton (2003)).

3.4.3 Multivariate regressions: The Bank's choice of loan currency

Table 13 and Table 14 report our results for the Bank's currency decision. We observe the Bank's currency decision both for those loans which were requested in foreign currency (EUR) and for those which were requested in local currency (BGN). We can therefore examine the Bank's currency choice conditional on the firms' requested currency. As Figure 4 shows, a substantial share of loans which firms request in BGN are switched by the Bank to EUR, while few loans requested in EUR are switched to BGN. Our attention is therefore focused on those loans which are requested in BGN. Here we want to identify the firm-, bank- and macro-level drivers behind the Bank's switching of loans to foreign currency (EUR).

Table 13 reports our analysis of the Bank's currency choice for loans requested in BGN. Panel A reports baseline results for the full sample and the sample of repeat clients. The instrumental variable analysis presented in Panel B accounts for the possible endogeneity of the Bank's refinancing structure.

Column (1) of Panel A displays our results for the full sample of loans requested in local currency. We find that the Bank's currency decision to offer EUR is related to indicators of observable credit risk. The Bank is more likely to grant a EUR loan to firms which have foreign currency income (*EUR account*), are not a *Sole proprietorship* and which are larger (*Assets*).

The *Requested amount*, *Requested maturity* and purpose of the loan (*Mortgage loan*) strongly affect the Bank's currency decision. The fact that mortgage loans are more likely to be granted in EUR may be related to lower credit risk, as the collateral of these loans (houses, which as mentioned above are transacted in EUR) is denominated in EUR. The fact that large loans and loans with longer maturity are more likely to be granted in EUR provides support for our conjecture that the Bank may not trust (future) domestic monetary policy.

Our full sample results suggest, importantly, that the Bank is more likely to switch loans from BGN to EUR when its share of liabilities in foreign currency (*EUR wholesale funding*, *EUR customer funding*) is higher. We find that the economic magnitude and significance of customer funding in foreign currency is greater than that of wholesale funding in foreign currency. This finding contradicts common wisdom that foreign currency borrowing in Eastern Europe is strongly driven by EUR wholesale funding of subsidiaries by their parent banks and international

financial institution (e.g. the EBRD). Rather, our findings suggest that the "dollarization" of customer deposits is a key driver of foreign currency lending.

Considering the actual macroeconomic conditions during our observation period we find that the Bank's decision to switch loans from local currency to foreign currency is positively related to perceived exchange rate stability (*EU announcement*). By contrast, current domestic *Inflation volatility* does not lead the Bank to lend more in foreign currency. We further find that the Bank's lending behavior is partly related to competitive conditions. While lending in EUR is unrelated to the intermediation spread on foreign versus local funds (*Spread differential*), the Bank does grant less loans in EUR when the share of loans in the entire banking sector is higher (*Aggregate FX loans*).

Columns (2-4) of Panel A report results for the subsamples of Medium loans, loans exceeding 5,000 EUR and Non-mortgage loans. The results presented in these columns largely confirm our full-sample results. One notable difference for the subsample of Medium loans (column 2) is that the firm-level indicators of income, distress costs and transparency are not significant. This result seems to be driven by the substantially lower number of observations in this specification. One notable result from column (4) is that, even when we exclude the sample of mortgage loans, the Bank is more likely to switch large and long-term loans from local to foreign currency.

Column (5) reports panel results for our sample of repeat clients, again confirming the qualitative results from our full sample. Most notably, we find that the effect of customer funding in EUR is still positive in our panel analysis. Thus if the same client approaches the Bank at different times, in both instances asking for a loan in local currency, the Bank is more likely to switch the loan to foreign currency if it has more foreign currency deposits.

Could our finding that the Bank's funding in foreign currency is positively correlated with its lending in foreign currency be driven by reverse causality? We believe that our findings are not subject to endogeneity bias because Panel A in Table 13 examines the probability of the Bank offering a foreign currency loan to clients who requested a loan in local currency. It is therefore unlikely that the correlation between funding and lending is driven by firms' demand for foreign currency loans.

To rule out potential endogeneity of foreign currency funding, we nevertheless conduct an instrumental variable analysis. We conjecture that wholesale funding in foreign currency is more likely to be endogenous to the demand for foreign currency loans than customer deposits, which were shown to be sluggish.[33] We therefore instrument our variable EUR wholesale funding with the spread on sovereign debt of Bulgaria (denominated in EUR) over that of Germany. As shown by Durbin and Ng (2005) the sovereign spread affects the cost of international funding for domestic enterprises (including banks) and therefore should affect the incentives of our Bank to borrow wholesale in EUR. At the same time the sovereign spread of Bulgaria (on its EUR debt) should hardly be related to the demand for EUR loans by small firms in the country. The results presented in Panel B of Table 13 confirm our result that Bank funding in foreign currency has a positive impact on Bank lending in foreign currency, and that this effect is stronger for customer than for wholesale funding.

Table 14 examines the Bank's currency choice for those firms which request a loan in foreign currency (EUR). Confirming our results in Table 13 we find that the Bank is more likely to grant a EUR loan to those clients that display lower credit risk (more *Assets,* not *Sole proprietorship*) and want long-term (*Requested maturity*) or *Mortgage loans*. By contrast, we find little evidence that lending in foreign currency to clients that request foreign currency is driven by macroeconomic conditions or bank funding[34].

[33] The "sluggishness" of retail deposits is a well-established stylized fact (Song and Thakor (2007)).
[34] The maturity of the Bank's refinancing may also determine its lending decisions. Unfortunately, we do not have sufficiently detailed information to control for this aspect.

Table 13. Foreign currency loan supply: Loans requested in BGN

Panel A. Logit regressions

This table reports marginal effects from logit estimations for the sample of loans requested in BGN only. The dependent variable *EUR granted* equals one if the firm received a EUR loan and equals zero otherwise, while all explanatory variables are defined in Table 8. Standard errors are reported in brackets and account for clustering at the industry-branch level. ***, **, * denote significance at the 0.01, 0.05 and 0.10-level.

	(1)	(2)	(3)	(4)	(5)
	Full sample	Medium loans	Amount > 5.000 EUR	Without mortgages	Repeat clients
EUR account	0.004***	0.028	0.018**	0.001*	0.006
	[0.001]	[0.121]	[0.009]	[0.001]	[0.004]
Disposable income	0.000	0.008	0.000	0.000	0.000
	[0.000]	[0.018]	[0.000]	[0.000]	[0.000]
Leverage	-0.000	-0.056	-0.002	-0.000*	0.002
	[0.000]	[0.073]	[0.003]	[0.000]	[0.002]
Sole proprietorship	-0.001**	-0.005	-0.004***	-0.001***	-0.003***
	[0.000]	[0.033]	[0.002]	[0.000]	[0.001]
Bank relationship	-0.000	0.001	-0.000	-0.000	-0.000
	[0.000]	[0.001]	[0.000]	[0.000]	[0.000]
Assets	0.001***	0.010	0.004***	0.000***	0.004***
	[0.000]	[0.019]	[0.001]	[0.000]	[0.000]
Age	-0.000	-0.034	-0.000	0.000	
	[0.000]	[0.035]	[0.001]	[0.000]	
Requested amount	0.002***	0.033	0.013***	0.001***	0.007***
	[0.000]	[0.028]	[0.001]	[0.000]	[0.001]
Requested maturity	0.002***	0.247***	0.013***	0.001***	0.009***
	[0.000]	[0.021]	[0.001]	[0.000]	[0.001]
Mortgage loan	0.006***	0.116***	0.034***		0.015***
	[0.001]	[0.030]	[0.004]		[0.002]
Spread differential	-0.000	-0.012	-0.000	0.000	-0.000
	[0.000]	[0.016]	[0.000]	[0.000]	[0.000]
EU announcement	0.003***	0.111	0.017***	0.001***	0.008***
	[0.001]	[0.088]	[0.003]	[0.000]	[0.002]
Inflation volatility	-0.002***	0.072	-0.013***	-0.001***	-0.005**
	[0.000]	[0.114]	[0.004]	[0.000]	[0.002]
Aggregate FX loans	-0.040***	-1.119	-0.286***	-0.020***	-0.150***
	[0.006]	[1.092]	[0.037]	[0.003]	[0.025]
EUR wholesale funding	0.003*	0.761**	0.023*	0.000	0.013
	[0.002]	[0.305]	[0.014]	[0.002]	[0.008]
EUR customer funding	0.019***	0.622	0.136***	0.006**	0.088***
	[0.004]	[0.879]	[0.028]	[0.003]	[0.019]
Observations	101,049	1,017	36,505	93,981	66,003
Method	Logit	Logit	Logit	Logit	Logit
R^2 (pseudo)	0.418	0.221	0.323	0.368	
Wald Chi^2-statistic for model goodness-of-fit					1,133.55***
Branch fixed effects	yes	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes	yes
Firm random effects	no	no	no	no	yes

Panel B. Instrumental variable approach

This table reports marginal effects from IV probit estimations in columns (1) to (4) and OLS estimates in column (5) for the sample of loans requested in BGN only. The dependent variable *EUR granted* equals one if the firm received a EUR loan and equals zero otherwise. We instrument the variable EUR wholesale funding with the spread between Bulgarian and German sovereign debt in EUR obtained on a monthly basis for our whole observation period from Bloomberg. All explanatory variables are defined in Table 8. Standard errors are reported in brackets and account for clustering at the industry-branch level. ***, **, * denote significance at the 0.01, 0.05 and 0.10-level. Athrho is the estimate of the inverse hyperbolic tangent of ρ, the correlation among the errors in the first and second-stage regression equations. The table also provides Wald Chi² statistics for the independence of the two equations and the model goodness-of-fit.

	(1)	(2)	(3)	(4)	(5)
	Full sample	Medium loans	Amount > 5.000 EUR	Without mortgages	Repeat clients
EUR wholesale funding	0.026*	0.386	0.140**	0.008	0.100
	[0.015]	[2.551]	[0.055]	[0.008]	[0.118]
EUR customer funding	0.034***	0.323	0.276***	0.011	0.216***
	[0.013]	[2.644]	[0.060]	[0.007]	[0.071]
athrho	-0.208**	0.049	-0.114**	-0.162	
	[0.105]	[0.298]	[0.046]	[0.146]	
Observations	101,049	1,017	36,505	93,981	66,003
Method	IV probit	IV probit	IV probit	IV probit	IV OLS
Wald Chi²-test of exogeneity	3.91**	0.03	6.17**	1.23	
Wald Chi²-statistic for model goodness-of-fit	3,935.96***	327.39***	3,443.31***	3,046.96***	
R^2 (overall)					0.117
Firm characteristics, Loan application, Macroeconomic conditions	yes	yes	yes	yes	yes
Branch fixed effects	yes	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes	yes
Firm random effects	no	no	no	no	no

Table 14. Foreign currency loan supply: Loans requested in EUR

This table reports marginal effects from logit estimations for the subsample of loans requested in EUR only. The dependent variable *EUR granted* equals one if the firm received a EUR loan and equals zero otherwise, while all explanatory variables are defined in Table 8. Standard errors are reported in brackets and account for clustering at the industry-branch level. ***, **, * denote significance at the 0.01, 0.05 and 0.10-level.

	(1)	(2)	(3)	(4)	(5)
	Full sample	Medium loans	Amount > 5.000 EUR	Without mortgages	Repeat clients
EUR account	0.007		-0.002	-0.052	0.016
	[0.012]		[0.013]	[0.082]	[0.019]
Disposable income	-0.002	-0.003	-0.003	0.003	-0.001
	[0.002]	[0.003]	[0.002]	[0.010]	[0.004]
Leverage	-0.005	-0.010	-0.011	-0.041	-0.015
	[0.012]	[0.011]	[0.009]	[0.039]	[0.019]
Sole proprietorship	-0.010*	0.005	-0.009*	-0.062***	-0.011
	[0.005]	[0.007]	[0.005]	[0.017]	[0.009]
Bank relationship	0.000	0.000	0.000	-0.000	-0.000
	[0.000]	[0.000]	[0.000]	[0.001]	[0.000]
Assets	0.017***	0.002	0.014***	0.061***	0.023***
	[0.002]	[0.004]	[0.003]	[0.010]	[0.005]
Age	-0.004	-0.003	-0.002	-0.009	
	[0.004]	[0.004]	[0.004]	[0.016]	
Requested amount	0.000	0.006	0.000	-0.022	-0.003
	[0.003]	[0.004]	[0.003]	[0.015]	[0.005]
Requested maturity	0.005	0.010***	0.008**	-0.018	0.019***
	[0.004]	[0.003]	[0.003]	[0.013]	[0.006]
Mortgage loan	0.085***	0.027*	0.071***		0.064***
	[0.013]	[0.016]	[0.014]		[0.012]
Spread differential	0.002	0.002	0.003	0.000	0.004
	[0.003]	[0.003]	[0.003]	[0.012]	[0.004]
EU announcement	0.010	-0.008	0.012	-0.034	0.004
	[0.011]	[0.017]	[0.011]	[0.047]	[0.018]
Inflation volatility	-0.016	-0.024	-0.018	-0.085	-0.027
	[0.014]	[0.017]	[0.013]	[0.053]	[0.026]
Aggregate FX loans	-0.161	-0.073	-0.193	-1.237**	-0.442
	[0.129]	[0.199]	[0.133]	[0.534]	[0.283]
EUR wholesale funding	0.038	0.053	0.033	-0.101	0.204**
	[0.051]	[0.062]	[0.059]	[0.181]	[0.092]
EUR customer funding	-0.092	-0.032	-0.127	0.393	0.226
	[0.127]	[0.145]	[0.131]	[0.380]	[0.215]
Observations	4,222	935	3,932	1,323	3,175
Method	Logit	Logit	Logit	Logit	Logit
R^2 (pseudo)	0.211	0.162	0.159	0.192	
Wald Chi^2-statistic for model goodness-of-fit					104.08***
Branch fixed effects	yes	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes	yes
Firm random effects	no	no	no	no	yes

3.4.4 Switching loan currency and credit risk

Figure 4 shows that nearly one-third of the foreign currency loans of the Bank were initially requested in local currency. Our results from Table 13, column (4) suggest that this finding is partly driven by the Bank's reluctance to lend large amounts for longer maturities in local currency and by matching of the currency structure of its assets to that of its liabilities. In Table 15 we examine what this implies for the quality of those loans which are switched from local to foreign currency. Comparing those EUR loans which were requested in BGN to those which were requested in EUR we examine whether the bank consciously takes on greater credit risk by switching the currency of loans.

Unfortunately we do not have precise indicators of the ex-post performance of the loans in our sample. Moreover, given that the currency board of the BGN to the EUR held throughout our observation period, there can be no exchange-rate induced defaults on foreign currency loans. However, we can assess the ex-ante credit risk associated with each loan by examining the pricing behavior of the bank. If loans which are switched from BGN to EUR involve a higher default probability we should find that the Bank charges a higher risk premium and thus a higher interest rate on these loans than on otherwise identical loans, which were requested in EUR. Note that we can conduct this exercise for medium loans only, as small loans from the Bank are granted at standardized interest rates.

Table 15 examines the pricing of medium loans denominated in EUR, relating the nominal interest rate to firm characteristics, *actual* loan terms (*Amount, Maturity, Annuity loan, Mortgage loan*) and the requested currency (*BGN requested*). In all specifications we control for macroeconomic conditions and bank-funding with year-quarter fixed effects. The baseline results reported in column (1) for all clients confirm that the bank does practice risk adjusted pricing for the segment of medium loans. Firms which are more likely to have foreign income (*EUR account*), are more transparent (not *Sole proprietorship, Bank relationship*) and are larger (*Assets*) pay lower interest rates on EUR loans. Firms with larger loans and shorter maturities also pay lower interest rates, while mortgage loans carry higher interest rates. The repayment schedule (*Annuity loan*) does not seem to affect pricing. These findings are confirmed by panel results for our subsample of repeat clients in column (2).

For the full sample and the panel of repeat clients, we find that firms with loans which were switched from BGN to EUR pay significantly higher interest rates than

firms with loans which were requested and granted in EUR. The results in columns (1) and (2) suggest that loans with switched currency have on average 12-18 basis points higher rates. At first sight, this effect appears small compared to the average interest rate of 10.2% for this sub-sample, as well as to the dispersion of interest rates for this sample which varied depending on year-quarter between 500 and 600 basis points. However, the difference is similar in magnitude to the effect on interest rates of other unfavorable firm characteristics such as being a *Sole proprietorship* or not having a foreign currency account (*EUR account*).

The pricing of loans which were switched from BGN to EUR suggests that by offering these loans in foreign currency the Bank may be exposing the firm to higher default risk and itself to higher credit risk. However, higher interest rates for switched loans may also be explained by market power and bargaining by the Bank. During our observation period, interest rates on medium loans in BGN are on average 38 basis points higher than interest rates on medium loans in EUR. As firms which requested loans in BGN were prepared to pay the higher interest rate, the Bank may be simply reaping part of the "saved interest expenses" for the firm by charging higher interest on switched loans.

In column (3) of Table 15 we examine whether the higher interest rate on switched loans may be explained by market power of the Bank rather than higher credit risk. To this end, we include not only the main term of *BGN requested* but also its interaction term with the variable *Interest differential*, which captures the (risk-free) difference in local currency and foreign currency interest rates. If market power alone explains the higher pricing of switched loans we should find that the mark-up of the Bank on switched loans is higher in months when the interest differential between BGN and EUR funds is higher. Thus we would expect the interaction term of *BGN requested * Interest differential* to be significantly positive. The results in column (3) show, however, that the main effect of BGN requested remains significant and positive while the interaction term *BGN requested * Interest differential* is not significant. We conclude therefore that the higher relative pricing of loans which are switched from BGN to EUR reflects higher default and credit risk rather than bargaining by the Bank.

Table 15. Interest rate on medium loans in EUR

This table reports estimations for the sample of medium loans in EUR only. The dependent variable *Interest rate* is the nominal interest rate charged on the loan at disbursement, while all explanatory variables are defined in Table 8. Standard errors are reported in brackets and account for clustering at the branch-industry level. ***, **, * denote significance at the 0.01, 0.05 and 0.10-level.

	(1)	(2)	(3)
	Full sample	Repeat clients	Full sample
EUR account	-0.512**	-0.287	-0.509**
	[0.201]	[0.228]	[0.197]
Disposable income	-0.091***	-0.068*	-0.091***
	[0.031]	[0.035]	[0.031]
Leverage	-0.625***	-0.657***	-0.626***
	[0.164]	[0.171]	[0.164]
Sole proprietorship	0.266***	0.271***	0.266***
	[0.054]	[0.084]	[0.054]
Bank relationship	-0.004*	-0.005**	-0.004*
	[0.002]	[0.002]	[0.002]
Assets	-0.104*	-0.133***	-0.104*
	[0.053]	[0.040]	[0.053]
Age	0.063		0.063
	[0.056]		[0.055]
Amount	-0.339***	-0.278***	-0.340***
	[0.064]	[0.057]	[0.064]
Maturity	0.180***	0.155***	0.180***
	[0.062]	[0.056]	[0.061]
Annuity loan	0.042	0.014	0.044
	[0.195]	[0.139]	[0.195]
Mortgage loan	0.455***	0.252**	0.455***
	[0.126]	[0.127]	[0.126]
BGN requested	0.181***	0.122*	0.318***
	[0.063]	[0.073]	[0.118]
BGN requested Interest differential*			-0.112
			[0.091]
Constant	17.203***	16.870***	17.242***
	[0.553]	[0.702]	[0.553]
Observations	1,473	1,168	1,473
Method	OLS	OLS	OLS
R^2 (adjusted / overall)	0.450	0.463	0.450
Branch fixed effects	yes	yes	yes
Industry fixed effects	yes	yes	yes
Quarter fixed effects	yes	yes	yes
Firm random effects	no	yes	no

3.5 Conclusions

In this paper we examine the currency denomination of loans extended to small firms by one retail bank in Bulgaria. Our analysis is based on credit file data for 105,589 loans over the period 2003-2007. In contrast to existing studies, our data allows us to disentangle demand and supply side drivers of the currency

denomination of loans. We observe not only the actual currency denomination of the loan extended, but also the loan currency that was requested by the firms in their loan application. We can therefore identify how clients' demand for foreign currency loans and the Bank's supply of such loans are related to firm characteristics, other loan terms, macroeconomic conditions and the Bank's liability structure. Our results suggest that foreign currency borrowing in Eastern Europe is at least partly supply-driven, with banks hesitant to lend long-term in local currency and eager to match the currency structure of their assets and liabilities.

Our results have implications for policy makers throughout Eastern Europe who have recently taken measures to discourage foreign currency borrowing in the retail sector (Rosenberg and Tirpak (2008)). In Hungary, Poland and Latvia, for example, banks are now forced to disclose the exchange rate risks involved in foreign currency borrowing and have had to tighten eligibility criteria for such loans. As we find that foreign currency borrowing in Emerging Europe seems to be driven not only by demand but also by supply factors, measures that address only more transparency to increase borrowers' awareness of the inherent risks may not be enough to significantly curb the extent of foreign currency lending. When foreign currency lending is at least partly supply driven, measures like stronger provisioning requirements on foreign currency compared to local currency loans as they were taken in Romania and Croatia should be more effective.

Our results suggest that wholesale foreign currency funding of banks in Eastern Europe is not the key driver of foreign currency lending in the region. We find that foreign currency deposits by customers have a much stronger impact on foreign currency lending of our Bank. This finding suggests that recent attempts to foster local currency wholesale funding in Eastern Europe may not be sufficient to reduce foreign currency lending.[35] Instead, credible macroeconomic policies which encourage customers to save in local currency may be more promising. A credible macroeconomic environment would also make banks less hesitant to extend large and long-term loans in local currency.

[35] Some hedging and local lending facilities have already been established, e.g. the special purpose funds TCX, MFX Solutions and MICROFIX (see Abrams (2008)). The President of the EBRD, Thomas Mirow, highlighted several new proposals in a speech at the 2010 joint conference of the IIF and EBRD on Financial Systems in Emerging Europe in Zagreb (http://www.ebrd.com/pages/news/speeches/mirow_100513.shtml).

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

4.1 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.

We 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 we are 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 (2010a)).

Exploiting the structure of our dataset, we 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, we 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 being a young or small firm 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. We 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. We 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 no 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.

Our 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)). Our study, on the contrary, is concerned with loan size constraints for those borrowers who receive credit.[36]

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 by using information from loan applications as well as loan contracts (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. We 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). We 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.

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

The remainder of the paper is organized as follows. Section 4.2 reviews the related theoretical and empirical literature. Section 4.3 provides institutional details on the loan granting process and describes the data while section 4.4 presents the findings from the empirical analyses. Section 4.5 concludes.

4.2 Literature overview

4.2.1 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 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.[37] Therefore, we expect granted loan amounts to increase over repeated interactions between borrowers and banks. 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 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

[37] 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)).

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.[38] 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.[39]

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 (1995)). While Jimenez, Lopez and Saurina (2009) examine the determinants of credit line usage, Norden and Weber (2010a) 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.

[38] In these auctions, the ECB 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.

[39] The myopic best-reply behavior may be an argument for overstated requested loan amounts at the second interaction between borrower and bank in our 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.

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 us 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 our 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[40] 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 that borrowers received a smaller than requested amount or no loan at all.

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 us 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.

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

4.3 Data and methodology

4.3.1 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.

Table 16. 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	
Previous constraints	Indicator for extent of credit constraint at previous loan
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

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. We 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 16.

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 our

sample of small loans (loans with amounts of up to 50,000 EUR).[41] Therefore, we 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[42]) 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.

4.3.2 The ratio of requested to granted loan amounts

Since we observe requested and granted loan amounts we are able to establish the extent to which borrowers receive a smaller loan amount than they requested. We denote this as observed credit constraints and measure it by the *Requested-granted ratio* (the higher the ratio the more constrained the borrower). Table 17 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)). We 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, we 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.

[41] With 85% of loans having an amount below 10,000 EUR, there should be only very few loan sequences that may have grown to loan sizes above 50,000 EUR.

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

Table 17 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 17 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, we will pool all borrowers in the regression analysis.

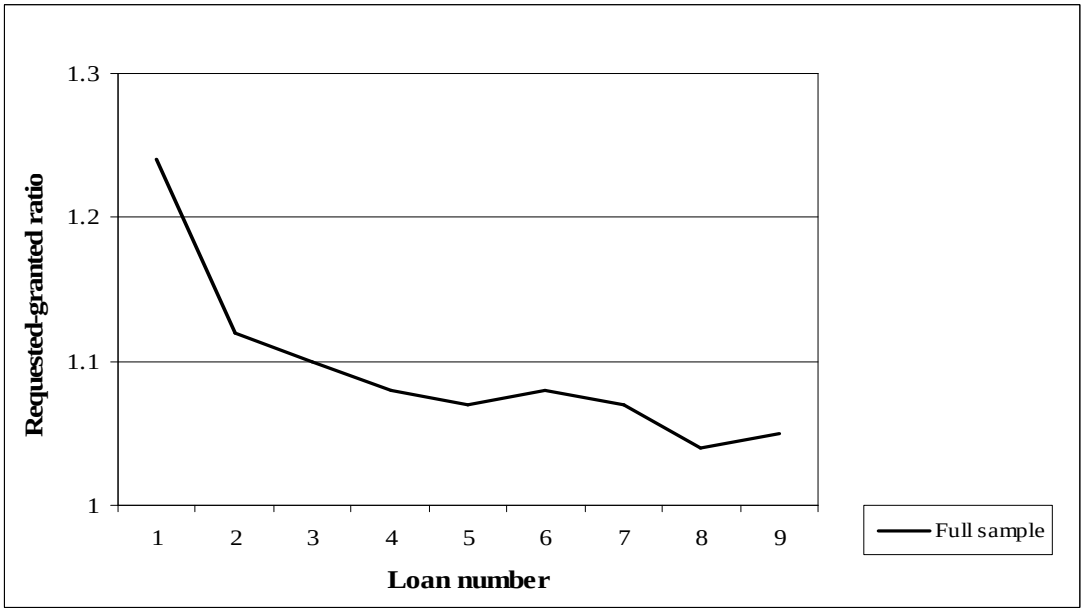
Table 17. Asymmetric information and the *Requested-granted ratio* at first loans

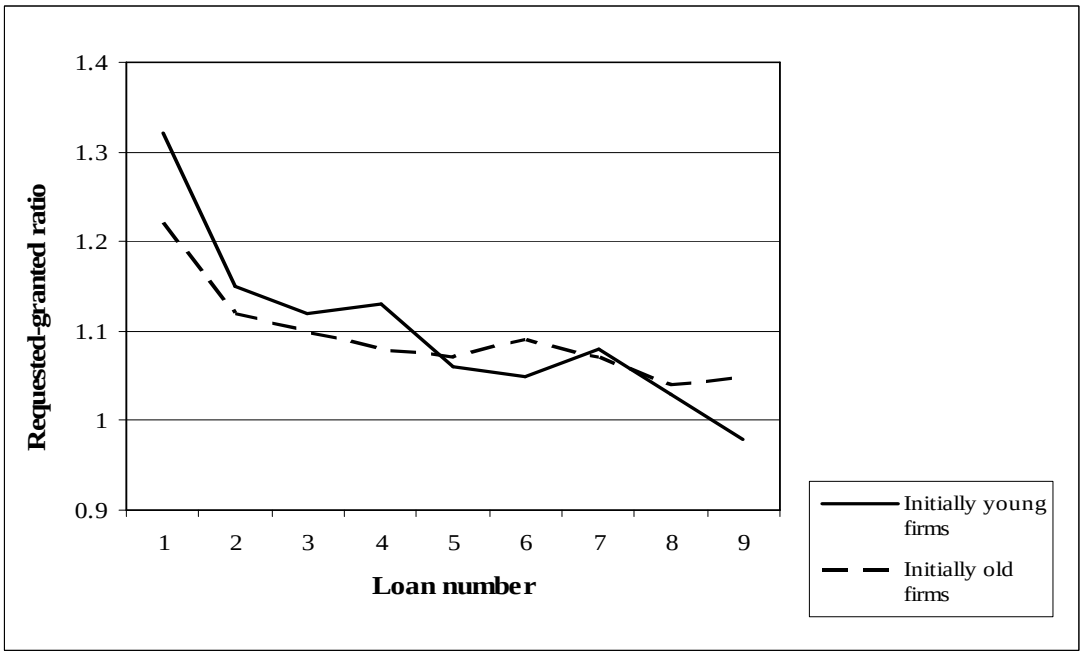
This table reports the average *Requested-granted ratio* for *Single loan clients* (borrowers with only one loan) and *Repeat clients* (borrowers taking out more than one loan during the observation period), for different subsamples based on the asymmetric information indicators. *Initially young* (old) 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.

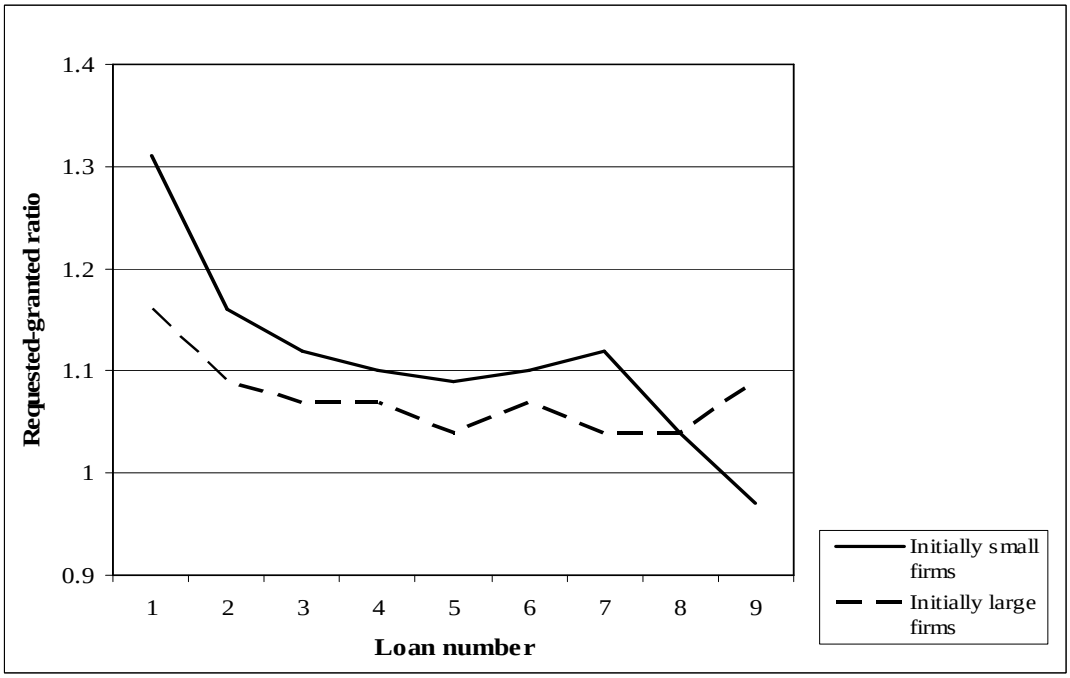
	Requested-granted ratio		
	Single loan clients	Repeat clients	Diff / **Diff-in-Diff**
N	32,832	20,350	
Initially young firms, N = 11,334	1.33	1.32	0.01
Initially old firms, N = 41,848	1.20	1.22	-0.02***
Diff / **Diff-in-Diff**	0.13***	0.10***	**0.03****
Initially small firms, N = 25,835	1.32	1.31	0.01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

Figure 6. 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.







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 6 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.

Figure 6 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.[43] 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 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

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

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 6 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 6 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.

4.3.3 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, we start with studying the factors that influence the degree of observed loan size constraints in the sample in two steps. First, we 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*:

$$\textit{Requested-granted ratio}_{i,k,t} = a + \beta_1 A_{i,t} + \beta_2 F_{i,t} + \beta_3 L_k + \beta_4 B_t + \beta_5 T_t + e_{i,k,t} \qquad (5)$$

$A_{i,t}$ 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, we estimate outcome equation (5) 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.[44] 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 we 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.[45]

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. We 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 we assess the

[44] We 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.
[45] We also test for the differences in adjacent time dummies and find that they are significant in all specifications.

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 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.[46] 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 we 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*

[46] 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).

(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 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, we concentrate the main analysis on requested and granted loan amounts but will provide some further evidence on requested and granted maturities in the extensions.

4.3.4 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 aspects are studied in a panel model with firm fixed effects because the interest lies in the factors that affect changes in requested and granted loan amounts and their relation over borrowers' loan sequences. Introducing previous experience into the regressions adds a dynamic component to the model. However, we have to refrain from estimating a dynamic panel model since in our setting the time intervals (between adjacent loan numbers)

differ between sequences of observations. To reduce the bias that would arise from the direct introduction of a lagged variable in a fixed effects regression, we use *Previous constraints* instead, a categorical variable based on the degree of credit constraints at the previous loan to account for the effect which the previous experience to receive a smaller than requested loan amount has on current behavior. The variable is 0 if the previous loan carries a higher granted than requested loan amount. It is 1 if requested amount equals granted amount at the previous loan, 2 if the borrower experienced high constraints at the previous loan (*Requested-granted ratio* between 1 and 1.67) and 3 if the borrower experienced very high constraints at the previous loan (*Requested-granted ratio* larger than 1.67).

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*:

$$\textit{Requested amount}_{i,k,t} = a_i + \beta_1 \textit{Previous constraints}_k + \beta_2 A_{i,t} + \beta_3 F_{i,t} + \beta_4 L_k + \beta_5 T_t + e_{i,k,t} \quad (6)$$

$$\textit{Granted amount}_{i,k,t} = a_i + \beta_1 \textit{Previous constraints}_k + \beta_2 A_{i,t} + \beta_3 F_{i,t} + \beta_4 L_k + \beta_5 T_t + e_{i,k,t} \quad (7)$$

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.

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* now serving as the reference category in this dynamic setting) is included. The interaction effects *Times_3*Previous constraints,…, Times_5*Previous constraints* 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. We 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. Besides, investments in fixed assets may be more difficult to split. Again, *Requested maturity* and *Granted maturity* are not included because they are complements to requested and granted amount.

4.3.5 Summary statistics

Table 18 presents summary statistics for the indicators of asymmetric information and the loan and firm characteristics.[47] 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 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.

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

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.

Panel B of Table 18 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*.

Table 18. Loan and firm characteristics: descriptive statistics

Panel A. Sample means by loan sequence

This table displays summary statistics for the loan, firm and asymmetric information variables. See Table 16 for definitions of all variables. Note that for all otherwise log-transformed variables the statistics are calculated by using the original values.

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 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***

4.4 Results

4.4.1 Determinants of the ratio of requested to granted loan amounts

Table 19 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.

Table 19. Relationship effects on 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 16. ***, **, * 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)

Table 19. Cont.

Constant	0.448***	0.368***
	(0.019)	(0.037)
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

Effects of asymmetric information indicators and firm and loan variables

Column (1) of Table 19 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.

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 (2010a) 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 we 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, we 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.

4.4.2 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, we 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 us 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.[48]

Table 20 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.

[48] 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 us to observe the evolution of borrowers' requests over multiple interactions with the same lender and to draw conclusions on borrower learning from the results.

Table 20. Requested and granted loan amounts over loan sequences

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 16. ***, **, * 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
Times_3	0.166***	0.360***	0.199***	0.151***
	(0.015)	(0.026)	(0.014)	(0.025)
Times_4	0.299***	0.454***	0.353***	0.325***
	(0.025)	(0.037)	(0.024)	(0.036)
Times_5	0.392***	0.509***	0.467***	0.443***
	(0.036)	(0.046)	(0.036)	(0.045)
Previous constraints	-0.097***	-0.019	0.013	-0.004
	(0.008)	(0.012)	(0.008)	(0.011)
Times_3*Previous constraints		-0.149***		0.037**
		(0.016)		(0.015)
Times_4*Previous constraints		-0.119***		0.021
		(0.022)		(0.021)
Times_5*Previous constraints		-0.088***		0.018
		(0.025)		(0.024)
Loan officer change	-0.178***	-0.179***	-0.197***	-0.197***
	(0.012)	(0.012)	(0.012)	(0.012)
Age	0.131*	0.154**	0.117	0.113
	(0.075)	(0.075)	(0.073)	(0.073)
Assets	0.065***	0.068***	0.093***	0.092***
	(0.021)	(0.021)	(0.021)	(0.021)
Asset growth	0.054***	0.052***	0.044***	0.044***
	(0.016)	(0.016)	(0.015)	(0.015)
Leverage	-0.427***	-0.424***	-0.464***	-0.465***
	(0.041)	(0.041)	(0.039)	(0.039)
Disposable income	0.115***	0.115***	0.117***	0.117***
	(0.012)	(0.012)	(0.011)	(0.011)
Fixed capital loan	0.370***	0.372***	0.377***	0.377***
	(0.012)	(0.012)	(0.012)	(0.012)
Annuity loan	0.529***	0.528***	0.506***	0.506***
	(0.033)	(0.033)	(0.032)	(0.032)
Constant	6.130***	5.937***	5.528***	5.570***
	(0.285)	(0.282)	(0.276)	(0.277)
Observations	40,345	40,345	40,345	40,345
Method	Panel FE	Panel FE	Panel FE	Panel FE
R^2 (within)	0.222	0.226	0.242	0.243
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

Columns (1) and (2) contain estimates for the determinants of *Requested amount*. The estimates in column (1) reveal several interesting findings. Generally, firms 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. We explicitly account for this possible drop-out problem in Table 21 by relating the number of loans a firm takes out to firm characteristics. The negative coefficient of *Previous constraints* indicates that the more credit constrained a borrower was at the previous loan, the lower the requested amount at the current loan. On average, the requested amount at the current loan decreases by 9.7% with each higher category of *Previous constraints*.

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 we introduce the interaction terms of both variables in column (2).

Figure 7. Requested loan amounts and the extent of previous credit constraints

This figure displays the effect of high vs. no previous credit constraints (*Previous constraints* = 2 vs. *Previous constraints* = 1) on the relation between *Requested amount* and the *Times* dummies. See Table 16 for definitions of all variables.

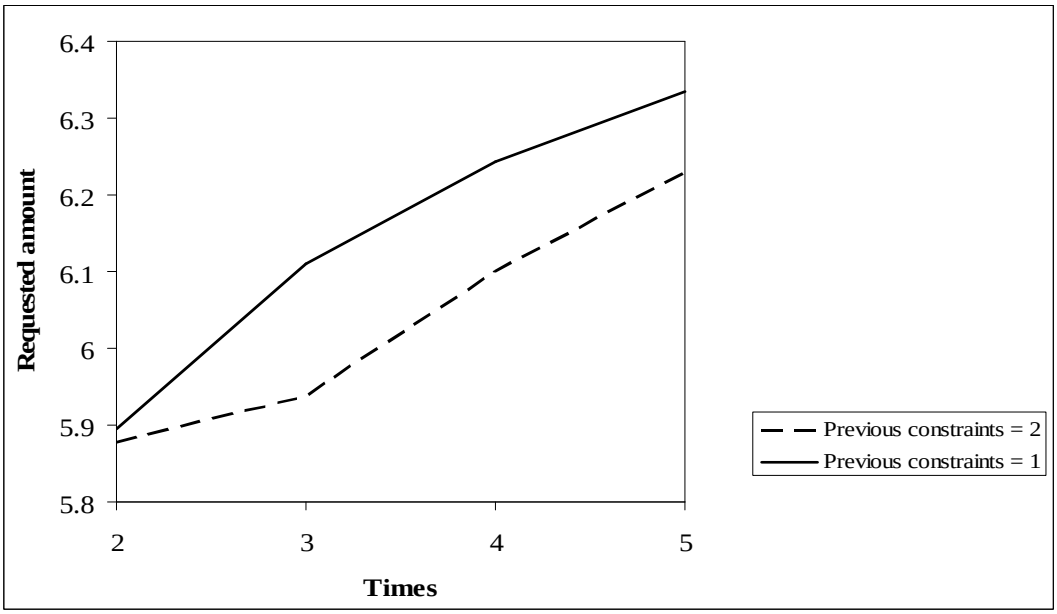


Figure 7 illustrates the results and shows that, in the beginning of the relationship, the increase in requested loan amounts is flatter for those borrowers that experienced high credit constraints in the past. Thus, while borrowers increase their loan requests over time they seem to learn from previous 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 (17.8%) 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 *Previous constraints* and its interactions with *Times_3, ..., Times_5*. However, these effects are much smaller and less precisely measured than on the borrower side. 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 19.9% higher than for second loans. Although the effect of the previous experience with credit constraints is not

statistically significant, the significantly positive interaction term *Times_3*Previous constraints* indicates that the Bank grants relatively more to borrowers facing high in contrast to no constraints at their previous loans in early stages of the relationship. Figure 8 illustrates that the slope of the regression line for those borrowers that were highly constrained at their previous loan is steeper up to loan number three than the slope of the regression line for those borrowers that did not face any credit constraints at their previous loan with the effect leveling 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 (19.7%) 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, we 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).

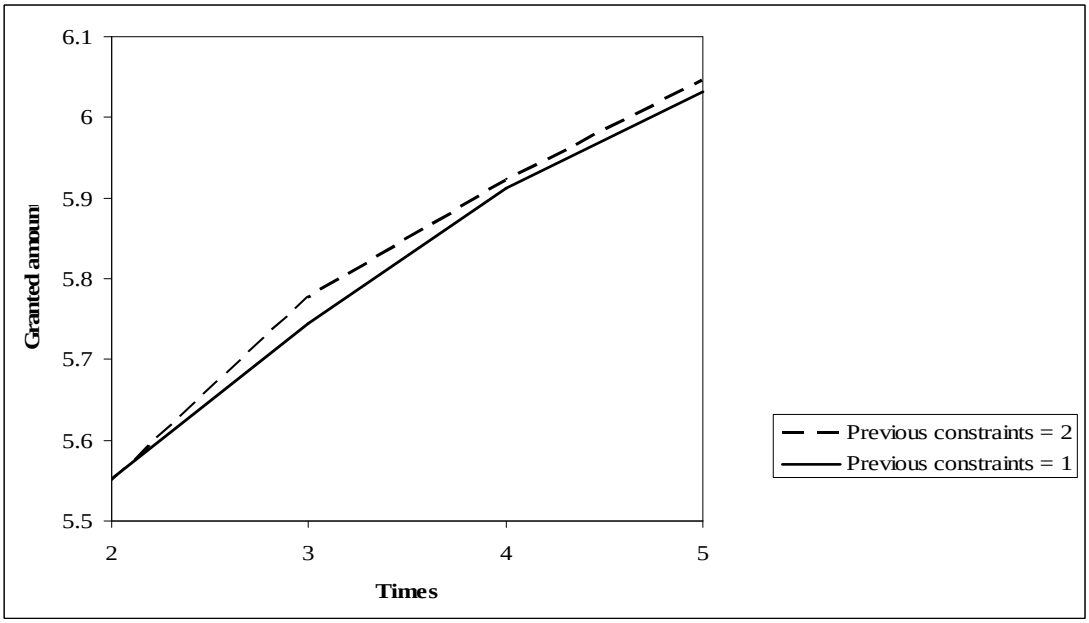
It turns out that each additional interaction with the same loan officer increases requested loan amounts by 9% (p-val.<0.01) and granted loan amounts by 11% (p-val.<0.01) with this effect being stronger than the average effect of the *Times* dummies. Although there are a few relationships between borrowers 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 difficult to be split

and may be sold in case of default and *Annuity loan*s with regular repayment schedules and thus lower risk show higher granted amounts.

Figure 8. Granted loan amounts and the extent of previous credit constraints

This figure displays the effect of high vs. no previous credit constraints (*Previous constraints* = 2 vs. *Previous constraints* = 1) on the relation between *Granted amount* and the *Times* dummies. See Table 16 for definitions of all variables.



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, we 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. no previous credit constraints. And third, we 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.[49] Nevertheless, their repayment capacity should have increased over 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).

4.4.3 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 we cannot observe their coming back. It is

[49] We calculate an indicator for other bank relationships from the information we have and include it into the regressions specified in Table 20. 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 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.

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.

Unfortunately, we can neither directly observe a borrower's decision whether to ask for another loan nor do we have information on 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 us to deal with the attrition problem nevertheless. To account for the attrition process we follow the approach in Wooldridge (1995).[50] Firstly, we estimate probit regressions for each period (loan number) to obtain the probability of observing loan *k+1* based on the credit constraint and the firm and loan characteristics for loan *k* as well as the borrower's risk category (four categories depending on the days of arrears) at the time of repayment of loan *k*. Apart from that, we include two dummy variables indicating whether loan *k* 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.

[50] 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 Brown, Ongena, Popov and Yesin (2010), 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 our case this means to estimate for each loan number the probability that borrowers take out a subsequent loan.

Table 21. 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 16. ***, **, * 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
Times_3	0.308***	0.497***	0.330***	0.279***
	(0.040)	(0.045)	(0.038)	(0.044)
Times_4	0.457***	0.609***	0.509***	0.482***
	(0.047)	(0.054)	(0.046)	(0.053)
Times_5	0.593***	0.717***	0.671***	0.648***
	(0.062)	(0.067)	(0.059)	(0.064)
Previous constraints	-0.097***	-0.018	0.014*	-0.004
	(0.008)	(0.012)	(0.008)	(0.012)
Times_3*Previous constraints		-0.147***		0.040**
		(0.016)		(0.016)
Times_4*Previous constraints		-0.119***		0.021
		(0.021)		(0.019)
Times_5*Previous constraints		-0.096***		0.018
		(0.025)		(0.025)
Loan officer change	-0.154***	-0.155***	-0.174***	-0.173***
	(0.013)	(0.013)	(0.013)	(0.013)
Age	0.201**	0.225***	0.178**	0.173**
	(0.086)	(0.086)	(0.083)	(0.083)
Assets	0.063***	0.067***	0.090***	0.089***
	(0.021)	(0.021)	(0.021)	(0.021)
Asset growth	0.053***	0.051***	0.045***	0.045***
	(0.015)	(0.015)	(0.015)	(0.015)
Leverage	-0.412***	-0.408***	-0.452***	-0.453***
	(0.040)	(0.040)	(0.040)	(0.040)
Disposable income	0.115***	0.115***	0.117***	0.117***
	(0.011)	(0.011)	(0.011)	(0.011)
Fixed capital loan	0.362***	0.364***	0.370***	0.369***
	(0.013)	(0.013)	(0.013)	(0.013)
Annuity loan	0.554***	0.553***	0.531***	0.532***
	(0.032)	(0.032)	(0.031)	(0.031)
Constant	6.488***	6.279***	6.045***	6.090***
	(0.279)	(0.283)	(0.284)	(0.283)
Chi²-statistic: test of joint significance of Mills ratios	52.12***	50.59***	50.36***	51.09***
Observations	40,234	40,234	40,234	40,234
R^2 (within)	0.225	0.228	0.245	0.246
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

Secondly, we 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 we bootstrap the standard errors performing 300 replications to derive their correct values.

Table 21 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 20 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 20.

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 18 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 22 reports descriptive statistics for the two groups of loans for which the Bank either adjusted maturity or amount.

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 these 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. We 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.

Table 22. 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 16 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) Requested maturity > Granted maturity	(2) Requested maturity < Granted maturity	(3) Requested amount > Granted amount	(4) 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

In a next step, we assess the determinants of maturity constraints more formally.[51] We re-estimate the regressions displayed in Table 19 with the dependent variable now being the ratio of requested to granted loan maturity. We 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 *Times* dummies the economic relevance of all explanatory variables is very small. Furthermore, *Initially Young*, *Initially small* and their interaction terms with the *Times* dummies are insignificant which confirms the descriptive findings in Table 22.

Finally, we re-estimate all specifications displayed in Table 19 and Table 20 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.

4.5 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 we 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 us 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.

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

Taking the analysis one step further and studying the dynamics behind the observed reduction of credit constraints over a bank-borrower relationship we 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 especially in the first periods 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 no 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 overdrafts, for instance. Finally, our 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 we denote as observed credit constraints may as well be a measure of borrower bargaining power or capture the borrower's financial literacy. In addition, increased competition in lending to small businesses especially in transition countries which has led to increased multi-source borrowing by small firms is an important

aspect to understand whether borrowers are actually credit constrained when taking into account their different sources of external finance. 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.

5 The impact of the US financial crisis on credit availability for small firms in Central Asia

5.1 Introduction

"Our present crisis is like no other," says CGAP (Consultative Group to Assist the Poor) CEO Elizabeth Littlefield. *"Microfinance is far more connected now. While it still has deeply shock-resistant roots, and many places seem unaffected today, there is little doubt that there will be impact."* Whereas microfinance institutions (MFIs) and their customers have been found to be considerably resilient to the effects of previous financial crises, they are more likely to be affected by the current crisis because they have become more globally integrated in the past decade (e.g. Rhyne and Reddy (2006) and Galema, Lensink and Spierdijk (2008)). The global integration of financial markets contributed to worldwide liquidity and solvency problems of banks and the banking panic in the aftermath of the Lehman collapse in September 2008 which, in turn, is reported to have globally affected credit availability for firms and households (Ivashina and Scharfstein (2008) and Puri, Rocholl and Steffen (2009)). At the same time, firms around the world have been hit by a decline in demand due to the concurrent economic downturn.

The goal of this paper is to understand, on a micro-level, how the current financial crisis, which has its roots in the collapse of the US subprime mortgage market, has globally impacted on bank lending to micro, small and medium enterprises in Central Asia. Does the financial crisis affect MFIs' lending business? Is an observed reduction in credit availability driven by the bank offering less credit or by the borrowers demanding fewer loans? And which types of loans are affected most severely? These questions are of particular interest in the context of microfinance since one of its goals is to generally foster the availability of financial services to small enterprises and poor households.

Among the emerging markets, Eastern Europe and Central Asia (ECA) seem to be hit hardest by the current financial crisis (CGAP (2009)). The region has some of the most elaborated and leveraged microfinance markets and therefore has felt the impacts of liquidity shortages and increased borrower risks very severely (Reille, Kneiding and Martinez (2009)). A survey among 44 MFIs in the ECA region (more than 400 worldwide) conducted by CGAP in early 2009 finds that clients in these

countries seem to be more affected by the crisis than clients in other regions. While urban clients of MFIs are found to be more affected by the crisis than rural ones (CGAP (2009)), there is by now only anecdotal evidence on how exactly MFIs' clients are hit by the crisis. In general, a larger proportion of microenterprises is engaged in the supply of essential goods and services, for which demand fluctuates less even in times of crisis (Littlefield and Kneiding (2009)). SME businesses, in contrast, rather tend to provide non-essential goods and services (such as the sale of furniture and household appliances), for which demand typically decreases in economic downturns. However, it is also possible that micro borrowers are more severely hit by the effects of the crisis since these borrowers have often been the target of (aggressive) consumer lending. Especially in the well developed microfinance markets in Latin America and Eastern Europe the boundaries between micro loans and consumer finance have more and more blurred because often both products are offered by the same staff through the same technologies (e.g. Christen (2001) and Littlefield and Rosenberg (2004)). Thus, many micro entrepreneurs have borrowed from multiple sources and accumulated high levels of debt which makes them vulnerable to even small changes in their income positions. Therefore, the question whether the risks from lending to small and medium borrowers or those arising from microenterprise loans will be more worrisome to lenders remains to be answered empirically.

We analyze a unique dataset including information from all business loan applications and loan contracts of AccessBank Azerbaijan between 2002 and 2009. AccessBank Azerbaijan provides an interesting object of study. While Azerbaijan's banking sector as a whole is still comparatively small and not yet much globally integrated, providing some immunity to the spillovers of a global financial crisis, AccessBank itself is foreign-owned and largely refinanced in foreign currency as are many micro banks in the region. Due to the distortions in international capital markets, which, for instance, made the placement of a microfinance CDO impossible, the bank was hit by unforeseen delays in its refinancing pipeline in the second and third quarters of 2008 although its financial performance remained strong. This provides us with a natural experiment to study the effects of an external refinancing shock on bank lending. Furthermore, Azerbaijan's economy is weakly diversified and highly dependent on the development of the oil price making it vulnerable to the economic crisis that is brought about by the financial crisis. We

therefore explicitly distinguish between refinancing problems and increased borrower risk as the two possible causes for reduced credit availability which arise from the effects of the financial and economic crisis. This distinction is particularly important for policy makers and development practitioners when designing adequate measures to overcome periods of tight credit.

Since we observe loan applications and the bank's decision whether to approve the application as well as the requested and granted loan amounts, we study credit availability in two ways. First, we analyze the determinants of the probability that the bank approves a loan application. Second, we estimate a Heckman selection model to account for the bank's two-stage decision process on whether and to what extent to constrain credit. We therefore analyze the determinants of the ratio of the granted to the requested loan amount given that the loan was approved in the first stage. Furthermore, we assess which loan types (agro, micro and SME) are affected most by the crisis and whether previous bank-borrower relationships help to mitigate credit constraints.

Our empirical strategy allows us to identify three channels through which the financial and economic crisis affects credit availability for microfinance clients. On an individual loan level, we separate two channels of credit constraints by our distinction between loan approval rates and loan volume constraints. Our findings for those borrowers who actually apply for a loan suggest that credit availability for agro loan borrowers is merely affected by the crisis. This is surprising on first sight since agro loans are regularly classified as particularly risky because of their highly correlated risks in case of natural disasters or commodity price fluctuations (e.g. Wenner, Navajas, Trivelli and Tarazona (2007)). In an economic crisis like the current one, however, agro businesses in a country like Azerbaijan remain comparatively unaffected because they mostly produce crops and subsistence goods for local markets. Thus, such loans may offer some stability to a bank's loan portfolio in times of a global financial and economic crisis. The same seems to apply to the diversification into different loan sizes as the micro loans in our sample show a considerably smaller reduction in approval rates due to the crisis than the SME loans which may be explained by their lower risk. SME borrowers whose firms are more likely to be internationally connected therefore have to face the greatest cuts to their credit availability. Overall, we find that credit constraints during the crisis mainly

work via the loan approval channel while volume constraints are of minor importance.

We derive the third channel of credit constraints by analyzing aggregate numbers of loan requests and approvals. Our results suggest that the bank discourages potential borrowers from applying for new loans and existing customers from requesting additional loans during the period of refinancing delays and cancellations in the second and third quarters of 2008. The bank's temporary liquidity squeeze therefore resulted in a slowdown of portfolio growth because lending had to be limited. Lending restrictions were implemented by tighter risk management as in the business loan portfolio mainly SME and high-risk micro loans were restricted. Thus, both the refinancing delays as well as borrowers' increased credit risk seem to mainly reduce credit availability of SME and high-risk micro loans due to the bank's tighter risk management during the crisis. Finally, we find that bank-borrower relationships are an important determinant for increasing credit availability for micro and SME borrowers in times of crises.

The rest of the paper is organized as follows. Section 5.2 embeds the paper into the literature. Section 5.3 provides information on Azerbaijan's economy and how it is affected by the financial crisis. Section 5.4 describes the data and methodology while section 5.5 reports the empirical results. Section 5.6 concludes.

5.2 Literature review

Our paper contributes to three strands of the banking and finance literature: the determinants of access to finance in developing and transition economies, the impact of financial crises on microfinance, and the effects of the current financial crisis on bank lending and the real economy.

The access to finance literature examines factors that affect firms' access to financial services. Determinants vary from factors external to a firm such as the institutional environment to internal firm characteristics. Among those internal factors, not only are the firms' financial means important, but also qualitative information on the firms and their owners, particularly in the case of relationship lending (Boot (2000)). Two determinants of financing constraints which relate to the context of our study are financial development and firm size. Laeven (2003) and Love (2003) find that financial liberalization positively affects credit availability in

developing countries. Beck, Demirgüç-Kunt, Laeven and Maksimovic (2006) show that larger, older, and foreign-owned firms have better access to finance. Similarly, Beck, Demirgüç-Kunt and Maksimovic (2008) report that stronger property rights protection benefits small firms disproportionately in their access to finance. While these studies have established differences in the levels of financial constraints faced by large vs. small firms, there has been relatively little research on the factors that determine credit availability for different firms within the universe of relatively small firms. We add to this literature by studying relatively small firms of various sizes (micro and SME) and different industries (agro vs. non-agro). We also extend the access to finance literature by providing first insights on the micro-level effects of a global financial and economic crisis on the lending activities of a foreign-owned microfinance bank. Global financial connections which are part of the financial development process may have adverse effects on credit availability in times of crises because it facilitates contagion among banks and countries (see e.g. Prasad, Rogoff, Wei and Kose (2003)).

The effects of the current financial and economic crisis on microfinance institutions and their clients can probably best be compared to the performance of MFIs and their portfolios during the East Asian financial crisis of 1997-1998. One of the countries which was most affected by the Asian crisis was Indonesia[52]. McGuire and Conroy (1998) note that default rates in the microfinance sector increased strongly during the crisis. In this context, it is interesting that Patten, Rosengard and Johnston (2001) find differential effects with respect to repayment rates of microfinance compared to SME loans by analyzing the effects of the crisis on Bank Rakyat Indonesia (BRI), one of the largest MFIs in the world. While in the microfinance portfolio nearly no effects on repayment behavior could be observed, nonperformance rates increased tremendously in the SME portfolio, especially for the loans denominated in USD as the rupiah underwent a strong devaluation during the crisis. Their findings imply that micro loans appear to be less risky in times of crises compared to SME loans. Since higher default rates and reduced credit availability may both be outcomes of higher credit risk, we complement these results

[52] Other countries which were strongly affected were Korea and Thailand while Bangladesh and the Philippines felt less impacts of the crisis (Radelet and Sachs (1998a, (1998b)). See also Borensztein and Lee (2002) for an analysis of the credit crunch following the financial crisis in Korea.

by showing that credit availability is similarly less affected for micro loans than for SME loans during the current financial crisis.

Finally, our study adds to the growing literature on the effects of the current financial crisis on bank lending and the question whether these effects are mainly demand or supply driven. Ivashina and Scharfstein (2008) report that new lending in the US syndicated loan market dropped significantly during the crisis with this effect being considerably stronger for banks with less refinancing from deposits and higher risk of credit line drawdowns (e.g. if a bank co-syndicated more credit lines with Lehman). Huang (2009) studies the impact of bank performance on credit supply in terms of takedown volumes of credit lines in the US. The results suggest that mostly higher risk borrowers, borrowers with short relationships and smaller borrowers are affected by their bank's financial situation, i.e. they show lower takedowns when their bank performs badly. Interestingly, these results suggest that credit lines are not perfect substitutes for cash because banks may have the power to influence takedown volumes due to their discretion over whether to waive borrowers' compliance with financial covenants or collateral requirements. In a cross-country study of syndicated loans, De Haas and van Hooren (2009) analyze how banks adjust their lending behavior during a financial crisis. They find that banks increase their monitoring and screening efforts instead of simply cutting lending across the board. They also find that establishing a track-record with the bank through repeated interactions as a means to avoid tightened lending standards seems to be more important in emerging than in developed countries.

While these papers are not able to distinguish between demand and supply effects, Jimenez, Ongena, Peydro and Saurina (2009) and Puri, Rocholl and Steffen (2009) match information from loan applications and loan contracts to disentangle whether reduced credit availability is the result of demand or supply determinants. On the one hand, it seems reasonable to assume that the demand for loans will decrease during a financial and economic crisis due to fewer investment opportunities, especially if the economic downturn in the respective country is severe. On the other hand, Berg and Schrader (2009) find a positive credit demand response after natural disasters such as volcanic eruptions which are aggregate and unpredictable shocks as well. In addition, a slight positive demand effect for a given bank might be possible due to rejections of borrowers at other financial institutions. With respect to the evidence, Jimenez, Ongena, Peydro and Saurina (2009) analyze the effect of economic and monetary

conditions on the availability of credit dependent on firm and bank balance sheet strength for their sample of Spanish firms. They find that tight monetary and economic conditions reduce the likelihood that a loan is granted and that effects seem to work strongly through the bank balance-sheet channel. Puri, Rocholl and Steffen (2009) study the effects of the financial crisis on retail lending at German savings banks and find a general decrease of loan demand after the beginning of the crisis. On the supply side, it turns out that affected banks are less likely to grant loans but that bank relationships help to mitigate this effect. Our paper is most closely related to the latter two studies since we are also able to distinguish between loan applications and loans granted. However, our study is, to the best of our knowledge, the first to provide loan-level evidence on the impacts of the current crisis on credit availability for micro, small and medium firms in an emerging market economy.

5.3 Azerbaijan's economy and the financial crisis

Azerbaijan's economy is highly dependent on the oil and gas sector. The high real growth rates of 12 percent on average since 1998 with a peak in 2007 of 25 percent would not have been possible without the oil sector which accounts for about 60 percent of GDP and 95 percent of all exports (Economist Intelligence Unit (2009)). Furthermore, even though growth was strong, it is concentrated in urban areas and in the extractive sectors leading to high disparities within the country. Thus, while the average per capita income (in PPP) was at 11,413 USD in 2008 – corresponding de facto to a middle income country –an estimated 20 percent of the whole population still lives in poverty (Economist Intelligence Unit (2009), Hübner and Jainzik (2009)). Furthermore, the omnipresent corruption and state interventions in the economy are hindering the future development of the country.[53]

The banking sector in Azerbaijan has shown high growth rates over the last years, starting from a relatively low level. Total sector assets grew by 78 percent to 8 billion USD in 2007 while the total loan portfolio increased by 102 percent to 5.4 billion USD (Central Bank Azerbaijan (2008)). Yet, financial intermediation measured as total banking assets over GDP is with 27 percent at year end 2007 still

[53] In 2008, Azerbaijan has ranked 158th out of 180 countries on the list of Transparency International (Transparency International (2008)).

low.[54] The sector remains highly concentrated with the only state-owned bank (International Bank of Azerbaijan) accounting for 39 percent of total banking assets in April 2009. Besides of the private and state-owned banks, there exist 96 non-bank financial institutions. The microfinance sector is targeted by 12 banks and 20 non-banks. Yet, even though the high number of banks may lead to the impression that the country is over-banked, access to credit especially for micro and small enterprises (MSEs) remains one of the main impediments for further growth especially in rural areas.

Deposits are an important source of refinancing for the banking sector, but the limited trust of the population in the banking sector leads to a considerable number of households still keeping their savings under the mattress. Yet, deposits have been growing over the last years (44.7% in 2008). Nevertheless, access to long-term refinancing sources remains a challenge for the sector even more during the financial crisis.

The global financial and economic crisis has affected Azerbaijan's economy with growth being expected to slow down in 2009 to no more than 3% (Economist Intelligence Unit (2009)) from a growth rate of 25% in 2007. Compared to other CIS countries such as Georgia, the Ukraine or Russia the overall macroeconomic and financial situation seems rather comfortable due to the high growth rates and the constant inflow of hard currency during the years before the crisis. While other CIS countries suffered from high currency devaluation, Azerbaijan's local currency, the Manat, remained stable. This stability can be associated with interventions of the Central Bank which, among other measures, spent 1.2 billion USD to keep the currency stable (Hübner and Jainzik (2009)). These interventions were important to maintain confidence in the currency. Yet, without the underlying economic fundamentals being at least more promising than in the rest of the region, these short-term supporting measures would not have kept the Manat stable in more than the short run.

However, what was felt in the economy and in particular in sectors such as trade and construction was the drop in oil prices. Sectors that remained more or less unaffected were those which are mainly independent from international markets such

[54] For means of comparison, Georgia and Russia have financial intermediation ratios of 42 and 52 percent, respectively.

as agriculture. Thus, the vulnerability of the Azerbaijani economy mainly stems from the lacking diversification which will remain a challenge for the future.

With respect to the banking sector, indeed most banks had to stop lending at some point and the quality of the loan portfolio deteriorated from 2.2 to 3.2 percent of loans being delinquent by more than 90 days in the first quarter of 2009 (Central Bank Azerbaijan (2009)). Furthermore, those official figures reported by the Central Bank of Azerbaijan are most likely underestimating the actual figures as restructured loans, for instance, are not included. With respect to deposits, crisis-effects were visible as business clients increasingly withdrew their savings to keep their businesses going and households attempted to convert their savings from Manat to USD due to their fear that the Manat would devaluate. However, as the liquidity and funding situation of the Azerbaijani banks tightened in the third quarter of 2008, the Central Bank provided comprehensive stabilization measures which included, among others, an emergency facility for liquidity support and a decrease in the refinancing interest rate from 12 to 3 percent (Hübner and Jainzik (2009)). And while the low financial intermediation would otherwise be considered unsatisfactory, it helped the banking sector to remain somewhat immune against the effects of the crisis as the sector as a whole is only integrated into global financial markets in a limited way. Nevertheless, those few banks which are globally connected directly felt the effects of the turmoil in financial markets. Apart from that, all Azeri banks have had to deal with a possible increase in their customers' risks.

5.4 Data and methodology

5.4.1 The dataset

The data we use for the empirical analysis was generated using the Management Information System of AccessBank Azerbaijan. The data ranges from the first month of operation in November 2002 to August 2009 and therewith covers a period of close to seven years of operation and also a sufficient period for analyzing the effects of the financial and economic crisis.

The mission of AccessBank is to provide financial services at European standards to micro and small businesses and low and medium income families while also

offering products for larger enterprises.[55] AccessBank was founded by international financial institutions in October 2002 under the name Micro Finance Bank of Azerbaijan (MFBA). The bank has a full banking license and is a closed stock company under Azerbaijani law. Until today, AccessBank is the only fully-fledged bank targeting the micro and small business sector in Azerbaijan. The shareholders of the bank are with 20 percent each the European Bank for Reconstruction and Development (EBRD), the International Finance Corporation (IFC), the German Development Bank KfW and the Black Sea Trade & Development Bank (BSTDB) as well as the Access Microfinance Holding AG (16.53%) and the consultant LFS (3.47%).

With respect to debt refinancing, the bank has attracted refinancing funds from various international financial institutions (not only the shareholders) and has received two funds denominated in Manat from private capital sources. AccessBank has been rated BB+ by Fitch Ratings – the highest rating in Azerbaijan – which has helped the bank to complete the first bond issue on international capital markets by an Azeri issuer in 2008. The deposit portfolio of the bank is growing and its overall strong performance during the financial crisis has helped to attract various refinancing loans from the international (private) capital market so that the refinancing pipeline of the bank is strong.

Nevertheless, the bank's refinancing position was temporarily affected by the financial crisis in the second and third quarters of 2008 so that it did not have as much capital as would have been needed to meet total credit demand. This was not caused by a change in the investors' perception of the institution but by the turmoil in capital markets which induced the cancellation of and delay in international refinancing. International capital markets were unable to provide the necessary liquidity because, for instance, a planned microfinance CDO could not be placed in the prevailing environment.

Besides of the central branch in Baku, AccessBank has 22 branches located all over the country both in rural and urban areas. As of July 2009, the loan portfolio is concentrated in the trade sector (60% of outstanding loan amount, 40% of outstanding number of loans) and in the Baku area (62% of outstanding loan amount, 46% of outstanding number of loans). However, services and agriculture have

[55] See http://www.accessbank.az/en/index.html or AccessBank (2008) for detailed information on the bank and its business activity.

increased in importance as have other regions of Azerbaijan. With respect to the total number of clients, AccessBank is with 63,432 business loan clients in July 2009 the leading bank in Azerbaijan. The market share of AccessBank was at 2.7% measured by the bank's share of total banking assets while in the microfinance sector, the bank has a total market share of 38%. In particular due to the fact that AccessBank did not face serious long-lasting shortages of funds during the crisis and had to limit its lending business only for a short period of time, the bank was able to gain in market share and is now one of the ten biggest banks in Azerbaijan in terms of total loan portfolio. The bank has been profitable since 2004 and in 2008 the return on equity was at 44.4 percent. The portfolio quality is very good with a portfolio at risk (PAR>30 days) of below 1 percent in mid 2009.

The total business loan portfolio at the end of July 2009 was at 235 million USD. The total number of business loans was at 65,238 of which 95 percent can be characterized as micro loans as they have a value of up to 10,000 USD. Besides of business loans, the bank offers retail and staff loans, yet business lending is the focus of the bank. Within the business portfolio, micro, small, and medium loans are offered. The various products not only differ by their loan sizes but also with respect to the loan granting process. While a personal visit of the loan officer is part of the rigorous financial analysis of all business clients, the analysis is more structured for SME loans including the consideration of longer time-periods and financial projections. Therefore, the loan terms of SME loans (loans with amounts of more than 10,000 USD and up to 500,000 USD) capture a broader range of individual risk factors, whereas loan terms for micro loans are more standardized due to their small amounts. Finally, an agro loan product was developed in 2007 which explicitly targets farmers and the agricultural sector by offering flexible disbursement and repayment schemes tied to the agricultural cycles and the respective cash-flows of agro-businesses.

Given the differences between the various loan types and the clients they target, we treat agro, micro and SME loans separately throughout our analysis. In total, the bank disbursed 251,211 loans to 151,533 clients during the observation period. For each loan the dataset includes information on the loan amount requested by the borrower as stated in the loan application form as well as the granted loan terms (amount, maturity, currency and collateral) as stated in the loan contract. Furthermore, the data not only contains detailed information on the actual clients, but

also on those who applied for a loan, but were rejected. Table 23 provides definitions of all variables.

We exclude all observations with missing loan or firm characteristics. Since we are interested in the effect of the US financial crisis on the availability of credit for firms that need loans to finance their business operations, we focus our analysis on investment loans and exclude all retail loans to private households and loans to bank staff. This leaves us with our final sample of 184,881 loans to 97,252 firms.

Table 23. Variable definitions

Variable	Definition
Dependent variables	
Approved	Borrower's loan request was approved (1=yes, 0=no)
Granted-requested ratio	Share of the requested loan amount that was granted by the bank
Loan characteristics	
Crisis	Loan was granted after the collapse of Lehman (1=yes, 0=no)
Agro	Loan is an agro loan (1=yes, 0=no)
Micro	Loan is a micro loan with an amount up to 10,000 USD (1=yes, 0=no)
SME	Loan is an SME loan with an amount between 10,000 and 500,000 USD (1=yes, 0=no)
Requested amount	Requested loan amount (USD)
Collateral	Value of collateral (USD)
Repeat loan	Loan is a repeat loan vs. first loan (1=yes, 0=no)
Manat	Loan is denominated in AZN (local currency) vs. USD (1=yes, 0=no)
Branch	Branch dummies which are one if loan was granted at one of the following branches: Baku, Gyanja, Jalilabad, Khachmaz, Lenkoran, Mingachevir, Qazax, Salyan, Sheki, Sumqayit and Zagatala
Firm characteristics	
Age	Age of firm owner at date of disbursement (years)
Male	Firm owner is male vs. female (1=yes, 0=no)
Married	Firm owner is married at date of disbursement (1=yes, 0=no)

5.4.2 The bank's business loan portfolio

Table 24 provides a detailed overview of the bank's business loan portfolio during the observation period. While Panel A shows the number of disbursed loans by year for our three loan categories of agro, micro and SME loans and the number of rejected loans, Panel B displays the respective total volumes of the loans disbursed. The majority of loans in our sample are micro loans (75% in terms of numbers and 56% in terms of volume) with a loan size of up to 10,000 USD. However, when considering total loan volumes, it becomes clear that SME loans make up a sizable

part of the bank's business loan portfolio with a share of 35%. Agro loans, which were introduced only quite recently, seem to play an increasingly important role in the bank's lending business. Rejection rates were substantial in the beginning of the bank's operations but have come down to less than 6% in 2009. One explanation is that the bank deals with more and more repeat clients over time so that it can assess their credit risk better due to reduced informational asymmetries. At the same time, (potential) borrowers might have become acquainted to the bank's loan granting standards and have learnt to better self-assess whether their loan application will be successful or turned down (see Kirschenmann (2010) for borrower learning in repeated interactions with the same lender).

Table 24. Lending by year and loan type

This table reports statistics on the bank's loan portfolio for the full sample and the following subsamples: Agro: Loans intended for agricultural investments. Micro: Loans with loan amounts up to 10,000 USD (from 2008: also with amounts up to 20,000 USD). SME: Loans with loan amounts of more than 10,000 USD and up to 500,000 USD. Rejected: Loan applications that were turned down by the bank.

Panel A. Number of loans disbursed and rejected

	Rejected	Agro	Micro	SME	Total
2002	80		104		184
2003	503		2,888	66	3,457
2004	860		3,583	154	4,597
2005	1,010		6,789	369	8,168
2006	1,363		16,561	739	18,663
2007	2,408	2,163	32,661	1,202	38,434
2008	3,086	10,105	41,349	1,523	56,063
2009	3,144	15,635	35,589	947	55,315
Total	12,454	27,903	139,524	5,000	184,881

Panel B. Volume of loans disbursed (USD)

	Agro	Micro	SME	Total
2002		115,535		115,535
2003		5,788,970	1,292,500	7,081,470
2004		6,597,272	3,828,095	10,425,367
2005		13,754,232	11,831,532	25,585,765
2006		32,239,557	28,260,126	60,499,683
2007	3,655,380	69,632,677	50,910,208	124,198,266
2008	22,266,514	125,173,771	81,594,199	229,014,584
2009	33,719,686	112,488,057	49,922,596	196,130,338
Total	59,641,579	365,770,172	227,639,257	653,051,008

Since we observe both loan applications and actually granted loans we are able to establish the impact of the financial crisis on borrowers' requests and the bank's decision to approve or reject the loan application and to assess whether the three subgroups of loans are affected differently.

Figure 9. Loan applications and approvals for new vs. repeat borrowers

Figure 9A. Agro loans

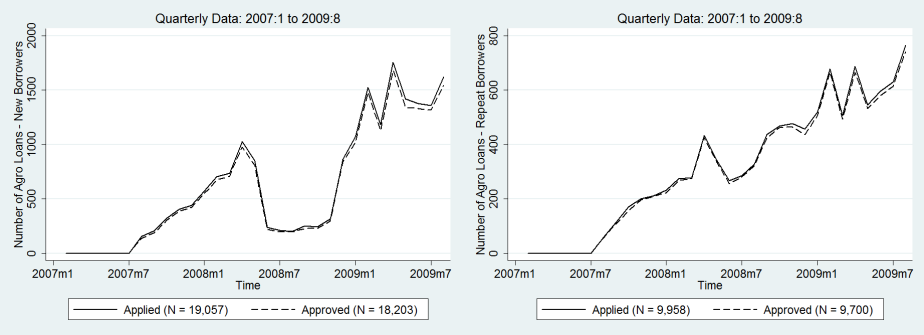


Figure 9B. Micro loans

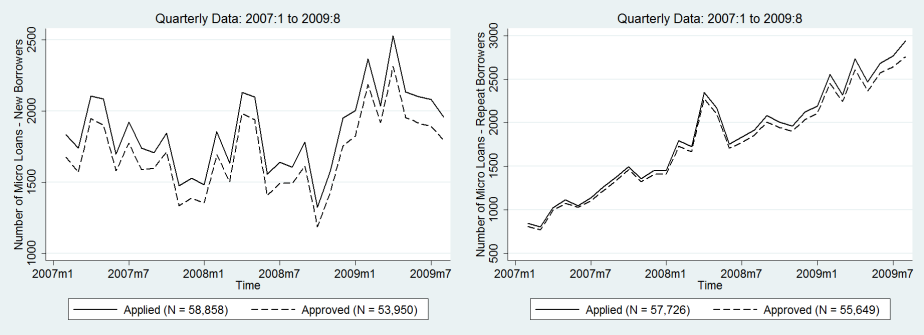


Figure 9C. SME loans

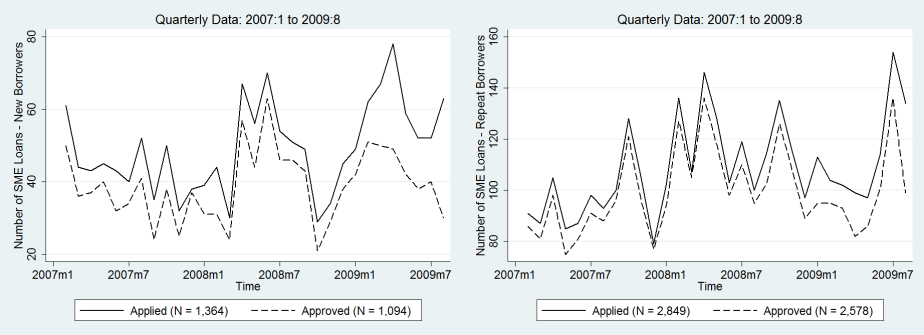


Figure 9 displays the number of loan applications and loan approvals during the period 2007 to 2009 for new vs. repeat borrowers in our three subsamples respectively. We focus the analysis on this time period because two major events that

may influence loan demand and supply decisions occurred in the meanwhile. Firstly, the financial crisis reached its peak with the collapse of Lehman Brothers Holdings Inc. in September 2008. This led not only to worldwide turmoil in financial markets but also attributed to the sharp decline in oil prices and therefore affected both the Azerbaijani economy and its banking sector. Secondly, although AccessBank's financial performance was strong, it experienced delays in its refinancing pipeline especially during the second and third quarters of 2008 because the capital markets were not able to provide the necessary liquidity. Together with the strong portfolio growth, these unexpected refinancing difficulties forced the bank to introduce limits on lending and portfolio growth which was done in accordance with risk considerations.

Generally, while the first event may decrease loan applications as well as approvals, the second event should mainly influence the bank's ability to meet given loan requests. However, the refinancing problems may also mirror themselves in the number of loan applications because of the particular marketing strategy of AccessBank (and similar micro banks). To attract new borrowers, the bank's loan officers visit the surrounding potential clients and call their attention to the bank's business. Otherwise, many potential borrowers would never learn that they are eligible for credit and how much they are actually able to take and repay. During the time of tight refinancing, the bank curtailed this active marketing of its products (e.g. loan officers were encouraged to take vacation) and therefore the number of loan applications may also decline due to the squeeze in the bank's liquidity.

Figure 9 shows that loan applications and approvals develop differently for the three subgroups. Agro loan applications drop considerably between March and June 2008, especially for new agro borrowers. This is due to a combination of seasonal effects as agro clients' income streams peak in spring and summer and stricter risk management due to the tightened refinancing situation which induced the bank to limit marginal (very small) lending that was often found not to be used for business enhancement in the past. Interestingly, loan applications of repeat borrowers decrease much less while they steadily increase for both new and repeat borrowers after this short period of retrenchment (Figure 9A). This is a first indication that the agricultural sector remained mostly unaffected by the financial crisis. Nevertheless, the bank's refinancing difficulties and the subsequent introduction of tighter eligibility criteria during the second and third quarters of 2008 clearly affect agro

lending because clients were obviously deterred from applying for loans. *Loan approval rates* (approved loans as a share of applied loans)[56] slightly decrease during that period for the new borrowers but remain at a high level of more than 95% afterwards. Thus, while the bank obviously refrains from attracting new borrowers during the time of refinancing difficulties, it is still willing and able to meet most of the demand of those agro clients who actually request a loan.

For micro loans, we similarly observe a considerable decrease in loan applications in the second quarter of 2008 and another decrease following the failure of Lehman in autumn 2008 (Figure 9B). These findings suggest that both the bank's liquidity squeeze, again via tighter risk management, as well as the general economic impacts of the Lehman failure affected micro borrowers' credit availability. This is also confirmed by the clear downward trend in *approval rates* for micro loans after mid 2008. While approval rates for new micro loans are on average about 4 percentage points lower than for repeat micro loans, they particularly decrease during 2008, which may reflect that borrowers who were rejected at other banks turned to AccessBank and were denied a loan because they were the higher-risk borrowers.

Figure 9C reveals that the demand for new and repeat SME loans is more volatile; however there is also a clear decline in the number of loan applications after March 2008. For the repeat SME loans this decline is longer-lasting in comparison to the agro and micro loans indicating that the comparatively bigger firms in our sample are more seriously hit by the crisis. Since these firms are more likely to be internationally connected, they may have to cope with a larger and more persistent decrease in demand for their products. Agro and micro businesses, on the contrary, mostly produce subsistence goods and therefore remain better insulated from the effects of the financial and economic crisis. Furthermore, SME clients are more likely to finance fixed assets which are first to be postponed in times of crises while micro clients often take out working capital loans. Finally, with a decrease in housing prices in Azerbaijan, borrowing to finance real estate became less attractive. Considering the *approval rates* of SME loans, we observe a negative trend starting during the third quarter of 2008. Approval rates for SME loans decrease much more than for agro and micro loans from around 90% to 50% for new SME loans and from above 95% to 75% for repeat SME loans which seems to reflect the increased risk

[56] Separate graphs for the approval rates are available from the authors upon request.

associated with SME loans. A further explanation may be that it is easier and cheaper for the bank to "save" a certain amount of liquidity by denying some SME loans in contrast to a large number of micro loans.

To sum up, Figure 9 suggests that both external events have an impact on the lending operations of AccessBank but that these effects vary for the three different types of loans. While credit availability for agro and micro borrowers decreases for a very short period due to the stricter risk management induced by the bank's refinancing difficulties, credit availability for SME borrowers is tightened more persistently. For the latter not only reduced supply possibilities due to missing refinancing funds but also factors such as increased firm risk, especially after the Lehman failure, seem to play an important role.[57] Thus, we do not find support for the conjecture that micro clients may be mostly affected by the crisis due to their high indebtedness from multiple (consumer) lenders. Moreover, the analysis of approval rates shows that previous bank relationships benefit borrowers by better credit availability and help to mitigate the negative crisis effects which is in line with the findings of Berg and Schrader (2009).

Additionally and importantly, Figure 9 establishes the different mechanisms by which the refinancing and the Lehman effect influence credit availability. The refinancing delays seem to mainly affect the number of loan applications and much less the probability of receiving a loan, whereas the Lehman effect is especially important for SME loans and to a lower extent for micro loans, driving down both loan applications and approval rates after September 2008. Therefore, the refinancing effect reveals itself on an aggregate level but the Lehman effect may also be observed on an individual level. As the structure of our dataset allows us to measure credit availability on an individual level, a crucial part of the following analysis will be concerned with the impact of the crisis (measured by the Lehman failure) on credit availability in the three subgroups of loans.

5.4.3 Determinants of credit availability

We analyze the effects of the current financial crisis on the availability of credit for our sample of agro, micro and SME loans in two steps. First, we estimate a linear

[57] Analyzing total loan volumes and volume constraints also reveal that SME borrowers are most affected by the crisis.

probability model (LPM)[58] in which the dependent variable $\Pr(\textit{Approved})_{i,\,k,\,t}$ is the probability of firm *i* to receive loan *k* in period *t*:

$$\Pr(\textit{Approved})_{i,k,t} = \alpha_i + \beta_1 C_{k,t} + \beta_2 L_{k,t} + \beta_3 F_{i,t} + \beta_4 T_t + \varepsilon_{i,k,t} \qquad (8)$$

$C_{k,t}$ is a dummy variable that indicates whether loan k was disbursed during the crisis while $L_{k,t}$ and $F_{i,t}$ are vectors of loan and firm characteristics including 11 bank branch dummies that control for the location of loan origination. Finally, T_t is a time trend accounting for the general macroeconomic conditions at the time of loan origination.

Credit availability not only refers to the incidence whether a loan application is turned into a loan granted but also to the wedge between the granted amount and the requested amount for those loans that were approved. In a second step we therefore estimate a Heckman selection model. Since the extent of loan amount constraints is only observed for those loans which are actually approved and since approval is likely to be non-random, estimates of a simple OLS model would suffer from selection bias. A Heckman selection model incorporates the possible dependence in the two stages of the model and produces estimates that allow for predictions for the population and not only for the subsample of approved loans. We estimate equation (8) as the selection equation to obtain inverse Mill's ratios which we then include in the outcome equation to account for the selection. To estimate unbiased second-stage standard errors in the presence of a regressor that depends on the first-stage parameter estimates, we bootstrap the standard errors using 50 replications. The dependent variable of the outcome equation is $\textit{Granted-requested ratio}_{i,\,k,\,t}$ which is the share of the requested loan amount that was finally granted by the bank and therefore higher values of the variable indicate higher credit availability (or equivalently, lower credit constraints):

$$\textit{Granted-requested ratio}_{i,\,k,\,t} = \alpha_i + \beta_1 C_{k,t} + \beta_2 L_{k,t} + \beta_3 F_{i,t} + \beta_4 T_t + \varepsilon_{i,k,t} \qquad (9)$$

[58] We re-estimate all our regressions using probit and logit models. Since the estimates remain qualitatively the same, we restrict the presentation of results to the LPM models since they are easier to interpret.

All variables and vectors are defined as above. However, we exclude the branch dummies from the outcome equation and use them to identify the first stage regression. Branch specific effects such as the number and experience of loan officers should determine a branch's capacity to make loans (approval decision). The actual degree of constraint, in turn, should essentially be determined by the individual relationship, firm, and loan characteristics (loan amount decision).

Crisis indicator and loan characteristics

To measure the impact of the financial crisis, we include the dummy variable *Crisis* which is equal to one for those loans disbursed after the failure of Lehman Brothers Holdings Inc. in September 2008 and zero otherwise. We account for the structure of the bank's loan portfolio by introducing the dummy variables *Agro*, *Micro* and *SME* which are one if the loan is an agro, micro or SME loan, respectively.

If a firm requests a very high loan amount, the bank may be more likely to reject the loan application or to grant a considerably lower loan amount. Therefore, we include the variable *Requested amount* which is the requested loan amount in USD. The bank's decision to grant a loan and its willingness to grant the requested amount should critically depend on the perceived risk of the loan. One means to make a loan safer is to pledge collateral. We include the variable *Collateral* which is the value of the pledged collateral in USD. Additionally, we include *Repeat loan* as a relationship indicator since close bank-borrower relationships have been found to increase credit availability (e.g. Petersen and Rajan (1994)).[59] It is a dummy variable indicating whether a loan is a firm's later vs. first loan. We expect the bank to be able to gather valuable private information when interacting repeatedly with the same borrower, which, in turn, may benefit the borrower (see Allen and Gale (1999), Boot (2000) and Ongena and Smith (2000)). The dummy variable *Manat* indicates whether a loan is denominated in local currency (AZN) vs. USD.

[59] We repeat all estimations with two other relationship measures, the length of the bank-borrower relationship and the number of times a borrower has taken out a loan before the current loan, and find that results remain qualitatively unchanged.

Firm characteristics

We include several firm characteristics that may influence the bank's decision to grant a loan and, if it does so, which amount to grant. Since most of the firms in the sample are run by their owners, owner characteristics are of particular importance. First of all, we include the borrower's *Age* (in years). On the one hand, it may be negatively related to credit availability because older firm owners who are close to retirement have a lower incentive to keep a good credit record in order to receive future loans if their reputation cannot be transferred to their successor (see Ortiz-Molina and Penas (2008)). On the other hand, older firm owners may be more experienced and therefore less risky borrowers, which would mean a positive relation between borrower's age and credit availability.

In microfinance, often the argument is made that women are better borrowers because they are more reliable in repaying their loans (e.g. Armendariz de Aghion and Murdoch (2005)). To capture a possible gender effect, we include the dummy variable *Male* which is one if the borrower is male and zero if she is female. A similar reasoning might be true for a *Married* (dummy variable that is one if the borrower is married and zero otherwise) borrower who has responsibility towards a family.

5.4.4 Summary statistics

Table 25 presents summary statistics of our loan and firm variables for the approved loans. Panel A provides statistics for the full sample, whereas Panel B displays sample means by loan category for the periods before and during the crisis.

Panel A shows that most of the loan applications in our sample are successful (*Approved)*, but that the bank makes use of loan size constraints. Borrowers who receive a loan are, on average, granted only 83% of their requested amounts. The statistics confirm that the majority of approved loans in our sample are micro loans with an average *Requested amount* of 4,698 USD. Interestingly, loans are regularly collateralized at clearly more than 100% with the value of *Collateral* having an average value of more than 14,000 USD. Considering firm characteristics, the majority of borrowers are *Male* (83%) and *Married* (73%).

Table 25. Descriptive statistics

This table displays summary statistics for our loan and firm variables. See Table 23 for definitions of all variables. Note that only approved loans are included in the calculations.

Panel A: Loan and firm characteristics (of approved loans)

	N	Mean	Minimum	Maximum
Loan characteristics				
Approved	184,881	0.93	0	1
Granted-requested ratio	172,427	0.83	0.04	2
Crisis	172,427	0.38	0	1
Agro	172,427	0.16	0	1
Micro	172,427	0.81	0	1
SME	172,427	0.03	0	1
Requested amount	172,427	4,698	100	1,000,000
Collateral	172,427	14,494	0	3,717,322
Repeat loan	172,427	0.47	0	1
Manat	172,427	0.57	0	1
Firm characteristics				
Age	172,427	42.11	19	87
Male	172,427	0.83	0	1
Married	172,427	0.73	0	1

Panel B. Sample means by loan type and crisis

This table reports sample means of our loan and firm variables for the periods before and after the Lehman failure (*Crisis*) for the following subsamples: *Agro*: Loans intended for agricultural investments. *Micro*: Loans with loan amounts up to 10,000 USD (from 2008: also with amounts up to 20,000 USD). *SME*: Loans with loan amounts of more than 10,000 USD and up to 500,000 USD. ***, **, * 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. Note that summary statistics for the variable *Approved* are calculated including all loans while for all other variables only those loans that were approved by the bank are included in the calculations.

	Agro loans			Micro loans			SME loans		
	Crisis = 0 N = 9,956	Crisis = 1 N = 19,059	Diff	Crisis = 0 N = 101,239	Crisis = 1 N = 48,867	Diff	Crisis = 0 N = 4,195	Crisis = 1 N = 1,565	Diff
Loan characteristics									
Approved	0.958	0.964	-0.006 **	0.925	0.938	-0.013 ***	0.883	0.829	0.054 ***
Granted-requested ratio	0.851	0.835	0.017 ***	0.824	0.823	0.001	0.842	0.831	0.011 *
Requested amount	2,447	2,709	-262 ***	2,871	3,878	-1,006 ***	55,076	66,525	-11,450 ***
Collateral	6,293	5,993	300 ***	9,570	8,385	1,185 ***	198,975	240,033	-41,058 ***
Repeat loan	0.37	0.34	0.04 ***	0.46	0.56	-0.10 ***	0.66	0.71	-0.05 ***
Manat	0.78	0.90	-0.12 ***	0.45	0.69	-0.24 ***	0.02	0.01	0.01
Firm characteristics									
Age	44.18	43.68	0.50 ***	42.09	40.98	1.12 ***	43.3	42.57	0.73 ***
Male	0.89	0.90	-0.01 **	0.83	0.80	0.03 ***	0.91	0.91	0.01
Married	0.79	0.79	-0.00	0.72	0.70	0.02 ***	0.84	0.81	0.03 *

Panel B of Table 25 presents statistics for the three loan categories of agro, micro and SME loans. To assess changes in loan terms and the borrower pool along the crisis, it compares loan and firm characteristics of approved loans for the time before and after the Lehman failure. The statistics confirm that the availability of agro loans was only little affected by the crisis. Approval rates slightly increase while the *Granted-requested ratio* decreases by less than 2 percentage points. For micro loans, the impact of the crisis on the credit availability is relatively small as well. For SME loans, however, the probability that a loan application is *Approved* decreases by 5 percentage points after the Lehman failure. In addition, the *Granted-requested ratio* also drops, but only to a small extent. The average *Requested amount* for agro and micro loans increases regardless of the distortions in international financial markets in the aftermath of the Lehman collapse. This is similar to Berg and Schrader (2009) who find increased demand of micro borrowers after unexpected external shocks such as volcanic eruptions. SME loans show a larger average *Requested amount* after Lehman as well, but in contrast to the other loan groups they also turn out to be more collateralized after Lehman which may be due to the increased risk associated with SME loans.

Establishing good bank-borrower relationships seems to be especially important for micro and SME clients as the share of repeat loans increases for both loan groups during the crisis. This confirms the graphical analysis in Figure 9 that relationship lending helps to enhance credit availability in times of crises. Interestingly, the financial crisis influences the denomination of agro and micro loans considerably. After the Lehman failure 90% of agro loans and 69% of micro loans are denominated in local currency (*Manat*) compared to 78% and 45% before. This finding can be explained by the fear of a depreciation of the local currency towards the USD after the currencies of neighboring countries such as Russia and Kazakhstan plunged considerably due to the financial and economic crisis. Even though the Manat did in fact only depreciate little, especially small borrowers nevertheless demanded more loans in local compared to foreign currency as their income is mostly in local currency as well. The statistics on firm characteristics imply that the pool of borrowers is little affected by the crisis.

5.5 Results

5.5.1 Determinants of the likelihood that a loan application is approved

Table 26 displays regression results for the determinants of the bank's decision to approve a loan application for the full sample and for the three subsamples based on our loan type categories. Standard errors are reported in parentheses and are adjusted for clustering at the borrower level.

Effects of loan and firm characteristics on loan approval

Columns (1) and (2) present estimates of the LPM regressions for the full sample. The results confirm the main hypothesis: the crisis has a negative impact on credit approval rates, but the likelihood that a loan application is approved varies significantly for agro, micro and SME loans.

The estimates in Column (1) reveal several interesting findings. The variable *Crisis*, which captures the effect of the Lehman failure and the subsequent turmoil in capital markets, shows that loan applications made after September 2008 have, on average, a 3.8% lower chance to be approved. *Agro* and *Micro* loan applications are significantly more likely to be successful than SME loan applications (the base category). On average, agro (micro) loan applications have a 12.5% (9.4%) higher probability to be finally granted compared to SME loan applications. To study how the relation between our loan groups and the probability of loan approval is influenced by the crisis, we introduce the interaction terms *Agro*Crisis* and *Micro*Crisis* in column (2). Both interaction terms and both main effects are significantly positive. This means that the probability to be granted a loan is not only higher for agro and micro loans compared to SME loans before the failure of Lehman but that this effect is even more pronounced after Lehman. For instance, before Lehman *Agro* loans have a 9.7% higher probability to be approved than SME loans. After Lehman, this difference in probabilities increases by another 8.3%. The effects are qualitatively the same for *Micro* loans, yet they are economically smaller.

These results relate to the specific structure of Azerbaijan's economy with its larger firms being more dependent on oil price fluctuations and international economic developments and therefore being more affected by the crisis. Micro firms, on the contrary, rather produce subsistence goods or deliver essential services and agro borrowers mostly grow fruit and vegetables or raise sheep for the local market

so that both are considerably less affected by the crisis. These varying levels of affectedness seem to influence the bank's risk assessment of firms and to finally translate into accordingly varying levels of credit availability. Apart from that, it is plausible to assume that it is easier for the bank to "save" refinancing funds by cutting SME in contrast to micro lending which additionally explains that credit availability is mostly affected for SME borrowers.

The economic relevance of the effects of the other loan characteristics *Requested amount* and *Collateral* is very low, but the estimates are statistically significant and their signs are in line with economic reasoning. All else equal, borrowers who request larger loan amounts are less likely to receive a loan indicating that they may be comparatively risky. Providing *Collateral*, by contrast, increases the probability to be granted a loan, all else equal, because such loans are safer in the sense that the pledged asset may be sold in case of default. Furthermore, we find that bank relationships are valuable because being a repeat borrower strongly increases the likelihood to receive a loan by 5.7%. This result is in line with findings from the US and Europe (see e.g. Cole (1998) and Angelini, Di Salvo and Ferri (1998) and for a comprehensive overview Degryse, Kim and Ongena (2009)). Loans that are denominated in the local currency *Manat* have a higher probability to be approved. The reason is that most of the agro and micro loans are denominated in local currency which at the same time reduces their inherent credit risk as agro and micro enterprises are likely to earn the majority of their income in local currency. Besides, the missing refinancing funds during the second and third quarters of 2008 were to be denominated in USD which may also have impacted on the preferred lending currency.

Turning to the firm characteristics, the estimates reveal that *Married* borrowers indeed have a 1.2% higher probability to receive a loan than unmarried borrowers.

Effects of loan and firm characteristics for agro, micro and SME loans respectively

Columns (3) to (5) of Table 26 report estimates of LPM regressions for agro, micro and SME loans respectively to further disentangle differences in the factors determining loan approval rates for these three categories. The separate regressions confirm our findings from the full sample specifications. They reveal that our *Crisis* indicator does not have any impact on loan approvals for agro loans. For both micro

and SME loans, the probability to receive a loan decreases after the Lehman failure with the effect being considerably stronger for SME loans (8.2% vs. 4.3%).

Being a repeat borrower is crucial for increasing credit availability for all three loan groups. Nevertheless, it seems to play the most important role when applying for an SME loan. Since SME loans involve considerably larger loan amounts, the information gathered from previous interactions with borrowers may be most valuable in this segment. Interestingly, the denomination of the loan influences credit availability adversely for the three loan groups. While agro and micro loans are more likely to be approved when they are denominated in *Manat*, SME loans in manat are less likely to be granted. One explanation for this result lies in the bank's refinancing structure. Since it receives most of its funding in USD, it has an incentive to lend on in foreign currency to prevent currency mismatches on its own balance sheet. At the same time, the bank seems to channel its funds according to the borrowers' abilities to deal with foreign currency risks. Agro and micro loans which are granted to very small businesses that probably do not earn foreign currency have a higher probability to be approved in local currency. SMEs, on the contrary, are likely to be more capable to handle USD loans or even earn (some of) their income in USD. Thus, for the larger SME loans the bank insists on lending in USD to hedge at least part of its currency risk (Brown, Kirschenmann and Ongena (2009) provide similar evidence for micro and SME lending in Bulgaria).

Turning to the impact of the firm characteristics, we find that only the variable *Married* has a uniform, significantly positive impact on loan approval rates for all three loan categories. Of all our firm characteristics it seems to provide the strongest signal to the bank. The borrower's gender has only a small economic effect on credit approvals, but it works in the opposite direction for agro vs. micro loans. For agro loans, being *Male* decreases the probability to receive a loan which is line with the notion that women are the more reliable borrowers (Armendariz de Aghion and Murdoch (2005)). Yet, male borrowers who request micro loans have a higher probability to succeed in applying for a loan in comparison to female borrowers. Finally, a borrower's *Age* plays a minor role in determining credit availability and is only significant for SME loans with a one standard deviation increase in borrowers' age (10 years) decreasing the loan approval rate by only 1%.

Table 26. Loan approvals: loan and firm determinants

This table reports results from LPM regressions for the full sample and the following subsamples: *Agro*: Loans intended for agricultural investments. *Micro*: Loans with loan amounts up to 10,000 USD (from 2008: also with amounts up to 20,000 USD). *SME*: Loans with loan amounts of more than 10,000 USD and up to 500,000 USD. Standard errors are reported in parentheses and account for clustering at the borrower level. The dependent variable is *Approved* which is a dummy variable indicating whether a loan application was approved by the bank or rejected. All explanatory variables are defined in Table 23. ***, **, * denote significance at the 0.01-, 0.05- and 0.1-level.

	(1) Full sample	(2) Full sample	(3) Agro loans	(4) Micro loans	(5) SME loans
Crisis	-0.038***	-0.105***	0.004	-0.043***	-0.082***
	(0.002)	(0.010)	(0.005)	(0.002)	(0.013)
Agro	0.125***	0.097***			
	(0.008)	(0.008)			
Micro	0.094***	0.078***			
	(0.007)	(0.007)			
Agro*Crisis		0.083***			
		(0.011)			
Micro*Crisis		0.064***			
		(0.011)			
Requested amount	-0.000**	-0.000**	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Collateral	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Repeat loan	0.057***	0.057***	0.024***	0.059***	0.087***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.010)
Manat	0.017***	0.016***	0.023***	0.020***	-0.140***
	(0.001)	(0.001)	(0.004)	(0.002)	(0.044)
Age	-0.000	-0.000	0.000	0.000	-0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Male	0.003*	0.003	-0.008**	0.004**	-0.012
	(0.002)	(0.002)	(0.003)	(0.002)	(0.015)
Married	0.012***	0.012***	0.008**	0.012***	0.036***
	(0.002)	(0.002)	(0.003)	(0.002)	(0.013)
Constant	0.698***	0.712***	0.916***	0.775***	0.801***
	(0.009)	(0.009)	(0.027)	(0.006)	(0.038)
Observations	184,881	184,881	29,015	150,106	5,760
R^2 adjusted	0.032	0.032	0.033	0.033	0.060
Time trend	yes	yes	yes	yes	yes
Branch fixed effects	yes	yes	yes	yes	yes

Summarizing, we find that the impact of the financial crisis on credit availability strongly depends on firm size and on the industry a firm operates in. Although agro loans are often considered to be very risky due to their highly correlated risks in case of natural disasters, bad weather conditions or commodity price volatility (e.g. Wenner, Navajas, Trivelli and Tarazona (2007)), our results imply that the diversification of a bank's portfolio into different industries and firm size categories

may provide stability in case of a financial and economic crisis that mainly hits those firms that are internationally connected. Additionally, in contrast to anecdotal evidence from Eastern Europe (e.g. ProCredit Holding (2009)) which suggests that banks currently worry especially about their lending to micro clients and have limited their exposure in that segment because many of these clients carry high levels of (consumer) debt, we find that credit availability is mostly affected for SME customers. This may be explained by the comparatively small and underdeveloped banking sector in Azerbaijan which has prevented micro clients from accumulating debt.

5.5.2 Determinants of the extent of volume constraints

Table 27 reports results from a Heckman selection model to assess our second dimension of credit availability for the full sample and for the three subsamples based on the different loan categories. The bank may not only deal with risks arising from the crisis or from firms' characteristics by denying credit to certain borrowers but also by constraining the loan amount it is willing to grant to those borrowers whose loan applications are approved. The Heckman selection model explicitly accounts for these two decisions about constraining credit which the bank can make. Thus, columns (1), (3), (5) and (7) include estimates from the selection stage, i.e. they show the impact of our loan and firm variables on the likelihood that a loan is approved.

Since this step replicates the results from Table 26, we mainly concentrate our discussion on the second stage results displayed in columns (2), (4), (6) and (8). Note that the Mills' ratios which we derive from the first stage regressions and which are included in the second stage to account for the dependence in the two equations are statistically significant in all our specifications. This means that the selection procedure is needed to derive unbiased estimates in the outcome equation. The Mills' ratios indicate whether the unobserved factors that influence selection (loan approval) and the unobserved factors that influence the outcome (Requested-granted ratio) are positively or negatively correlated.

Table 27. Share of requested loan amount that was granted by the bank: loan and firm determinants

This table reports results from Heckman sample selection regressions for the full sample and the following subsamples: *Agro*: Loans intended for agricultural investments. *Micro*: Loans with loan amounts up to 10,000 USD (from 2008: also with amounts up to 20,000 USD). *SME*: Loans with loan amounts of more than 10,000 USD and up to 500,000 USD. Standard errors (reported in parentheses) are bootstrapped to derive their correct values in the two-step procedure. The dependent variables are *Approved*, which is a dummy variable indicating whether a loan application was approved by the bank or rejected, in columns (1), (3), (5) and (7) and *Granted-requested ratio*, which is the share of the requested amount that is granted by the bank, in columns (2), (4), (6) and (8). All explanatory variables are defined in Table 23. ***, **, * denote significance at the 0.01-, 0.05- and 0.1-level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Full sample		Agro loans		Micro loans		SME loans
Dependent variable	Approved	Granted-requested ratio	Approved	Granted-requested ratio	Approved	Granted-requested ratio	Approved	Granted-requested ratio
Crisis	-0.556***	-0.041***	0.011	0.002	-0.258***	0.001	-0.395***	-0.010
	(0.054)	(0.010)	(0.073)	(0.007)	(0.016)	(0.004)	(0.069)	(0.014)
Agro	0.541***	-0.001						
	(0.047)	(0.007)						
Micro	0.349***	-0.028***						
	(0.045)	(0.007)						
Agro*Crisis	0.441***	0.016*						
	(0.058)	(0.009)						
Micro*Crisis	0.278***	0.017**						
	(0.051)	(0.008)						
Requested amount	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Collateral	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Repeat loan	0.467***	0.064***	0.227***	0.043***	0.517***	0.035***	0.388***	-0.016
	(0.011)	(0.006)	(0.038)	(0.003)	(0.010)	(0.006)	(0.049)	(0.016)
Manat	0.124***	-0.008***	0.246***	-0.036***	0.049***	-0.021***	-0.518***	0.042
	(0.011)	(0.002)	(0.045)	(0.005)	(0.015)	(0.001)	(0.139)	(0.034)
Age	0.000	0.000***	0.001	0.000**	0.000	0.000***	-0.005*	0.001
	(0.001)	(0.000)	(0.002)	(0.000)	(0.001)	(0.000)	(0.003)	(0.000)
Male	0.019	0.039***	-0.106**	0.027***	0.042**	0.042***	-0.089	0.011
	(0.014)	(0.001)	(0.049)	(0.004)	(0.017)	(0.002)	(0.076)	(0.011)
Married	0.092***	0.012***	0.098**	-0.001	0.086***	0.005***	0.176***	-0.006
	(0.012)	(0.002)	(0.047)	(0.004)	(0.010)	(0.002)	(0.062)	(0.009)
Constant	0.251***	0.698***	0.925**	0.965***	0.537***	0.787***	0.875***	0.860***
	(0.058)	(0.025)	(0.378)	(0.041)	(0.032)	(0.021)	(0.175)	(0.041)
Mills ratio		0.144***		-0.603***		-0.209***		-0.267***
		(0.055)		(0.083)		(0.055)		(0.102)
Observations	184,881	184,881	29,015	29,015	150,106	150,106	5,760	5,760
Time trend	yes	yes	yes	yes	yes	yes	yes	yes
Branch fixed effects	yes	no	yes	no	yes	no	yes	no

Column (2) presents the results on the determinants of the wedge between granted and requested loan amounts (*Granted-requested ratio*) for the full sample. Note that *Granted-requested ratio* is an inverse measure of volume constraints which indicates fewer constraints the larger its value is (it indicates larger credit availability the

larger its value is). The variable *Crisis* captures the effect of the Lehman failure on volume constraints for SME loans (the base category). We find that SME loans which are made during the *Crisis* are significantly more constrained than those made before the Lehman failure. As SME loans are regularly collateralized by mortgages and real estate prizes were falling, borrowers received smaller amounts against their collateral. To study how the relation between *Agro* (*Micro*) loans and volume constraints is influenced by the crisis we introduce the interaction terms *Agro*Crisis* and *Micro*Crisis*. For *Agro* loans, the statistically insignificant main effect together with the positive and statistically significant interaction effect implies that volume constraints for agro loans are not different from those for SME loans before the crisis but that they are lower during the crisis. This result shows again that agro loans are less affected by the financial crisis than SME loans. For *Micro* loans, on the contrary, volume constraints are significantly higher before the crisis but this difference is cut by more than half during the crisis. Interestingly, while micro loans have a higher probability to be approved than SME loans, they are generally more volume constrained once they are approved but not during the crisis. Thus, the bank seems to apply its different constraint possibilities in different ways to the three loan categories.

Turning to the further loan and firm characteristics, we find that taking out a *Repeat loan* decreases volume constraints considerably. There are two complementary explanations for this result (see Kirschenmann (2010)). The bank may make use of dynamic incentives in environments with asymmetric information by increasing granted loan amounts after due repayment. Simultaneously, borrowers may learn what is reasonable to request from previous constraints and adjust their following requests accordingly. Thus, the observed reduction in volume constraints may stem from both the demand and the supply side. Although *Manat* loans have a higher probability to be granted, they are slightly more volume constrained. One explanation may be that borrowers requesting manat loans are less familiar with financial operations and therefore are more prone to miscalculate their financial needs and abilities. Finally, *Male* and *Married* borrowers turn out to be less volume constrained than female and unmarried borrowers.

Studying the three loan categories independently and not in relation to each other reveals that the crisis does not at all affect credit availability of agro loans for those borrowers that request such loans (columns (3-4)). Yet, micro loans (columns (5-6))

and SME loans (columns (7-8)) face a significantly lower probability to receive a loan after applying for one during the crisis compared to before the crisis, while volume constraints are not significantly influenced by the crisis. Therefore, our results show that credit availability in the sense of the availability of the requested loan volume does not significantly change due to the crisis when we analyze the three loan categories independently. Pooling all loans in one regression and assessing relative impacts of the crisis between the three subgroups by interaction effects, however, reveals that again agro and micro loans are hit less than SME loans.

For our loan and firm characteristics, we find that they have little impact on volume constraints for SME loans. As for the full sample, we observe for agro and micro loans that taking out a *Repeat loan* significantly decreases volume constraints while the loan's denomination in local currency (*Manat*) increases volume constraints. Although being *Married* turned out to be an important borrower characteristic in increasing loan approval probabilities, it plays a minor role in reducing volume constraints as the variable is only statistically significant for micro loans.

5.6 Conclusions

This paper studies the impact of the financial crisis on the credit availability for micro, small and medium enterprises in Azerbaijan. Azerbaijan provides an interesting object of study because, on the one hand, its economy is weakly diversified and highly dependent on the development of the oil price making it vulnerable to the economic crisis that is brought about by the financial crisis. On the other hand, its banking sector is still comparatively small and not yet much globally integrated, providing some immunity to the spillovers of a global financial crisis. Nevertheless, there are a few banks that may be expected to be affected by the crisis because they are foreign owned. One of these banks is AccessBank Azerbaijan whose credit file data for 184,881 loans made between November 2002 and August 2009 we use for our empirical analysis. The structure of the dataset allows us to analyze credit availability on an aggregate level as well as on an individual loan level, thereby identifying three channels of credit constraints.

By analyzing aggregate summary statistics, we derive the first channel of credit constraints. We observe that its refinancing delays in the second and third quarters of

2008 seem to lead the bank to discourage (potential) borrowers from applying for new or additional loans. The bank's temporary liquidity squeeze therefore resulted in a slowdown of its credit portfolio so that not all the demand could be met during this limited period of time. However, the restrictions on business lending were implemented in line with a conscious tighter risk management, i.e. that in the business loan portfolio mainly SME and high-risk micro lending was limited.

As we observe borrowers' loan applications and their requested loan amounts as well as the bank's decision whether to grant a loan and which loan amount to grant if the application is approved, we are able to separate two further channels of credit constraints at the individual loan level: loan approval rates and loan volume constraints.

Our findings for those borrowers who actually apply for a loan suggest that credit availability for agro loan borrowers is merely affected by the crisis. This is surprising on first sight since agro loans are regularly classified as particularly risky because of their highly correlated risks in case of natural disasters or commodity price fluctuations. In an economic crisis like the current one, however, the agro businesses in Azerbaijan are comparatively unaffected because they mostly produce subsistence goods. Thus, such loans may offer some stability to a bank's loan portfolio in times of a global financial and economic crisis. The same seems to apply to the diversification into different loan sizes as the micro loans in our sample show a considerably smaller reduction in approval rates compared to the SME loans as well which may be explained by their lower risk. SME borrowers whose business activities may be more severely hit by the crisis therefore have to face the greatest cuts to their credit availability. Apart from that, our results show that bank relationships are valuable in times of crises as being a repeat borrower considerably increases credit availability especially for micro and SME borrowers.

Finally, our results suggest that credit constraints mainly work via the aggregate channel by the bank discouraging loan applications and via the approval decision channel once a loan application is made. Loan volume constraints only slightly increase during the crisis. This may be explained by the fact that we study loans for specific investments which may not leave much room for amount adjustments.

One caveat has to be made concerning the interpretation of our results. To comprehensively assess the effects of the crisis on credit availability for the various types of enterprises one would actually have to take into account how many

borrowers have been deterred from applying for a loan by their loan officers. While we can provide some evidence on this aspect in our aggregate analysis, it is possible that the active marketing strategy which the bank uses to attract new customers is more intensively employed in the segment of micro loans compared to SME loans. This would imply that a decrease in these marketing activities would have a larger impact on the micro loan portfolio than on the SME loan portfolio. Thus, it may well be that we underestimate the negative effect of the crisis on micro credit availability because we do not have information on (potential) borrowers' intentions to apply for a loan. This opens up room for future empirical research to broaden the evidence on the effects of the financial crisis on credit availability for micro vs. SME borrowers in Central Asia and other emerging markets.

Our results have implications for development practitioners aiming at sustainably fostering credit access for micro, small and medium businesses in developing and transition economies. First, supporting MFIs in building up diversified credit portfolios that include various loan categories with respect to size and industry may increase a banks' stability in times of a global financial and economic crisis as the current one. However, further research on how different banks' portfolio quality is affected by such a crisis would be needed to shed more light on this aspect. Second, broadening MFIs' refinancing basis to achieve greater resilience against external shocks remains an important topic. Recent attempts to create adequate refinancing instruments in local currency therefore seem to be a crucial step to help MFIs to overcome refinancing problems.

6 Conclusions

This thesis has analyzed demand and supply effects on loan contract terms in bank lending to micro, small and medium enterprises in developed as well as in transition countries. Bank relationships of MSMEs represent a particularly interesting object of study because they are plagued by informational asymmetries and banks need to find ways to deal with the arising risks. For instance, they may use relationship lending techniques which imply that they do not only evaluate single transactions but multiple interactions with the same borrower over time and/or across products (Boot (2000)). This allows lenders to gain often proprietary information which facilitates implicit long-term contracting and intertemporal smoothing of loan contract terms. At the same time, informational asymmetries may also influence borrower behavior when requesting certain loan terms and borrowers may learn from previous loan negotiations when interacting repeatedly with the same lender. Incorporating these demand aspects into the analysis contributes to a better understanding of the processes that lead to the observed outcomes of loan negotiations.

The theoretical literature provides various arguments for the impact of asymmetric information on borrower and bank behavior when requesting / granting loan terms. Due to an asymmetric distribution of information between lenders and borrowers banks may, for instance, deny credit even to borrowers with profitable projects (Stiglitz and Weiss (1981), Gale and Hellwig (1985) and Aghion and Bolton (1992)). Borrowers, in turn, may first have to signal their good quality to lenders by requesting short-term loans before they can receive long-term financing (Flannery (1986)). Apart from that, when lenders are imperfectly informed about the currency of firm revenue, local currency borrowers may be more likely to choose foreign currency loans. The reason is that in a pooling “equilibrium” these borrowers are not fully charged for the credit risk involved in taking these unhedged loans (Brown, Ongena and Yesin (2009)).

The aim of this thesis was to disentangle demand from supply determinants of loan contract terms. Thereby, it wanted to broaden the understanding of how observed contractual outcomes arise and how requested and granted loan terms evolve over bank relationships in a sequence of interactions between borrowers and lenders. Analyzing various loan contract terms such as amount, maturity and

currency as well as credit availability (i.e. the probability to receive a loan) reveals that taking into account information from both loan applications and loan contracts offers new insights into the factors that drive contractual outcomes in MSME bank lending. Importantly, incorporating the demand side into the analysis does not render previous empirical results obsolete but enriches the picture of bank relationships and loan negotiations that may be gained from studying bank portfolio data.

Chapter 2 finds that the relation between borrower risk and loan maturity is determined by the interplay of various demand and supply side factors. The positive and monotonic risk-maturity relation may be explained by good borrowers choosing short maturities to signal their low risk to the bank when informational asymmetries are high. In case of low asymmetric information, relationship lenders' willingness to assist risky borrowers by offering them long-term loans provides an explanation. Adding borrower bargaining power to the analysis reveals that borrowers would actually like to borrow at longer maturities (if informational asymmetries were absent) and do so when they have bargaining power. Finally, cost considerations (i.e. the term structure of the interest rate curve) seem to play a role.

Chapter 3 offers insights into the demand and supply factors that drive foreign currency lending in Eastern Europe. The results show that foreign currency lending is not only driven by borrowers who try to benefit from lower interest rates. They also show that a substantial share of foreign currency retail loans is supply-driven with banks hesitant to lend long-term in local currency and eager to match the currency structure of their assets and liabilities. This implies that recent policy measures to curb the extent of foreign currency lending which address only the demand side to increase borrowers' awareness of the inherent risks may not be sufficient.

Chapter 4 provides a new and more comprehensive measure of observed credit constraints that incorporates requested and granted loan amounts. The results indicate that the extent of (publicly) available information matters for initial differences in credit constraints between borrowers. Analyzing the evolution of requested and granted loan amounts over multiple interactions between borrowers and one bank reveals that observed credit constraints decrease over a loan sequence due to a convergence of the demand and supply sides. On the demand side, this finding implies that borrowers learn from the negative feedback they receive from previous credit constraints and adjust their requests accordingly. On the supply side, the results indicate that the bank uses dynamic incentives to overcome information

problems increasing loan sizes disproportionately after due repayment when contracting repeatedly.

Finally, Chapter 5 deals with the impact of the 2007-2008 financial and economic crisis on the demand and approval of MSME loans in Azerbaijan, a country whose heavily oil-dependent economy is vulnerable to external shocks. The data comes from AccessBank Azerbaijan which was affected by the financial crisis by temporary delays in its refinancing pipeline. On an aggregate level the results indicate that the delays in the bank's refinancing resulted in a temporary slowdown of portfolio growth, especially in the SME segment. On an individual loan level the findings show that the availability of agro loans is merely affected by the crisis while micro loans face a moderate and SME loans a considerable reduction in approval rates. The results suggest that the real effects of the crisis critically depend on firms' industry and size. Finally, bank relationships are found to mitigate the effects of the crisis on credit availability.

In summary, the results not only amend the existing academic literature but may also be interesting for policy makers who aim to foster access to credit for small firms. The studies hint at certain peculiarities that determine MSME lending in transition (and developing) countries such as missing long-term refinancing in local currency, instable macroeconomic policies or borrowers' inexperience in dealing with formal banks resulting in a pronounced learning process. At the same time, the studies indicate that informational asymmetries are an important factor in MSME lending whether studying the US and Western Europe or the transition countries in South-eastern Europe and Central Asia. Accordingly, close bank relationships are valuable in the various settings increasing credit availability and leading to more favorable loan terms. However, it is beyond the scope of this thesis to quantify whether bank relationships are more valuable in one region or the other.

The analysis in Chapter 2 clearly illustrates that having only information on contracted loan terms allows no more than collecting indications of the various demand and supply factors being at work. While this does provide interesting insights, adding information from loan applications helps disentangling the two sides more clearly and improves the understanding of how loan contracting works. For future research, studying more comprehensive panel datasets with information on borrowers' different sources of external funds should be fruitful. This would allow testing the impact of bank competition and multi-source borrowing on requested and

granted loan terms and would provide a more distinct picture about the actual extent of credit constraints which borrowers face in different countries.

On the demand side, measuring borrower bargaining power is challenging. This thesis offers one approach but there may be various other ways how to capture bargaining power and future research could address this issue in more detail. In addition, this thesis entails implications for research in (behavioral) corporate finance. For instance, there are studies indicating that managers choose a particular debt maturity structure or try to time the market with debt issues to manage the financing costs (e.g. Graham and Harvey (2001)). Further research may analyze if and how behavioral issues can be observed in bank-borrower relationships, particularly in small business lending, as well. Moreover, the finding that borrowers obviously learn from the feedback they get from previous outcomes of loan negotiations highlights that financial literacy plays a role in loan contracting. While financial literacy has been shown to be a widespread phenomenon there is little evidence on how this influences debt decisions in general and requested and granted loan terms in particular (see Jappelli (2009) for a recent overview).

On the bank side, future research may address the question how the bank's refinancing (kind, maturity, currency as well as their changes over time) influences its lending decisions. So far, there is only little known about the interplay of the two sides of a bank's balance sheet. This is a particularly difficult issue because of the inherent endogeneity problem concerning the question whether the refinancing side drives the bank's lending decisions or whether the bank's anticipated lending operations drive its refinancing decisions.

To conclude, while the four studies which compose this thesis point out several important aspects, they simultaneously open up a wide scope for future research on demand and supply effects in bank lending.

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