Relationship Lending and Loan Performance*

JOB MARKET PAPER

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This version: November 15, 2014

Abstract

This paper studies the effect of relationship lending on ex-post loan performance. In a novel approach, I combine a new and direct measure of relationship lending with unique credit registry data, exploiting an exogenous rule that determines the lending technique for each loan of a firm. My findings demonstrate that the *same firm* is more likely to become delinquent on a relationship-based relative to a transaction-based loan. Consistent with theory, I show that relationship banks are willing to tolerate *temporary* delinquencies of a firm as long as they do not face higher defaults or lower rents in the *long run*. Relationship banks are also more likely to continue to lend to firms after past non-performance. These findings reveal that relationship lending serves as a liquidity insurance for firms in distress. I conclude that relationship banks are better at enforcing contracts, not having ex-ante riskier customers or rescheduling loans more often despite higher delinquency rates.

JEL Classification: G21, G30

Keywords: Bank Financing, Relationship Lending, Loan Performance

*I would like to thank Lieven Baele, Thorsten Beck, Vicente Bermejo, Tobias Berg, Patrick Bolton, Emily Breza, Charles Calomiris, Nicola Cetorelli, Hans Degryse, Linda Goldberg, Benjamin Guin, Andrew Hertzberg, Vasso Ioannidou, Elisabeth Kempf, Mauricio Larrain, Alberto Manconi, Steven Ongena, Enrichetta Ravina, Jonah Rockoff, João Santos, Philipp Schnabl, and Daniel Wolfenzon for fruitful discussions and comments. Special thanks go to employees of the Central Bank of Armenia and ACRA for kindly providing me with the data and to the Development Facility of the European Fund for Southeast Europe (EFSE) for making this cooperation possible. All errors are my own.

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1 Introduction

Relationship lending constitutes one of the most important comparative advantages of bank lending to firms. When engaging in relationship lending, banks gather propriety information about their customers through repeated interactions (Boot (2000)). Some theories suggest that banks use their superior knowledge to extend loans at favorable contract terms and provide firms with better access to finance (Boot and Thakor (1994), Petersen and Rajan (1995)). In contrast, alternative theories point out that relationship lending is associated with possible "hold-up" problems and extraction of rents from firms (Sharpe (1990), Rajan (1992)). While the empirical literature has mostly focused on contract terms and credit availability, far less is known about the behavior of banks when firms are in distress. This paper fills the gap by examining the effect of relationship lending on ex-post loan performance.

Understanding bank behavior when firms are hit by idiosyncratic liquidity shocks is important for practitioners and academics alike. Firms and their sources of funding when faced with liquidity shocks are vital for the economy as a whole. Moreover, insights into banks' reactions to idiosyncratic shocks of firms will help designing policies to foster financial stability. While the theoretical literature has shown that informed banks provide continuation financing when firms are in need, the empirical literature is still lagging behind. The findings of the paper present first evidence that relationship lending serves as a liquidity insurance for firms in distress, offering greater financial flexibility and better access to finance.

Studies on relationship lending face several empirical challenges. First, relationship lending is not readily observable, being part of a bank's internal policy. Empirical studies often use the length, strength, and depth of a bank-firm relationship or the geographical distance between firms and banks as measures of relationship lending.[1] Second, the use of the relationship lending is likely correlated with firm and bank characteristics. Relationship lending centers around the acquisition of "soft" information (knowledge of

[1]See among others Petersen and Rajan (1994), Berger and Udell (1995), Cole (1998), Elsas and Krahnen (1998), Harhoff and Körting (1998), Machauer and Weber (1998), Degryse and Ongena (2005), Agarwal and Hauswald (2010).

the client), which plays a more important role for lending to small and opaque firms by small and decentralized banks (Stein (2002)). Ideally, one would like to observe variation in the use of relationship lending *within* banks and firms in order to eliminate biases coming from confounding effects of bank and firm characteristics. Third, one needs randomization in the use of relationship lending across banks and firms to avoid selection and composition biases.

A novel approach that combines survey data on banks' lending policies with unique credit registry data from Armenia allows me to address the identification challenges. First, the survey data provide a new and direct measure of the importance (frequency of use) of relationship lending based on answers of banks. Second, the use of the relationship lending technique varies within some banks across loan types and not others. Third, a bank specific rule determines whether a loan of a firm is based on relationship or transactional lending. Since the bank specific rule is set by the bank and a firm is unlikely to know and thus influence the rule, it creates exogenous variation (from a firm's perspective) in the use of lending techniques within a firm across banks.[2]

To evaluate the effect of relationship lending on loan outcomes, the relationship lending measure is linked to loan-level data from the private credit registry of Armenia for the period between January 2009 and June 2013. The credit registry data covers virtually all loans to firms during the sample period, containing detailed data on every loan such as date of origination, maturity date, contract terms and loan performance as well as data on firm characteristics such as legal status, industry, location, and banking relationships. Armenia provides an ideal setting to examine the effects of relationship lending on loan performance. By 2004, Armenia was completely privatized, leaving no government banks and only few government firms that should not distort the analysis.[3] The credit market is still at a developing stage with banks dominating the financial system.[4] Since

[2]In Appendix B, I find that some manipulation is present, probably by loan officers. However, in Section 4.4 I show that, different from a regression discontinuity design, identification is coming from loans further away from the threshold for which the main results continue to hold.

[3]In particular, firms with private domestic ownership make up 89.9% of all firms, followed by firms with private foreign ownership (7.7%) and with state ownership (0.7%) (World Bank (2011)).

[4]The loans to GDP ratio was around 40% in 2013 compared to 96% and 198% in developed markets such as Germany and United States. According to a report by CBA (2014), banks were holding almost 90% of financial assets in 2013 and earned most of their income from lending.

few outside financing options exist and bank lending is of high importance, my analysis is not contaminated by other financing options for firms. While 97.7% of all registered legal entities in 2009 were small and medium-sized enterprises (SMEs), even large firms in Armenia are rather comparable to SMEs (World Bank (2014)).[5] Most importantly, stylized facts from other banking markets also hold for Armenia such as the reliance of relationship banks on "soft" information and a contract menu of high interest rates, less collateral requirements and longer maturities compared to more transaction-based banks.

For the analysis, I distinguish between *Relationship Banks* that always rely on relationship lending and *Mixed Banks* that value relationship lending only for corporate loans and employ transactional lending based on firm fundamentals and collateral for SME loans.[6] Figure 1 illustrates the idea, presenting bank types, loan types and the corresponding lending techniques. Now, imagine a firm that receives an SME loan from a *Relationship Bank* and another SME loan from a *Mixed Bank*. Controlling for loan characteristics, I examine differences in loan performance of such a firm when lending techniques differ (relationship versus transactional lending, left arrow in the figure). In contrast, if a firm receives two corporate loans from a *Relationship* and *Mixed Bank* when both banks rely on relationship lending, I expect no differences in loan performance (right arrow in the figure).

The effect of relationship lending on ex-post loan performance is ambiguous. Theories on financial intermediation advocate that banks mitigate asymmetric information problems by acquiring propriety information through screening and monitoring of clients in repeated interactions (see, e.g., Diamond (1984), Ramakrishnan and Thakor (1984), Allen (1990)). If relationship lending results in more efficient screening and monitoring, better ex-post loan performance should be the outcome. If banks use their knowledge to be more lenient toward a client, they might allow the client to temporarily become delinquent. Von Thadden (1995) suggests that banks might tolerate short-term bad results as

[5]Relative to the European Union and the US, Armenian SMEs are much smaller with employee numbers below 100 compared to 250 and 500 employees (SME DNC (2010)).

[6]Although it might seem surprising that *Mixed Banks* do not apply relationship lending for SME loans, survey evidence by De la Torre, Martínez Pería, and Schmukler (2010) confirms that banks often offer standardized products to SMEs. Moreover, *Mixed Banks* report that they rely more on fundamentals/cash flow analysis and collateral for SME loans.

long as they can extract long-term rents. The reasoning for this is that banks learn the firm's quality through monitoring, and hence will not interpret short-term bad results as sings of bad quality and prematurely terminate good projects.

My findings demonstrate that the *same firm* is more likely to become delinquent on a relationship-based loan relative to a transaction-based loan. In particular, relationship-based loans are by 1.5 to 1.7 percentage points more likely to become delinquent over 90 days which is a large effect considering an average delinquency rate of 3%. When both banks rely on relationship lending, differences in loan performance disappear. The result continues to hold when I control for loan characteristics, the crisis period, and loan origination fixed effects. The finding also survives a battery of robustness tests, including different performance measures, timing of information dispersion, time variation in firm characteristics, an alternative definition of relationship lending and alternative estimation techniques.

Next, I examine the effect of relationship lending on long-term loan performance. Results reveal that, albeit higher delinquency rates, *Relationship Banks* do not experience higher defaults or lower recovery rates at the end of the loan spell relative to *Mixed Banks*. Moreover, relationship lending does not suffer from significantly lower returns on loans, even conditional on previous delinquencies. In line with Von Thadden (1995), *Relationship Banks* are willing to tolerate *temporarily* higher delinquencies as long as they can secure long-term rents, not incurring higher defaults or lower returns in the *long run* relative to *Mixed Banks*. Finally, I show that *Relationship Banks* are more likely to continue to lend to firms after past non-performance. The findings indicate that relationship lending provides a liquidity insurance for firms when they face temporary problems, offering financial flexibility and improved access to finance.

Does the result on long-term loan performance imply that *Relationship Banks* are better at enforcing contracts? To this extent, I show that albeit higher delinquency rates, *Relationship Banks* do not have ex-ante riskier customers or reschedule loans more often than *Mixed Banks*. The results indicate that *Relationship Banks* must have some additional unobservable information about their clients that allows them to be more

lenient and make no losses long term.

Since the measure of relationship lending is new to the literature and relies on survey responses, I conduct several robustness tests.[7] In particular, I confirm that relationship lending leads to more use of soft information in loan pricing. Further, I examine the determinants of relationship lending across all banks in the survey. Literature suggests that small and decentralized banks are more likely to engage in relationship lending, having a comparative advantage in collecting and processing soft information that is vital for lending to small and opaque firms (Stein (2002), Berger, Miller, Petersen, Rajan, and Stein (2005), Mian (2006)). I find that relationship banking is less prevalent among hierarchical and large banks. Still, in line with Berger and Udell (2006) and Beck, Ioannidou, and Schäfer (2014b), the main result on relationship lending shows that banks vary their use of lending techniques but can target the same clientele.

The paper is related to an extensive literature on relationship lending.[8] Some authors advocate that relationship lending provides better access to finance and favorable contract terms in the form of lower interest rates and less collateral requirements (see, e.g., Petersen and Rajan (1994), Berger and Udell (1995)), the more so in crisis times (see, e.g., Bolton, Freixas, Gambacorta, and Mistrulli (2013), Beck et al. (2014a)). Others, however, indicate that banks might lock-in borrowers and raise interest rates when borrowers face transportation costs and low bank competition (Degryse and Ongena (2005)) or informational hold-up and switching costs (Ioannidou and Ongena (2010)). While previous literature mostly uses approximations of relationship lending and primarily focuses on contract terms and credit availability, this paper combines a new and direct measure of relationship lending with credit registry data to empirically test Von Thadden (1995)'s theoretical predictions. The paper uncovers that relationship lending provides a liquidity insurance to firms in distress.

The paper also contributes to the literature on the effects of relationship lending and use of soft information on loan performance. Literature on consumer credit markets

[7] Beck, Degryse, De Haas, and van Horen (2014a) provide cross-country evidence on the validity of the measure.

[8] For a more detailed review, see Degryse, Kim, and Ongena (2009) and Kysucky and Norden (2014).

shows that relationship lending leads to lower default risk because of better screening and monitoring by banks (Puri, Rocholl, and Steffen (2013)). In mortgage markets, securitization may adversely affect screening standards of banks and result in higher default rates (Keys, Mukherjee, Seru, and Vig (2010)), while the involvement of risk managers alongside loan officers reduces default rates (Berg (2014)). Other papers show that hierarchical and physical distances decrease the use of soft information and make loan defaults more likely (Liberti and Mian (2009), Agarwal and Hauswald (2010), Skrastins and Vig (2014)). While most of the literature examines consumer defaults, this paper draws a more complete picture, showing that banks are temporary lenient toward firms without facing higher defaults or lower rents in the long run.[9] Indeed, banks might use relationship lending differently for consumers than firms, designing more complex and less standardized contracts and being more aware of enforcement of contracts.

The paper is structured as follows. Section 2 describes the data and provides summary statistics. Section 3 introduces the empirical methodology. Section 4 presents results and robustness tests. Section 5 validates the relationship lending measure. Section 6 concludes.

2 Data

2.1 Bank Survey Data

The first data source is the Banking Environment and Performance Survey (BEPS) II that provides information on banks' internal lending policies and organizational structures in the region of Central and Eastern Europe, Central Asia and North Africa. Since I only have credit registry data from Armenia, I focus on Armenian banks.[10] The survey data

[9]Some papers explore defaults of firms but rather focus on strategic choices of firms to default on lenders with which they have personal interactions and long relationships or that are geographically and culturally close to them (Morales (2014), Schoar (2014), Baele et al. (2014)). In contrast, this paper investigates the ability of relationship banks to acquire "soft" information about a firm over time which allows them to offer financial flexibility and continuation financing when the firm is in distress.

[10]The BEPS II survey was jointly undertaken by the European Bank for Reconstruction and Development (EBRD) and European Banking Center (EBC) at Tilburg University in 2011. CEOs of more than 400 banks in the region of Central and Eastern Europe, Central Asia and North Africa were interviewed by a specialized team of senior financial consultants with considerable banking experience on topics such

allows me to construct a direct measure of relationship lending, relying on the answers to Questions Q6 and Q10 of 17 Armenian banks. In these answers, banks indicate the importance (frequency of use) of four lending technologies on a five-point Likert scale for SME and corporate loans separately (ranging form 1 "very unimportant" to 5 "very important"): relationship lending (knowledge of the customer), fundamental/cash flow analysis (financial information), collateral (personal assets pledged by entrepreneur), and collateral (business assets). Additionally, in Questions Q4 and Q8 banks report the number of layers that needs to be passed for loan approval if the bank grants an SME or corporate loan. In a follow-up questionnaire banks report the loan amount threshold at which they differentiate between an SME type and a corporate type loan.

For the main empirical analysis, I focus on the importance of the relationship lending technology. In contrast to previous literature, I do not need to approximate relationship lending with the strength, length, depth or distance of bank-firm relationships but can directly measure the importance of relationship lending for each loan of a firm across banks.[11] The survey specifies relationship lending as knowledge of the client, which is similar to Boot (2000)'s definition of relationship lending as the acquisition of propriety information over multiple interactions with a customer. The fact that the measure does not refer to a specific time period should not pose a problem, since Fahlenbrach et al. (2012) confirm that bank business models stay relatively constant over time. Still, I conduct several robustness tests in Section 4.4 and show that the relationship lending measure captures the use of "soft" information when pricing loans in Section 5. Moreover, Beck, Degryse, De Haas, and van Horen (2014a) provide cross-country evidence for the validity of the relationship lending measure.

In particular, I define 9 *Relationship Banks* that report relationship lending to be "very important" for both SME and corporate loans, and 6 *Mixed Banks* that find relationship lending "very important" for corporate loans only but less for SMEs. Two banks drop from the sample because one bank grants SME loans only and the other one never

as activities, funding and risk management, lending technologies, competitive environment, the influence of foreign parent banks and perceptions of legal and regulatory systems.

[11] Based on the same survey, Beck et al. (2014a) construct the share of relationship banks in the vicinity of firms and test how it affects access to finance for these firms over the business cycle.

considers relationship lending as "very important" for both loan types. It might seem surprising that *Mixed Banks* do not rely on relationship lending for SMEs but rather on transactional lending. Indeed, these banks mostly report firm fundamentals, cash flow analysis and collateral to be more important for SME loans. Moreover, 97.7% of all registered legal entities in 2009 were SMEs, implying that even large firms in Armenia are rather comparable to SMEs in more developed countries (see, e.g., World Bank (2014)). SME loans are thus relatively small loans for which standardization of the lending process is more likely. Survey evidence by De la Torre et al. (2010) shows that banks offer standardized products, sometimes combined with tailor-made features, to a group of SMEs with similar needs such as adjusting the credit line to the business cycle of a specific industry.

The second important information from the survey are the loan amount thresholds that help assigning different loan types to loans of a firm. The loan amount thresholds differ across banks in size and currency such that a firm can receive an SME loan from one bank and a corporate loan from another.[12] Since the loan amount threshold is part of a bank's internal policy, it creates exogenous variation (from a firm's perspective) in the assignment of a firm's loan to a different loan type and hence to the frequency of use of relationship lending.[13] Such bank policies can still be subject to manipulation by loan officers. In Appendix B, I find that some manipulation is present. However, in Section 4.4 I show that, different from a regression discontinuity design, identification is coming from loans further away from the threshold for which main results continue to hold.

2.2 Credit Registry Data

The second unique dataset is the Armenian private credit registry from the Armenian Credit Reporting Agency (ACRA) that allows me to assess the effect of relationship

[12]Although there exists a law on "State Support to SMEs" that specifies annual assets and turnover as well as the number of employees for different firm categories, banks use their own rules of thumb to classify a firm as SME or corporate firm. Discussions with bank employees, ACRA and CBA employees, confirmed that banks classify firms mostly by loan amount. An IFC survey also shows that the loan amount is a good proxy for firm size (IFC (2013)).

[13]Liberti and Mian (2009) also use 19 bank rule variables that determine the hierarchical level to which a firm is sent in order to investigate the effect hierarchical distance on information production.

lending on loan outcomes.[14] Founded in 2004, the credit registry covers all loans to firms (without a loan amount restriction) from 21 Armenian banks between January 2009 and June 2013 on a semiannual basis.[15] For each loan, I have information on the origination and maturity dates, contract terms, ex-post loan performance, location of loan issue, and economic sector of a loan. For each firm, I have information on the legal status, industry, physical location, and banking relationships. The private credit registry is used by the Central Bank of Armenia (CBA) for the analysis of the banking sector as well as for supervision purposes. Since all banks are members of the private credit registry and have paid a flat rate membership fee, they mostly rely on data from the private credit registry, which is more complete, for screening and monitoring purposes of firms. In almost 99% of the cases banks inquire information in a standardized format that covers information on all current and past loans of a firm dating back 5 years without revealing the other bank's identity.[16]

The BEPS II survey data has been merged with the credit registry data by the CBA, keeping the bank and firm names anonymous. Using the loan amount threshold, I assign SME and corporate loan types to each loan of a firm. The final sample consists of 15 banks that report the frequency of use of the relationship lending, and account, on average, for 84% (87%) of all banks' credit contracts in terms of value (number). The credit registry covers different credit contracts such as loans, credit lines, factoring, leasing, guarantees, letters of credit, overdrafts, repurchase agreements, and swaps. I focus on loans and refer to them as "standard credit contracts".[17] These contracts account for 73% (70%) of all

[14]Armenia has also a public credit registry managed by the Central Bank of Armenia (CBA), which, however, covers only large loans above around 3.75 million US dollar (1.5 million Armenian Drams) that do not receive the highest credit rating, while the private credit registry virtually covers all loans to firms. Based on the "Procedure for Creation of Information System of Creditworthiness of Customers of Banks, Credit Organizations, Branches of Foreign Banks operating in the Republic of Armenia, that is of Credit Registry, and Procedure for Participation in Credit Registry", banks are obliged to report to all credit registries about all their loans within 3 business days. Discussions with ACRA and CBA stuff confirm that banks report on their loan portfolio almost on a daily basis.

[15]I received access to the credit registry through a collaboration of the CBA, the EFSE Development Facility and Tilburg University.

[16]Typical information includes contract terms, ex-post loan performance, firm characteristics and some information on borrower-affiliated parties. Information in a non-standardized format additionally covers detailed information on firm owners, participants, and guarantors but requires additional consent from involved parties and is only available against a much higher fee than the usual membership fee and is therefore only rarely requested.

[17]I use other credit contracts to calculate the exposure of firms to banks as well as relationship char-

credit contracts in terms of value (number). Most loans are issued either in Armenian Drams (AMD) or US dollars (49% and 48% respectively) with only few loans in euros, British Pounds and Russian Rubles. I convert all loan amounts in US dollars based on the monthly exchange rate of the Armenian Central Bank.[18] To ensure the use of timely information, I only study "new loans" that have been issued between January 2009 and June 2013.[19] Few loans that are not rated or have a written-off status at the date of loan issue and loans that have a zero interest rate (but possibly have some non-zero fees) are dropped. The resulting dataset consists of 53,066 loan-time observations of 19,332 loans to 6,649 firms with an average loan spell of almost 3 years.

Differences in firm composition might influence the effect of relationship lending on loan performance. For example, high-risk firms might self-select themselves to *Relationship Banks*, expecting that these banks will grant them more freedom to become delinquent on their loans. Therefore, I focus on firms that receive loans from both bank types, *Mixed* and *Relationship Banks*. Since sample selection is not random, inferences based on such a selected sample do not necessarily apply to the total sample but offer a cleaner identification not contaminated by firm selection and composition effects. The sub-sample consists of 10,567 loan-time observations of 4,441 loans to 621 firms and constitutes nearly 40% of the total lending amount of the entire sample.

2.3 Descriptive Statistics

In order to gain some insights into banks' survey responses as well as other characteristics of Armenian banks, Table 1 reports bank types (*Relationship* vs. *Mixed* Banks*)*, survey responses on the importance of relationship lending and the average number of hierarchical layers for loan approval by loan type as well as bank level summary statistics on the average loan amount threshold in US dollars, the market share in terms of loan number and loan value, the average borrower size based on the total borrowing amount across

acteristics.

[18]Note that base interest rates might differ across loans of different currencies. Since I focus on loan performance in Section 4.1 and the variation in interest rates in Section 5, it should not affect the results. Still, I control for differences in currencies and conduct robustness tests for loans of different currencies.

[19]I exclude loans that have been originated before January 2009 and stay in the system because of past non-performance.

all banks in US dollars, bank size and ownership.[20] A first look reveals that bank characteristics vary across the two bank types, *Mixed* and *Relationship Banks*. Unreported results suggest that no specific bank characteristic is correlated with the importance of relationship lending in Armenia. The only difference between the two groups is generally lower loan amount thresholds for *Relationship Banks*.[21] The differences in loan amount thresholds rather facilitate the analysis as it allows for more variation in loan types within one firm across the two bank types.

To strengthen results on the determinants of relationship lending, I use responses of 400 banks in the region of Central and Eastern Europe, Central Asia and North Africa to examine the effect of bank characteristics on the importance of relationship lending. Consistent with the literature, I find that relationship banking is more prevalent among small and decentralized banks (see e.g., Aghion and Tirole (1997), Stein (2002), Berger et al. (2005), Mian (2006), Berger and Black (2011), Beck et al. (2014b)). Foreign banks that are joint ventures or subsidiaries rely more on relationship lending than domestic banks, while there is no difference between domestic banks and foreign banks through mergers and acquisitions.

Table 2 shows ex-post loan performance measures, loan characteristics, relationship characteristics, and firm characteristics by bank type for the total sample of 19,332 loans and for the sub-sample of 4,441 loans to firms that borrow from both bank types. Definitions of the variables can be found in Table A.1 of the Appendix. The main loan performance measure "Non-Performance 90 days" is equal to one if a loan goes overdue for more than 90 days and zero otherwise. Other measures of loan performance indicate if a loan has any overdue principal or interest payments (Non-Performance), goes overdue for less than 90 days (Non-Performance 0-90 days) or more than 180 days (Non-Performance 180 days), or is completely written off/lost (Default).

Descriptive statistics and graphical analysis on loan performance lend first evidence that *Relationship Banks* temporarily experience higher delinquency rates without more

[20]Note that survey responses on lending technologies and hierarchical structures of banks from other EBRD countries do not significantly differ from Armenian banks.

[21]In unreported regressions results of the determinants of loan amount thresholds, I find that larger banks are more likely to have higher loan amount thresholds.

loan defaults for the same customer group. For the total sample, loan delinquencies are significantly higher by 0.8% to 2.6% for *Relationship Banks* compared to *Mixed Banks*. For the sub-sample of homogenous firms, the differences in loan delinquencies less and over 90 days or over 180 days increase, while the differences in loan defaults vanish. Figure 2 shows average delinquency rates over 90 days over time for the sub-sample of homogenous firms by bank type (*Relationship* versus *Mixed Banks*) and loan type (Figure 2a for SME loans and Figure 2b for corporate loans). Delinquency rates over 90 days are always higher for *Relationship Banks* compared to *Mixed Banks* for SME loans, the case when *Relationship Banks* rely on relationship lending but not *Mixed Banks*. In case of corporate loans, when both employ relationship lending, no consistent differences in delinquency rates are present. The figures confirms that relationship lending leads to temporarily higher delinquencies independent of time.

Apart from firm compositional and selection biases, differences in contract terms between *Relationship* and *Mixed Banks* might influence loan performance. For the total sample, *Relationship Banks* give out smaller loans ($181,000 versus $225,000) at slightly higher interest rates (15.4% versus 15.1%) that are less likely to be collateralized (82% versus 88%) or guaranteed (5% versus 10%) but are granted at almost 3 months longer maturities (36 months versus 33 months) without differences in credit ratings compared to *Mixed Banks*. The findings are consistent with Beck, Ioannidou, and Schäfer (2014b) who show that domestic banks are more likely to give out unsecured loans at higher interest rates and longer maturities than foreign banks. Except for collateral and guarantees, most of the differences in contract terms disappear for the more homogeneous set of firms in the sub-sample, suggesting that differences in loan characteristics should not be driving differences in loan performance.[22]

If contract terms do not significantly differ across bank types within the same firm, then I can isolate the effect of relationship lending on loan performance. Keys, Mukherjee,

[22]In unreported results, I also conduct a Kolmogorov Smirnov test for differences in distributions and find that differences in distributions of loan characteristics are never highly statistically significant between *Relationship* and *Mixed Banks*, especially not for collateral and guarantees. I also test for differences in distributions between the total and sub-sample, finding highly significant differences only in the classification of loans.

Seru, and Vig (2010) claim that when a firm applies for a loan banks collect "hard" information (e.g., credit rating) and "soft" information (e.g., knowledge of the client or future repayment ability). When studying loan performance around a FICO score threshold, they assume that after controlling for hard information any differences in default rates on either side of the threshold should be coming from the effect of securitization on the use of soft information. Similarly, the results above show that there are no significant differences in loan characteristics for the sub-sample of homogeneous firms.[23] The relationship lending measure thus captures some of the unobservable soft information "extracted" from the firm fixed effects and the residual. In Section 5, I show more formally that relationship lending is indeed associated with higher use of soft information.

Differences in other loan characteristics (location, industry and currency), relationship characteristics (bank-firm relationship in months, scope, primary bank, number of relationships) and other firm characteristics (firm location, industry, legal type) do not completely disappear for the total sample compared to the sub-sample. Since the main analysis focuses on variation within a firm, most of these differences will not play a role. Moreover, I control for these characteristics in different specifications of the model and robustness tests.

3 Empirical Methodology

In order to identify the effect of relationship lending on ex-post loan performance, I distinguish between *Relationship Banks* that always rely on relationship lending and *Mixed Banks* that value relationship lending only for corporate loans and employ transactional lending based on firm fundamentals and collateral for SME loans.[24] Figure 1 illustrates the idea, presenting bank types, loan types and corresponding lending techniques. *Mixed Banks* are the treatment group since they rely on transactional and relationship lending for SME and corporate loans respectively. *Relationship Banks* are the control group, al-

[23]Still, in the main analysis, I control for observable hard information variables (loan characteristics) and unobservable soft information (firm fixed effects).

[24]Indeed, *Mixed Banks* report to rely more on fundamental/cash flow analysis and collateral for SME loans.

ways employing relationship lending. Using the loan amount threshold, I assign SME and corporate loan types to each loan of a firm. The loan type then determines the lending technique for each loan of a firm.

Now, imagine a firm that receives an SME loan from a *Relationship Bank* and another SME loan from a *Mixed Bank*. Controlling for loan characteristics, I examine differences in loan performance of such a firm when lending techniques differ (relationship versus transactional lending, the left arrow in the figure). In contrast, if the firm receives two corporate loans from a *Relationship* and *Mixed Bank* when both banks rely on relationship lending, I expect no differences in loan performance (right arrow in the figure). Empirically, I estimate estimate the following logit model:

$$\begin{aligned}\text{Loan Performance}_{ijkt} = {} & \beta_1 \text{Corporate Loan}_{ijk} \text{Relationship Bank}_{ij} \\ & + \text{SME Loan}_{ijk} \text{Mixed Bank}_{ij} \\ & + \beta_3 \text{Corporate Loan}_{ijk} \text{Mixed Bank}_{ij} \\ & + \theta\text{'Loan Characteristics}_{ijk} + \alpha_j + \gamma_t + \varepsilon_{ijkt}, \end{aligned} \tag{1}$$

where i, j, k, t index loans, firms, banks, and time (semiannually). $\text{Loan Performance}_{ijkt}$ equals 1 if a loan becomes delinquent for more than 90 days in a given half year. $\text{Corporate Loan}_{ijk}\text{Relationship Bank}_{ij}$ equals one if a firm receives a corporate loan from a *Relationship Bank*. $\text{SME Loan}_{ijk}\text{Mixed Bank}_{\text{ij}}$ equals one if a firm receives an SME loan from a *Mixed Bank*. $\text{Corporate Loan}_{ijk}\text{Mixed Bank}_{ij}$ equals one if a firm receives a corporate loan from a *Mixed Bank*. The reference group are SME loans of *Relationship Banks*.

The coefficient β_2 is the main coefficient of interest that gauges the differences in performance for transaction-based versus relationship-based loans for the *same firm* (SME loans of *Mixed* vs. *Relationship Banks*). A negative (positive) coefficient implies that transactional lending leads to better (worse) loan performance, implying, in turn, that relationship lending leads to worse (better) performance of SME loans. The difference between the coefficients β_1 and β_3 measures the difference in performance when both banks employ relationship lending (corporate loans of *Mixed* vs. *Relationship Banks*).

Loan Characteristics$_{ijk}$ consists of loan contract terms such as the credit rating at loan initiation (Credit Rating$_{ijk}$), loan interest rate (Interest Rate$_{ijk}$), the natural logarithm of one plus the loan amount (Loan Amount$_{ijk}$), two dummy variables that indicate whether the loan is collateralized (Collateral$_{ijk}$) or has a guarantee (Guarantee$_{ijk}$), and the natural logarithm of one plus the loan maturity in months (Loan Maturity$_{ijk}$). Although results in Section 2.3 show that contract terms do not differ across *Relationship* and *Mixed Banks*, I still control for them in the regressions. I assume that contract terms are hard information variables that explain the performance of a loan. Controlling for hard information variables within the same firm ensures that the effect on loan performance is coming from differences in the importance of relationship lending and thus the use of unobservable soft information (see, e.g., Keys et al. (2010)).[25] If omitted variable bias is driving the results it would affect *Relationship* and *Mixed Banks* in the same way since contract terms do not differ across the two bank types.

The firm fixed effects, α_j, eliminate firm heterogeneity and compositional biases, comparing differences in loan performance within the same firm across different banks. Time of loan origination fixed effects, γ_t, are included to control for the timing of loan origination. Standard errors are always clustered at firm level to account for possible correlations in the residuals across observations of the same firm.[26] In addition, I estimate the logit model just with firm characteristics and a linear probability model since logit models with a large number of fixed effects suffer from the "incidental parameter problem".[27]

4 Relationship Lending and Loan Performance

In this section, I first show that relationship lending results in temporarily higher delinquency rates. Second, I reveal that, given previous delinquencies, *Relationship Banks* are

[25] In Section 5, I confirm that relationship lending is indeed associated with higher use of soft information in loan pricing.

[26] In Section 4.4, I also try double clustering at firm and loan level which reveals that clustering at firm level is sufficient.

[27] Because of the large number of fixed effects in the model relative to the smaller number of periods for which a borrower is observed, a non-linear model could give inconsistent estimates; this is known as the "incidental parameter problem" (see, for example, discussion in Cameron and Trivedi (2005, pp. 726-727)).

not worse off in the long run and continue to lend to firms. Third, I examine whether *Relationship Banks* are better at enforcing contract terms than *Mixed Banks*. Finally, I conduct several robustness tests.

4.1 Relationship Lending and Loan Delinquencies

In Figure 2, we have already observed that firms are more likely to become delinquent on relationship-based relative to transaction-based loans. Table 3 documents more formally that non-performance is lower for SME loans of *Mixed Banks* relative to SME loans of *Relationship Banks* (β_2). The result implies that non-performance is more likely for relationship lending. The odds ratio is statistically significant and ranges between 0.293 and 0.500, suggesting that the odds of becoming delinquent over 90 days increase by 50% to 71% for relationship-based relative to transaction-based loans. The effect is statistically significant at a 5% significance level for specifications without firm fixed effects and at a 1% significance level for specifications with firm fixed effects. In Column (1), I control for loan contract characteristics to isolate the effect of relationship lending on loan performance from observable hard information variables that explain loan performance. The odds ratio is at 0.500 and decreases to 0.479 in Column (2) when I additionally control for firm characteristics that can be seen as hard information variables on borrower level.

In Column (3), I conduct the cleanest test by including firm fixed effects. The firm fixed effects ensure that I compare loan performance for the same firm across different bank and loan types. The main effect becomes highly statistically significant and decreases to 0.369.[28] For the same firm, the odds of becoming delinquent over 90 days increase by 63% for a relationship loan relative to a transactional loan. In Column (4), I add a dummy for the crisis years 2009 and 2010, in Column (5), I add a dummy for the origination period of a loan, and in Column (6), I add the location, economic sector and currency of the loan. The odds ratios remain similar ranging from 0.293 and 0.358 and are still highly statistically significant.

To further strengthen my results, I test for differences between coefficients of corporate

[28]Note that the effect also holds if I control for firm×time fixed effects, meaning loan performance of the same firm in the same half year.

loans of *Relationship* and *Mixed Banks*, the case when both rely on relationship lending. The p-values at the bottom of Table 3 are never highly statistically significant, confirming that only differences in lending techniques affect loan performance. Additionally, the coefficient of the Corporate Loan_{ijkt}Mixed Bank_{ij} is often positive and significant, revealing that also within *Mixed Banks* relationship lending leads to higher non-performance.

Turning to loan characteristics, I find that non-performance is significantly lower for firms with higher initial credit rating. The credit rating has naturally the economically strongest effect on loan performance with an odds ratio between 0.046 and 0.102. As expected, albeit not always significant, the odds of becoming delinquent rise by 19% to 20% with higher interest rates, by 35% to 36% with larger loan amounts and by 40% to 90% with longer maturities, indicating that banks charge higher interest rates for larger loan amounts at longer maturities expecting higher non-performance. The effect of collateral is positive but not always highly statistically significant.[29] Having a guarantor does not affect the non-performance of the loan in any of the specifications.

Lastly, the crisis dummy enters positively and significantly, while other loan and firm characteristics do not enter significantly in most cases. Neither the location, industry nor legal status of the firm seem to affect loan performance. While loans in other fields of service are less likely to become delinquent compared to other industries, loans in wholesale and retail trade do not have different loan performance than other industries. Loans were less likely to become delinquent in crisis years 2009 and 2010 for the same firm.[30]

Alternatively, I estimate a linear probability model for the same specifications as in Table 4 since a high number of fixed effects in logit models could lead to inconsistent estimates. The table reveals that relationship-based loans are by 1.5 to 1.7 percentage points more likely to become delinquent over 90 days compared to transaction-based loans. This constitutes a large effect considering an average delinquency rate of 3% for

[29]The result might seem surprising but since collateral enforcement and creditors' rights protection do not function properly in Armenia and 85% of all loans are collateralized, non-performance on collateralized loans is likely since the value of collateral is not that high.

[30]Albeit surprising, the result is in line with the fact that the aggregate number of non-performing loans in Armenia was also not significantly higher for the crisis years and rather went slightly up in the last years but always remained under 6% (see CBA (2014)).

the sub-sample. In unreported results, I use delinquencies less than 90 days and find that the effect is also statistically significant ranging between 2.4% and 2.8% relative to an average delinquency rate of 5%, pointing to the temporary nature of overdue payments for relationship lending. With respect to other variables in Table 4, the signs, relative magnitudes, and statistical significance of the effects do not change considerably, indicating that the linear probability model offers a sufficient approximation of the logit model.

All in all, the results indicate that relationship lending results in *temporarily* higher delinquencies, although one would expect *Relationship Banks* to be better at screening and monitoring their clients. Von Thadden (1995), however, suggests that banks might tolerate short-term bad results as long as they can extract long-term rents. Banks learn a firm's quality through monitoring during the loan spell and thus do not see bad short-term results as a sign of bad quality and prematurely terminate good projects. Therefore, I explore what happens in the long run.

4.2 Relationship Lending and Long-Term Performance

In this section, I examine defaults, recovery rates, and losses of banks as well as returns on loans to test for differences in bank rents at the end of the loan spell. If Von Thadden (1995)'s theory holds, I should not find differences in loan performance at the end of the loan spell, despite temporary higher delinquencies for relationship-based relative transaction-based loans (i.e, SME loans of *Relationship Banks vs. Mixed Banks*).

Descriptive statistics in Table 2 have already shown that, for the sub-sample of homogenous firms, *Relationship Banks* have significantly higher delinquency rates but not higher default rates (in loss/written-off status) compared to *Mixed Banks*. Panel A of Table 5 reports default rates, recovery rates, and losses at the end of the loan spell after loans have become delinquent for more than 90 days. To account for right-censoring, I only select SME loans from the total sample and sub-sample that I observe until maturity. Loan default equals one if a loan is in loss or written-off status at the end of the loan spell and zero otherwise. The recovery rate equals one if a loan has had overdue

payments throughout the loan spell but did not default at the end of the loan spell. As I do not have a direct measure of written-off amounts, I calculate the overdue principal (plus interest rate amount) over the total contract amount given delinquencies over 90 days. Conditional on being delinquent, relationship-based loans do not default more often, are recovered less often, or carry higher losses at the end of the loan spell relative to transaction-based loans (i.e., SME loans of *Relationship Banks vs. Mixed Banks*).. In unreported regression results, I confirm that, even within the same firm, defaults and recovery rates do not significantly differ given previous delinquencies.[31]

In Panel B of Table 5, I repeat the analysis for SME loans conditional on loans that have been delinquent for less than 90 days to higher power and to test the temporary nature of delinquencies. Although SME loans of *Relationship Banks* seem to default more often after having gone overdue during the loan spell, the significant difference disappears once I control for firm compositional biases in the sub-sample. Recovery rates always remain insignificant for the total sample and sub-sample, while losses are slightly higher for *Mixed Banks* for the total sample. The result indicates that relationship lending does not lead to worse long-term performance at the end of the loan spell, despite higher delinquencies for less than 90 days during the loan spell.

While *Relationship Banks* do not experience worse long-term performance than *Mixed Banks* for SME loans, it still might be that they are earning lower returns on loans (ROL). Following Haselmann, Schoenherr, and Vig (2013), I calculate the return on a loan by bank j to firm i for the entire loan spell:

$$\text{ROL}_{ij} = \sum_{t=1}^{T} \frac{\text{Loan Balance}_{ijt}}{\sum_{t=1}^{T} \text{Loan Balance}_{ijt}} \left[(1 - \mathbb{1}_{\{NPL=1\}}) r_{ijt} + \mathbb{1}_{\{NPL=1\}} \text{Loss}_{ijt}\right], \qquad (2)$$

where the first term stands for the ratio of the outstanding loan amount from bank j to firm i at the beginning of period t ($\text{Loan Balance}_{ijt}$) to the sum of the outstanding loan amounts over the loan spell ($\sum_{t=1}^{T} Loan\,Balance_{ijt}$). The indicator function ($\mathbb{1}_{\{NPL=1\}}$) equals one when a loan has overdue amounts between t and t+1, r_{ijt} is the interest rate

[31] The results continue to hold when I condition on non-performance for less than 90 days.

charged by bank j to firm i and Loss_{ijt} is the loss of the bank, which is defined as the (negative) of the written off amount over the contract amount. The weights ensure that returns or defaults receive more weight at the beginning of the loan spell and less weight at the end of the loan spell, when most of the loan has been repaid.[32]

The data allows me to observe the loan balance and overdue principal and interest amounts if a loan enters a loss/written-off status but not whether the banks actually write off amounts. Therefore, losses are defined as the overdue principal (plus overdue interest) amount over the contract amount in case a loan is in a loss/written-off amount or becomes delinquent.[33]

Table 6 shows summary statistics and regression estimates of ROLs of SME loans for the total sample and the sub-sample. The first panel considers ROLs using only the overdue principal amount as a loss or both the overdue principal and interest amount. Surprisingly, *Relationship Banks* have significantly higher ROLs for the total sample relative to *Mixed Banks* but once firm compositional biases are taken into account the significant difference disappears. Next, ROLs given delinquencies over 90 days during the loan spell, show no significant differences between *Relationship* and *Mixed Banks*. Since differences in loan size might be driving the results, meaning that high losses of small loans receive more weight than small losses of large loans, I also calculate ROLs on bank level. In each period, I compute the value-weighted return on the loan portfolio of a bank and take the average over time. Unreported results confirm that return on loans on bank level are similar for both *Relationship* and *Mixed Banks*, being around 11%.

In a last step, I run regressions of the two ROL measures on a *Mixed Bank* dummy for the total sample and sub-sample of SME loans. The estimates reveal that even for the same firm there are no differences in ROLs between *Relationship* and *Mixed Bank*. When I further distinguish between SME loans that have been in arrears over 90 days or not, the insignificance remains to hold.

[32]Haselmann, Schoenherr, and Vig (2013) additionally discount the weights to account for the time value of money. Unreported results using discounted ROLs confirm that the findings are not affected.

[33]In unreported results, I also use the overdue principal (plus overdue interest) amount over the contract amount in case a loan is in a loss/written-off amount and zero in case a loan just becomes delinquent. This measure yields virtually the same results.

In sum, results in this section confirm Von Thadden (1995)'s claim that *Relationship Banks* let their customers become temporarily delinquent yet are able to extract long-term rents, not facing higher defaults or lower return on loans at the of the loan spell relative to *Mixed Banks*. These findings imply that relationship lending provides a liquidity insurance for firms in distress, offering greater financial flexibility without incurring higher losses.

4.3 Relationship Lending and Enforcement of Contracts

Since delinquencies are higher but losses and ROLs are not significantly different for *Relationship Banks* compared to *Mixed Banks*, the question arises whether *Relationship Banks* are better at enforcing contract terms. If *Relationship Banks* are indeed superior, I should not find any differences in "observable" ex-ante non-performance between all customers of both banks types despite differences in ex-post loan performance.

Panel A of Table 7 compares ex-ante non-performance with the bank a firm borrows from (Past NPL Bank), with any bank (Past NPL Any Bank), and with other banks (Past NPL Other Banks) between *Relationship* and *Mixed Banks* on bank-borrower-time and bank-borrower level for the total sample of firms. A t-test for differences in ex-ante loan performance reveals that while customers of *Relationship Banks* have a worse performance history with their *Relationship Bank* relative to customers of *Mixed Banks*, there are no statistically significant differences in ex-ante loan performance with any bank or other banks for the customer base of both bank types. The first result shows that *Relationship Banks* are more likely to continue to lend to firms despite past non-performance than *Mixed Banks*, which is another proof for the insurance function of relationship lending. At the same time, clients of *Relationship Banks* are not ex-ante riskier based on general past non-performance, albeit worse ex-post performance. This implies that *Relationship Banks* must have some additional unobservable information about their clients that allows them to be more lenient and not make losses long term.

Another way to test whether *Relationship Banks* are better at enforcing contracts is to look at loan rescheduling. If *Relationship Banks* do not roll over loans and renegotiate

contract terms more often than *Mixed Banks* (for SME loans) despite higher delinquency rates, then they must be better at enforcing contracts. Panel B of Table 7 shows the average percentage of rollover loans within one-month, two-month, and three-month windows as well as the average percentage of renegotiations of the interest rate, loan amount and loan maturity for the total sample and sub-sample.[34] Results reveal that there are no highly significant differences in rollover loans and renegotiation rates between *Relationship* and *Mixed Banks* despite higher delinquencies among SME loans of *Relationship Banks*. In unreported regression results, I confirm that, within the same firm, rollovers and renegotiations do not significantly differ.

In sum, results in this section reveal that *Relationship Banks* are better at enforcing contracts, not having ex-ante riskier customers or rescheduling loans more often than *Mixed Banks* despite higher delinquency rates. The results suggest that better enforcement of contracts might be an explanation for the insurance function of relationship lending. *Relationship* are also more likely to continue to lend to firms, providing a shelter for firms in distress.

4.4 Robustness Tests

In this section, I explore whether the effect of relationship lending on loan performance survives a battery of robustness tests. Table 8 documents results of several robustness tests, using specifications of Table 3 in Columns (2) and (3) with firm characteristics and with firm fixed effects. To consume space, Table 8 reports only the main coefficient of $\text{SME Loan}_{ijk}\text{Mixed Bank}_{ij}$ that measures the effect of low importance of relationship lending on loan performance as well as its standard error and the number of observations.

First, Panel A reports results for alternative non-performance measures, namely "Non-Performance", "Non-Performance 0-90 days" and "Non-Performance 180". While there is no systematically significant effect of relationship lending on loan performance with firm characteristics, I find significant effects with firm fixed effects that are also similar

[34] As I do not know for sure whether a loan has been rolled over, I declare a loan of a firm to be a rollover loan if a firm has a previous performing or non-performing loan with a bank and a new loan that has been issued within one, two, or three months before or after the previous loan with the same bank. Additionally, I assume that a bank renegotiates contract terms if they change during the spell of a loan.

in size to the main effect in Column (3) of Table 3. The stronger effect of delinquencies for less than 90 days confirms the temporary nature of overdue payments for relationship lending.

Second, in Row "Time-varying Firm Characteristics", I introduce time fixed effects and firm×time fixed effects for specifications of Table 3 in Columns (2) and (3), respectively, to control for the fact that firm characteristics might be changing over time. Note that I further reduce the sample to firms that received loans from both bank types in a given half year. Although I lose many observations, the main result continues to hold.[35] Third, Row "W/o Right-censored Loans" uses only loans that are observed until maturity to account for possible issues of right-censoring. Results might be biased if I underestimate possible loan non-performance that occurs after the observations period for loans that are not observed until maturity. Despite reduced significance, the main affects continues to hold.

Forth, I implement double clustering to account for the fact that firms and loans appear multiple times in the data set and standard errors could be correlated. Failure to account for clustering on both levels might lead to too low standard errors and wrong inference of the main results. Instead, if I find that standard errors only moderately differ from the case with just one-way clustering on firm level then it implies that the within-loan correlation of non-performance is not that high. Row "Double Clustering" shows that standard errors increase, on average, by 5% only and significance levels do not change, indicating that additional clustering at loan level is not essential to the analysis.

Fifth, imagine a firm that receives a transaction-based loan, and then a relationship-based loan within the same bank (i.e, SME vs. corporate loan of the same *Mixed Bank)*. If the information sharing across departments does not work perfectly and the customer will be assigned, for example, to different loan officers in different departments, the timing of loans will not influence the main results. If information on customers is shared among departments, then once a firm receives a transaction-based loan, the customer will be

[35]In unreported results, I use linear probability models to test for the effect of relationship lending on delinquencies less than and over 90 days within the same firm and period. The main effect continues to hold and is between 1% to 1.7% and 2.4% to 2.8% for delinquencies less than and over 90 days respectively.

known to the bank and there will be no difference in loan performance once it receives a relationship-based loan. Therefore, in Rows "Timing w/o SME & corp. Loans" and "Timing w/o SME Loans" of Table 8, I exclude (i) all SME and corporate loans once a firm switches from SME to corporate loans and (ii) only SME loans once a firms switches from SME to corporate loans. Only few loans are dropped and results remain virtually the same, suggesting imperfect information sharing across departments.

Sixth, I show that the main identification comes from loans at the tail of the loan amount distribution and not around the threshold. I assume that for a *Mixed Bank* differences in lending techniques will be stronger the further away a loan is from the threshold. Row "W/o loans 50% around threshold" of Table 8 shows that excluding loans outside a range of 50% around the threshold does not alter the main effect.[36] Seventh, Row "Only US dollar loans" uses only loans denominated in US dollars to test for possible biases coming from differences in currencies and confirms that main results prevail. Eight, Row "Loans after January 2011" focusses only on loans issued after 2011 to control for the fact that survey responses of banks were given in 2011 and bank business models might have changed over time. Again, results continue to hold.

Ninth, Relationship lending might not be the most important lending technology for a bank such that a 5 for "very important" might mean something else for one bank compared to another bank. Therefore, I construct a measure of the importance of relationship lending relative to the importance of other lending technologies (fundamental, private and business collateral) by loan type. For all *Mixed Banks* the relative importance of relationship lending is always higher for corporate compared to SME loans. The importance of relationship lending stays constant across loan types for only 4 out of 9 *Relationship Banks* and is always higher compared to *Mixed Banks*. Table 8 in Row "Alternative Relationship Lending" reveals for that for the reduced sample of banks the main result continues to hold.

Tenth, I add typical relationship variables such as the natural logarithm of one plus the bank-firm relationship in months, a dummy variable that equals one if a firm has more

[36]The results continues to hold for different percentages around the threshold.

than 50% of its outstanding debt with a bank, and a dummy variable that equals one if a firm has other products with the bank (e.g., credit lines, factoring, guarantees). Row "Relationship Variables" in Table 8 shows that although relationship variables significantly enter the regressions, the main result of relationship lending on loan performance prevails.

5 Relationship Lending and Information Use

Since the measure of relationship lending is new to the literature and relies on survey responses, this section shows that it captures the use of soft information when pricing loans. Similar to Rajan, Seru, and Vig (2014) and Skrastins and Vig (2014), I assume that in a state with just hard information and no soft information available, hard information variables will perfectly predict the loan interest rate. In a state with additional soft information, hard information variables will not be able to completely explain interest rates and the unexplained part becomes a measure of soft information.

For the analysis, I use a regression model with multiplicative heteroskcedasticity introduced by Harvey (1976) and firstly applied to banking by Cerqueiro, Degryse, and Ongena (2011). The model estimates mean effects on the interest rate and the determinants of the residual variance in interest rates. The model consists of an equation for the mean of interest rates, and a second one for the residual variance of interest rates:[37]

$$\text{Loan Spread}_{ijk} = \theta\text{'Loan Characteristics}_{ijk} + \alpha_j + \varepsilon_{ijk}, \tag{3}$$

$$\begin{aligned} Log(\sigma^2_{ijk}) = \alpha_0 &+ \delta_1 \text{Corporate Loan}_{ijk} \text{Relationship Bank}_{ij} \\ &+ \delta_2 \text{SME Loan}_{ijk} \text{Mixed Bank}_{ij} \\ &+ \delta_3 \text{Corporate Loan}_{ijk} \text{Mixed Bank}_{ij}, \end{aligned} \tag{4}$$

where i, j, k index loans, firms, and banks. Note that different from equation (1) I only use information at loan initiation such that each loan appears only once in the data set. The Loan Spread_{ijk} equals the loan interest rate minus the refinancing rate of

[37] A more detailed description of the methodology can be found in the Appendix A.

the Armenian banks with the Armenian Central Bank. $Log(\sigma^2_{ijk})$ stands for the natural logarithm of the residual variance of the loan spread. The other variables are defined as in equation (1). By including loan contract terms as well as firm fixed effects, I control for all hard information variables that explain the variation in interest rates for the *same firm*. The remaining unexplained variation should capture the use of soft information. A positive (negative) effect on the variance of the unexplained part means that the variance increases (decreases), hard information variables are less (more) predictive of future loan performance and more (less) soft information is used.

The coefficient δ_2 estimates the effect of transactional lending on the variation in interest rates (soft information use) relative to relationship lending (SME loans of *Mixed* vs. *Relationship Loans*). The difference in coefficients δ_1 and δ_3 measures the effect on the variation in interest rates (soft information use) when both banks rely on relationship lending (corporate loans of *Mixed* vs. *Relationship Loans*).

Table 9 shows estimation results of the regression model with multiplicative heteroscedasticity in equations 3 (Panel A) and 4 (Panel B), where the columns correspond to the specifications of the columns in Table 3. Panel A shows the coefficients of the mean of interest rates that are in line with the previous literature. Panel B documents the coefficients of the variance of the error term. All specifications reveal a negative effect of transactional lending on the variation in interest rates (SME loans of *Mixed Banks*). Transactional lending reduces the unexplained part of interest rates and leads to less use of soft information relative to relationship lending. A test for differences in coefficients shows that the use of soft information does not significantly differ when both banks rely on relationship lending. In sum, these results suggest that the relationship lending measure indeed captures the use of soft information in loan pricing.

6 Conclusions

Although the empirical literature on relationship lending is quiet extensive, few is known about the behavior of banks when firms are in distress. In a novel approach that combines

survey data on banks' lending policies with unique credit registry data, this paper fills this gap by examining the effect of relationship lending on ex-post loan performance. In line with Von Thadden (1995), I find that relationship banks are willing to tolerate *temporary* delinquencies without facing higher defaults or lower rents in the *long run*. Moreover, *Relationship Banks* are more likely to continue to lend to firms after past non-performance. These findings present first evidence that relationship lending serves as a liquidity insurance for firms in distress, offering greater financial flexibility and better access to finance.

The findings of the paper have several broader implications. Relying on soft information, relationship lending constitutes a critical tool to target SMEs which are the backbone of most economics.[38] This paper shows that relationship lending is especially beneficial when firms are hit by idiosyncratic shocks, offering continuation financing. In the long run, firms will thus have longer investment horizons which should lead to more investments, employment and economic growth. Moreover, knowledge of the client and enforcement of contracts seem to be key for banks to ease lending standards which calls for an improved contractual and informational framework. From a financial stability perspective, relationship lending appears to be an efficient lending technique to help firms in need without incurring higher losses for banks. Finally, the results might also be useful for other markets such as the labor market or insurance market in which close relationships help reducing existing information asymmetries.

[38] According to the website of the Global Alliance of SMEs, SMEs have provided nearly 50% of jobs in most countries (53% in US and 78% in Germany) and account for 75% and 39% of GDP in Germany and US (Global Alliance of SMEs (2014)).

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Table 1: Bank Level Descriptive Statistics

The Table reports bank level summary statistics on the importance of relationship lending and the average number of hierarchical layers for loan approval by loan type, the average loan amount threshold in US$, the market share in terms of loan number and loan value, the average borrower size based on the total borrowing amount across all banks in US$, bank size and bank ownership for 15 Armenian banks between January 2009 and June 2013.

		SME Loans		Corporate Loans							
Bank ID	Bank Type	Relationship Lending	Average Hierarchy	Relationship Lending	Average Hierarchy	Average Threshold in $US	Share in Number of Loans (%)	Share in Value of Loans (%)	Borrower Size	Bank Size	Foreign
38	Mixed	3	2	5	2	2,751,486	0.027	0.029	1,727,395	Small	0
59	Mixed	4	2	5	2	1,500,000	0.065	0.216	3,033,712	Big	0
70	Relationship	5	1	5	1	518,444	0.061	0.041	1,0679,69	Medium	0
219	Mixed	4	3	5	1	166,639	0.076	0.032	529,078	Medium	0
274	Relationship	5	2	5	3	837,301	0.054	0.036	466,309	Medium	1
457	Mixed	4	2	5	3	2,751,486	0.089	0.136	2,133,701	Big	0
470	Mixed	4	3	5	3	500,000	0.169	0.067	721,984	Medium	0
520	Relationship	5	2	5	1	1,000,000	0.037	0.108	3,756,655	Big	0
523	Relationship	5	2	5	2	1,355,53	0.025	0.017	1,211,437	Medium	0
662	Relationship	5	1	5	2	500,000	0.137	0.068	313,301	Big	0
702	Relationship	5	1	5	1	271,106	0.122	0.055	790,899	Medium	0
772	Mixed	4	1	5	3	661,568	0.026	0.024	1,833,290	Small	0
776	Relationship	5	3	5	3	300,000	0.040	0.028	1,748,996	Small	1
798	Relationship	5	2	5	2	200,000	0.037	0.029	1,319,247	Small	0
995	Relationship	5	5	5	5	500,000	0.035	0.112	2,471,792	Big	1

Table 2: Loan Level Descriptive Statistics

The Table reports loan level summary statistics on ex-post loan performance measures, loan characteristics, relationship characteristics, and firm characteristics by bank type between January 2009 and June 2013. The two bank types are *Relationship Banks* that always rely on relationship lending and *Mixed Banks* that rely on relationship lending only for corporate loans. Definitions of the variables can be found in the Appendix, Table A.1. The left panel "Total Sample" reports summary statistics for the total sample of 19,332 loans to 6,649 firms. The right panel "Sub-Sample" reports summary statistics for a sub-sample of 4,441 loans to 271 firms that received loans from both *Relationship* and *Mixed Banks*. The Columns "Difference t-test" in both panels report t-statistics for differences in means between the two bank types and indicate significance at the 1%, 5%, and 10% levels with ***, **, *.

	Total Sample					Sub-Sample				
	Relationship Bank		Mixed Bank		Difference	Relationship Bank		Mixed Bank		Difference
Variable Names	Mean	Std	Mean	Std	t-test	Mean	Std	Mean	Std	t-test
Ex Post Loan Performance										
Non-Performance	0.058	0.233	0.061	0.238	-0.002	0.051	0.220	0.046	0.209	0.005
Non-Performance 0-90 days	0.100	0.300	0.075	0.263	0.026***	0.088	0.284	0.058	0.234	0.030***
Non-Performance 90 days	0.046	0.210	0.037	0.188	0.010***	0.041	0.199	0.023	0.150	0.018***
Non-Performance 180 days	0.029	0.168	0.021	0.144	0.008***	0.025	0.156	0.015	0.123	0.010**
Default (loss/written-off)	0.020	0.139	0.012	0.110	0.008***	0.012	0.109	0.009	0.095	0.003
Loan Characteristics										
Credit Classification	4.99	0.17	4.99	0.14	-0.002	4.98	0.18	4.99	0.13	-0.007
Interest Rate	15.37	3.88	15.10	3.72	0.264***	13.81	3.73	13.76	3.56	0.045
Loan Spread	8.00	4.37	7.62	4.08	0.380***	6.41	4.21	6.25	3.98	0.152
Loan Amount in US$	181,386	606,152	224,708	714,815	-43,322***	352,903	963,534	341,802	752,242	11,100
Collateral	0.82	0.38	0.88	0.32	-0.062***	0.76	0.43	0.87	0.33	-0.108***
Guarantee	0.05	0.22	0.11	0.31	-0.053***	0.11	0.31	0.16	0.37	-0.051***
Loan Maturity in Months	36.32	21.37	33.38	22.46	2.940***	32.39	22.65	32.00	24.42	0.389
Other Loan Characteristics										
Loan Location in Yerevan	0.59	0.49	0.75	0.43	-0.163***	0.72	0.45	0.77	0.42	-0.051***
Wholesale and Retail Trade Industry Loan	0.46	0.50	0.42	0.49	0.041***	0.51	0.50	0.44	0.50	0.070***
Other Fields of Service Industry Loan	0.13	0.34	0.22	0.41	-0.083***	0.11	0.31	0.14	0.35	-0.037***
Loan in USD	0.46	0.50	0.51	0.50	-0.051***	0.58	0.49	0.61	0.49	-0.026*

Table 2 (continued): Loan Level Descriptive Statistics

	Total Sample					Sub-Sample				
	Relationship Bank		Mixed Bank		Difference	Relationship Bank		Mixed Bank		Difference
Variable Names	Mean	Std	Mean	Std	t-test	Mean	Std	Mean	Std	t-test
Relationship Characteristics										
Relationship in Months	15.63	18.16	15.92	17.65	-0.291	17.43	19.27	16.22	17.27	1.211**
Scope	0.18	0.38	0.24	0.43	-0.062***	0.30	0.46	0.31	0.46	-0.012
Primary Bank	0.93	0.26	0.90	0.30	0.032***	0.79	0.41	0.74	0.44	0.049***
Number of Relationships	1.93	1.39	1.94	1.47	-0.012	3.41	2.08	3.24	2.01	0.176***
Multiple Relationships	0.53	0.50	0.51	0.50	0.025***	1	0	1	0	0
Firm Characteristics										
Firm Location in Yerevan	0.59	0.49	0.75	0.43	-0.163***	0.72	0.45	0.77	0.42	-0.051***
Wholesale Retail Trade Industry Firm	0.23	0.42	0.16	0.36	0.075***	0.24	0.43	0.18	0.39	0.057***
Other Fields of Service Industry Firm	0.54	0.50	0.63	0.48	-0.087***	0.54	0.50	0.60	0.49	-0.057***
Private Firm	0.54	0.50	0.65	0.48	-0.104***	0.53	0.50	0.61	0.49	-0.076***
Observations	10,598		8,734		19,332	2,151		2,290		4,441

Table 3: Relationship Lending and Loan Performance (Logit Model)

The Table reports logit regression results for a sub-sample of 4,441 loans to 271 firms that received loans from both *Relationship* and *Mixed Banks* between January 2009 and June 2013. The dependent variable is Loan Performance$_{ijkt}$ that equals one when a loan is delinquent for more than 90 days. The main independent variable is "SME Loan Mixed Bank" which measures the performance of transaction-based relative to relationship-based loans, i.e., SME loans of *Mixed* versus *Relationship Banks* (the reference group). Columns (1)-(2) report results for the 10,656 loan-time observations with loan characteristics without and with firm characteristics. In Columns (3)-(6) firm fixed effects are added which reduces the sample to 1,087 loan-time observations of firms for which performance and non-performance is observed. Column (4) includes a crisis dummy for the years 2009 and 2010, Column (5) adds loan origination fixed effects, and Column (6) adds other loan characteristics. The last row uses a Walt test to test whether the difference in coefficients when both banks rely on relationship lending, i.e., corporate loans of *Relationship* versus *Mixed Banks*, equals zero. Definitions of the variables can be found in the Appendix, Table A.1. Coefficients are presented as odds ratios. Standard errors are clustered at firm level and presented in parenthesis. ***, **, and * indicate significance at the 1%, 5%, and 10%.

	(1)	(2)	(3)	(4)	(5)	(6)
Corporate Loan Relationship	1.083	1.130	1.172	0.963	0.916	1.284
Bank	(0.554)	(0.572)	(0.467)	(0.387)	(0.377)	(0.522)
SME Loan Mixed Bank	0.500**	0.479**	0.369***	0.326***	0.293***	0.358***
	(0.151)	(0.140)	(0.108)	(0.098)	(0.072)	(0.124)
Corporate Loan Mixed Bank	1.588	1.556	2.763**	2.382**	2.823***	2.596**
	(0.911)	(0.900)	(1.140)	(1.007)	(1.097)	(1.116)
Credit Rating	0.046***	0.042***	0.102***	0.041***	0.052***	0.069***
	(0.014)	(0.012)	(0.058)	(0.027)	(0.037)	(0.041)
Credit Interest Rate	1.192***	1.204***	0.901	1.111	1.049	0.922
	(0.061)	(0.061)	(0.076)	(0.097)	(0.123)	(0.083)
Loan Amount	1.359**	1.351**	0.786*	0.869	0.869	0.756*
	(0.181)	(0.175)	(0.108)	(0.091)	(0.107)	(0.110)
Collateral	3.850*	4.008*	4.090***	2.309**	2.736*	3.800**
	(2.740)	(2.905)	(2.015)	(0.885)	(1.607)	(2.027)
Guarantee	0.844	0.882	1.062	0.705	1.274	0.946
	(0.395)	(0.415)	(0.611)	(0.461)	(0.798)	(0.546)
Maturity	1.215	1.230	1.469**	1.627***	1.893***	1.440**
	(0.319)	(0.324)	(0.235)	(0.255)	(0.415)	(0.233)

Table 3 (continued): Relationship Lending and Loan Performance (Logit Model)

	(1)	(2)	(3)	(4)	(5)	(6)
Firm Location in Yerevan		1.491				
		(0.497)				
Wholesale Retail Trade		1.072				
Industry Firm		(0.524)				
Other Fields of Service		0.851				
Industry Firm		(0.368)				
Private Firm		1.456				
		(0.565)				
Crisis Dummy				0.021***		
				(0.011)		
Loan Location in Yerevan						1.102
						(0.643)
Wholesale Retail Trade						0.783
Industry Loan						(0.448)
Other Fields of Service						0.235**
Industry Loan						(0.148)
Loan in USD						1.281
						(0.407)
Firm Fixed Effects	No	No	Yes	Yes	Yes	Yes
Time Fixed Effects	No	No	No	No	Yes	No
Pseudo R-squared	0.205	0.212	0.120	0.281	0.174	0.135
Observations (Loan-Time Level)	10,656	10,656	1,087	1,087	1,087	1,087
Corporate Loan × Relationship Bank = Corporate Loan × Mixed Bank	0.697	0.743	0.243	0.238	0.130	0.349

Table 4: Relationship Lending and Loan Performance (Linear Probability Model)

The Table reports regression results from a linear probability model for a sub-sample of 4,441 loans to 271 firms that received loans from both *Relationship* and *Mixed Banks* between January 2009 and June 2013. The dependent variable is Loan Performance$_{ijkt}$ that equals one when a loan is delinquent for more than 90 days. The main independent variable is "SME Loan Mixed Bank" which measures the performance of transaction-based relative to relationship-based loans, i.e., SME loans of *Mixed* versus *Relationship Banks* (the reference group). Columns (1)-(2) report results for the 10,656 loan-time observations with loan characteristics without and with firm characteristics. In Columns (3)-(6) firm fixed effects are added. Column (4) includes a crisis dummy for the years 2009 and 2010, Column (5) adds loan origination fixed effects, and Column (6) adds other loan characteristics. The last row uses a Walt test to test whether the difference in coefficients when both banks rely on relationship lending, i.e., corporate loans of *Relationship* versus *Mixed Banks*, equals zero. Definitions of the variables can be found in the Appendix, Table A.1. Standard errors are clustered at firm level and presented in parenthesis. ***, **, and * indicate significance at the 1%, 5%, and 10%.

	(1)	(2)	(3)	(4)	(5)	(6)
Corporate Loan Relationship	0.004	0.004	0.001	-0.000	-0.000	0.002
Bank	(0.017)	(0.017)	(0.008)	(0.008)	(0.008)	(0.008)
SME Loan Mixed Bank	-0.015**	-0.016***	-0.016***	-0.017***	-0.016***	-0.015***
	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)
Corporate Loan Mixed Bank	0.012	0.012	0.021*	0.017	0.021*	0.020*
	(0.023)	(0.023)	(0.011)	(0.011)	(0.011)	(0.011)
Credit Rating	-0.388***	-0.388***	-0.206***	-0.207***	-0.208***	-0.209***
	(0.038)	(0.037)	(0.044)	(0.046)	(0.044)	(0.045)
Credit Interest Rate	0.004***	0.004***	-0.000	0.003**	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Loan Amount	0.007**	0.007**	-0.003*	-0.001	-0.003*	-0.003**
	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Collateral	0.021**	0.021**	0.019**	0.007	0.018***	0.020***
	(0.009)	(0.009)	(0.007)	(0.006)	(0.006)	(0.008)
Guarantee	-0.002	-0.002	0.003	-0.002	0.003	0.004
	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)
Maturity	0.002	0.002	0.005*	0.003	0.005*	0.005
	(0.005)	(0.005)	(0.003)	(0.003)	(0.003)	(0.003)

Table 4 (continued): Relationship Lending and Loan Performance (Logit Model)

	(1)	(2)	(3)	(4)	(5)	(6)
Firm Location in Yerevan		0.009				
		(0.008)				
Wholesale Retail Trade		0.004				
Industry Firm		(0.014)				
Other Fields of Service		-0.002				
Industry Firm		(0.012)				
Private Firm		0.010				
		(0.009)				
Crisis Dummy				-0.038***		
				(0.009)		
Loan Location in Yerevan						0.002
						(0.011)
Wholesale Retail Trade						-0.002
Industry Loan						(0.009)
Other Fields of Service						-0.017*
Industry Loan						(0.010)
Loan in USD						0.007
						(0.006)
Constant	1.814***	1.800***	1.069***	1.039***	1.061***	1.072***
	(0.189)	(0.184)	(0.215)	(0.224)	(0.220)	(0.215)
Firm Fixed Effects	No	No	Yes	Yes	Yes	Yes
Time Fixed Effects	No	No	No	No	Yes	No
R-squared	0.185	0.186	0.480	0.486	0.482	0.481
Observations (Loan-Time Level)	10,656	10,656	10,656	10,656	10,656	10,656
Corporate Loan × Relationship Bank = Corporate Loan × Mixed Bank	0.821	0.819	0.253	0.305	0.208	0.273

Table 5: Relationship Lending and Long-Term Performance

The Table reports performance statistics of SME loans selected from the total sample of 19,332 loans to 6,649 firms and the sub-sample of 4,441 loans to 271 firms that received loans from both *Relationship* and *Mixed Banks* between January 2009 and June 2013. For SME loans *Relationship Banks* rely on relationship lending and *Mixed Banks* on transactional lending. Both panels show loan defaults (loss/written-off), recovery rates, the percentage of the loan amount not repaid in time and the percentage of the loan and interest amount not repaid in time for SME loans that are observed until maturity. Loan default equals one if a loan is in loss or written-off status at the end of the loan spell and zero otherwise. Recovery rate equals one if a loan has been delinquent during the loan spell but did not default at the end of the loan spell. The percentage of loan amount (and interest) not repaid in time stands for the ratio of the principal (and interest rate) amount over the total contract amount in case of non-performance. While Panel A conditions loans to have been delinquent over 90 days during the loan spell, Panel B conditions loans to have been delinquent for less than 90 days during the loan spell. For all panels, the column "Difference t-test" reports t-statistics for differences in means between the two bank types and indicates significance at the 1%, 5%, and 10% levels with ***, **, *.

Panel A: Defaults, Recovery Rates, and Losses for SME Loans if NPL 90 days

	Total Sample: SME Loans					Sub-Sample: SME Loans				
	Relationship Banks		Mixed Banks		Difference	Relationship Banks		Mixed Banks		Difference
Variable Names	Mean	Std	Mean	Std	t-test	Mean	Std	Mean	Std	t-test
Loan Default (loss/written-off)	0.608	0.489	0.522	0.501	0.087*	0.512	0.506	0.600	0.498	-0.088
Recovery Rate	0.226	0.419	0.296	0.458	-0.070*	0.22	0.419	0.333	0.479	-0.114
% of loan amount not repaid in time	0.691	1.226	0.846	1.076	-0.155	0.831	1.794	0.526	0.589	0.304
%of loan and interest amount not repaid in time	0.85	1.407	0.937	1.137	-0.086	0.908	1.834	0.608	0.619	0.300
Observations (Loan Level)	301		186		487	41		30		71

Panel B: Defaults, Recovery Rates, and Losses for SME Loans if NPL 0-90 days

	Total Sample: SME Loans					Sub-Sample: SME Loans				
	Relationship Banks		Mixed Banks		Difference	Relationship Banks		Mixed Banks		Difference
Variable Names	Mean	Std	Mean	Std	t-test	Mean	Std	Mean	Std	t-test
Loan Default (loss/in written-off status)	0.249	0.433	0.198	0.399	0.051*	0.169	0.377	0.212	0.412	-0.043
Recovery Rate	0.127	0.333	0.158	0.366	-0.031	0.156	0.365	0.173	0.382	-0.017
% of loan amount not repaid in time	0.041	0.123	0.097	0.227	-0.056***	0.059	0.182	0.108	0.237	-0.049
%of loan and interest amount not repaid in time	0.049	0.127	0.106	0.229	-0.057***	0.066	0.185	0.118	0.239	-0.052
Observations (Loan Level)	543		303		846	77		52		129

Table 6: Relationship Lending and Long-Term Rents

The Table reports summary statistics and regression results of returns on loans for SME loans selected from the total sample of 19,332 loans to 6,649 firms and the sub-sample of 4,441 loans to 271 firms that received loans from both *Relationship* and *Mixed Banks* between January 2009 and June 2013. For SME loans *Relationship Banks* rely on relationship lending and *Mixed Banks* on transactional lending. Returns on loans are defined in equation 2 as the value-weighted interest rate and loss of a bank in case of non-performance. The loss of a bank is defined as the overdue principal over the contract amount (Return on Loans) or the overdue principal plus interest rate amount over the contract amount (Return on Loans (IR)). The first panel shows returns on SME loans on loan level for the total sample and the sub-sample by bank type. The second panel shows the same returns on SME loans that have been delinquent over 90 days. For all both panels, the column "Difference t-test" reports t-statistics for differences in means between the two bank types and indicates significance at the 1%, 5%, and 10% levels with ***, **, *. The last panel shows results from a regressions of the two returns on loans measures on a Mixed Bank dummy with firm fixed effects for all SME loans ("All Loans"), for SME loans not delinquent over 90 days ("NPL 90=0"), and for SME loans delinquent over 90 days ("NPL 90=1"),.

	Total Sample: SME Loans					Sub-sample: SME Loans				
	Relationship Banks		Mixed Banks		Difference	Relationship Banks		Mixed Banks		Difference
Variable Names	Mean	Std	Mean	Std	t-test	Mean	Std	Mean	Std	t-test
Return on loans on loan level										
Return on Loans	15.08	4.512	14.7	4.459	0.385***	13.75	4.421	13.53	4.2	0.221
Return on Loans (IR)	15.08	4.514	14.7	4.46	0.385***	13.75	4.421	13.53	4.201	0.221
Observations (Loan-Level)	9,630		8,289		17,919	1,770		2,091		3,869
Return on loans on loan level given NPL 90										
Return on Loans	7.841	5.122	7.282	4.868	0.558	7.642	5.08	6.387	4.411	1.255
Return on Loans (IR)	7.819	5.137	7.265	4.877	0.554	7.63	5.086	6.368	4.419	1.262
Observations (Loan-Level)	421		294		715	67		43		110

Regressions on returns on loans												
	SME Loans		SME Loans if NPL90=0		SME Loans if NPL90=1		SME Loans		SME Loans if NPL90=0		SME Loans if NPL90=1	
	ROL	ROL (IR)	ROL	ROL (IR)	ROL	ROL (IR)	ROL	ROL (IR)	ROL	ROL (IR)	ROL	ROL (IR)
Mixed Bank	0.283	0.283	0.084	0.084	-0.058	-0.057	0.283	0.283	0.084	0.084	-0.058	-0.057
	(0.233)	(0.233)	(0.225)	(0.225)	(1.572)	(1.568)	(0.203)	(0.203)	(0.197)	(0.197)	(1.340)	(1.337)
Constant	14.773***	14.772***	15.167***	15.167***	7.635***	7.615***	13.474***	13.474***	13.771***	13.771***	7.174***	7.159***
	(0.108)	(0.108)	(0.105)	(0.105)	(0.646)	(0.645)	(0.110)	(0.110)	(0.108)	(0.108)	(0.524)	(0.522)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.763	0.763	0.766	0.766	0.862	0.862	0.580	0.580	0.589	0.589	0.895	0.896
Observations (Loan-Level)	17,919	17,919	17,204	17,204	715	715	3,861	3,861	3,751	3,751	110	110

Table 7: Relationship Lending and Enforcement of Contract Terms

The Table reports summary statistics loans selected from the total sample of 19,332 loans to 6,649 firms and the sub-sample of 4,441 loans to 271 firms that received loans from both *Relationship* and *Mixed Banks* between January 2009 and June 2013. Panel A reports summary statistics on past non-performance of any kind with the present bank of the firm, with any bank and with other banks of the firm on bank-firm-time and bank-firm level. For the sample, I collapse all 19,332 loan observations to bank-firm-time level or bank-firm level. Panel B reports summary statistics on rollover loans as well as changes in the interest rate, loan amount and maturity during the loan spell for the total sample and sub-sample of SME loans. For SME loans *Relationship Banks* rely on relationship lending and *Mixed Banks* on transactional lending. I declare a loan of a firm to be a rollover loan if a firm has a previous performing or non-performing loan with a bank and a new loan that has been issued within one, two, or three months before or after the previous loan with the same bank. For all panels, the column "Difference t-test" reports t-statistics for differences in means between the two bank types and indicates significance at the 1%, 5%, and 10% levels with ***, **, *.

Panel A: Distribution of Ex-ante Borrower Risks

	Total Sample: Bank-Firm-Time Level					Total Sample: Bank-Firm Level				
	Relationship Bank		Mixed Bank		Difference	Relationship Bank		Mixed Bank		Difference
Variable Names	Mean	Std	Mean	Std	t-test	Mean	Std	Mean	Std	t-test
Past NPL with Bank	0.016	0.126	0.011	0.103	0.005***	0.013	0.104	0.008	0.080	0.005**
Past NPL with Any Bank	0.017	0.128	0.018	0.132	-0.001	0.014	0.116	0.017	0.124	-0.002
Past NPL with Other Banks	0.015	0.119	0.016	0.124	-0.001	0.013	0.110	0.015	0.121	-0.002
Observations	7,874		6,322		14,196	4,531		3,352		7,883

Panel B: Rollover Loans and Renegotiations of Contract Terms

	Total Sample: SME Loans					Sub-Sample: SME Loans				
	Relationship Bank		Mixed Bank		Difference	Relationship Bank		Mixed Bank		Difference
Variable Names	Mean	Std	Mean	Std	t-test	Mean	Std	Mean	Std	t-test
Rollover loans (-\+ 3 months)	0.025	0.157	0.022	0.148	0.003	0.033	0.178	0.022	0.145	0.011**
Rollover loans (-\+ 2 months)	0.020	0.139	0.017	0.128	0.003	0.024	0.154	0.015	0.121	0.009**
Rollover loans (-\+ 1 months)	0.013	0.115	0.010	0.101	0.003*	0.015	0.120	0.009	0.095	0.006
Change in Interest Rate during loan spell	0.029	0.167	0.032	0.175	-0.003	0.038	0.192	0.037	0.190	0.001
Change in Amount during loan spell	0.002	0.039	0.006	0.075	-0.004***	0.002	0.041	0.005	0.069	-0.003*
Change in Maturity during loan spell	0.013	0.111	0.008	0.090	0.004***	0.011	0.103	0.011	0.102	0.000
Observations (Loan Level)	9,630		8,289		17,919	1,770		2,091		3,861

Table 8: Robustness Tests of Relationship Lending and Loan Performance

The Table reports robustness logit regression results for different sub-samples of firms that received loans from both *Relationship* and *Mixed Banks* between January 2009 and June 2013. The dependent variable is Loan Performance$_{ijkt}$ that equals one when a loan is in arrears for more than 90 days unless otherwise noted. For each robustness test, I rerun specifications of Table3 in Columns (2) and (3) with firm characteristics and firm fixe effects. To consume space, I only report the coefficient of "SME Loan Mixed Bank" which measures the performance of transaction-based relative to relationship-based loans, i.e., SME loans of *Mixed* versus *Relationship Banks* (the reference group), as well as its standard error and the number of observations. Panel A reports regression results for alternative non-performance measures: Non-Performance that equals one if a loan has any overdue payments on the principal amount and interest rate and zero otherwise, Non-Performance 0-90 days that equals one if a loan is delinquent for less than 90 days and zero otherwise, and Non-Performance 180 days that equals one if a loan is delinquent for more than 180 days and zero otherwise. Panel B reports results of several other robustness tests. "Time-Varying Firm Characteristics" introduces time fixed effects to Specification (2) and interacted firm×time fixed effects to Specification (3); "W/o Right-censored Loans" reduces the original sub-sample to loans that are observed until maturity; "Double Clustering" indicates that standard errors are double clustered at firm and loan level; "Timing w/o SME & corp. Loans" excludes SME and corporate loans once a firm switches from SME to corporate loans for a *Mixed Bank*, meaning a switch from transactional to relationship lending; "Timing w/o SME Loans" excludes only SME loans once a firm switches from SME to corporate loans for a *Mixed Bank*; "W/o loans 50% around threshold" excludes loans 50% around the threshold; "Only US dollar loans" uses only loans denominated in US dollars; "Loans after January 2011" uses only loans after January 2011; "Alternative Relationship Lending" defines the importance of relationship lending relative to the importance of other lending technologies and reduces the sample to *Relationship Banks* for which the relative importance of relationship lending stays constant for SME and corporate loans (4 out of 9 *Relationship Banks*) and *Mixed Banks* for which the relative importance of relationship lending is higher for corporate loans compared to SME loans (all 5 *Mixed Banks*), and "Relationship Variables" adds relationship variables such as relationship duration, the scope of a firm-bank relationship and a dummy variable that equals one if a firm's debt exposure to a bank is above 50% and zero otherwise. Definitions of the variables can be found in the Appendix, Table A.1. Coefficients are presented as odds ratios. If not otherwise noted, standard errors are clustered at firm level and presented in parenthesis. ***, **, and * indicate significance at the 1%, 5%, and 10%.

	Specification (2) with firm characteristics			Specification (3) with firm fixed effects		
Variable Names	Coeff.	Std. Error	Obs.	Coeff.	Std. Error	Obs.
Panel A: Alternatives measure of non-performance						
Non-Performance	0.855	(0.237)	10,656	0.448***	(0.110)	1,578
Non-Performance 0-90 days	0.568**	(0.128)	10,656	0.444***	(0.105)	2,459
Non-Performance 180 days	0.595	(0.232)	10,656	0.378***	(0.131)	782
Panel B: Other Tests						
Time-varying Firm Characteristics	0.450***	(0.134)	10,656	0.155**	(0.137)	162
W/o right-censored loans	0.494*	(0.186)	5,214	0.389**	(0.157)	604
Double clustering	0.479**	(0.140)	10,656	0.347***	(0.108)	1091
Timing w/o SME & corp. loans	0.456**	(0.141)	9,887	0.354***	(0.106)	973
Timing w/o SME loans	0.455**	(0.141)	10,042	0.352***	(0.105)	991
W/o loans 50% around threshold	0.413***	(0.136)	9,161	0.344***	(0.113)	785
Only US dollar loans	0.456**	(0.145)	5,946	0.272**	(0.138)	688
Loans after January 2011	0.459**	(0.142)	7,775	0.374***	(0.117)	731
Panel C: Relationship Tests						
Alternative Relationship Lending	0.370*	(0.209)	5,898	0.223***	(0.102)	630
Relationship variables	0.459***	(0.135)	10,656	0.395***	(0.128)	1,087

Table 9: Relationship Lending and Information Use

The Table reports regression results from a multiplicative heteroskedaticity model based on Harvey (1976) and Cerqueiro et al. (2011) for a sub-sample of 4,441 loans to 271 firms that receivedloans from both *Relationship* and *Mixed Banks* between January 2009 and June 2013. The model estimates the determinants of the mean and the residual variance of the Loan Spread$_{ijkt}$, defined as the loan interest rate minus the refinancing rate of the Armenian banks with the Armenian Central Bank in the upper and lower panels. The main independent variable is "SME Loan Mixed Bank" which measures the effect of transactional lending on the residual variance in interest rates relative to relationship lending, i.e., SME loans of *Mixed* versus *Relationship Banks* (the reference group). Columns (1)-(2) report results with loan characteristics without and with firm characteristics. In Columns (3)-(6) firm fixed effects are introduced. Column (4) includes a crisis dummy for the years 2009 and 2010, Column (5) adds loan origination fixed effects, and Column (6) adds other loan characteristics. The last row uses a Walt test to test whether the difference in coefficients when both banks rely on relationship lending, i.e., corporate loans of *Relationship* versus *Mixed Banks*, equals zero. Definitions of the variables can be found in the Appendix, Table A.1. Standard errors are clustered at firm level and presented in parenthesis. ***, **, and * indicate significance at the 1%, 5%, and 10%.

Panel A: Mean Equation	(1)	(2)	(3)	(4)	(5)	(6)
Credit Classification	-2.224***	-2.062***	-0.206	-0.288	-0.245	0.067
	(0.490)	(0.469)	(0.539)	(0.357)	(0.291)	(0.504)
Loan Amount	-1.140***	-1.135***	-0.522***	-0.516***	-0.529***	-0.433***
	(0.072)	(0.071)	(0.080)	(0.065)	(0.065)	(0.068)
Collateral	-3.004***	-2.985***	-3.077***	-1.556***	-0.472**	-3.125***
	(0.511)	(0.462)	(0.210)	(0.170)	(0.194)	(0.205)
Guarantee	-0.794	-0.742	-1.024*	-0.364	-0.250	-1.068*
	(0.542)	(0.526)	(0.620)	(0.320)	(0.345)	(0.611)
Maturity	1.320***	1.208***	0.222*	0.085	0.004	0.287***
	(0.233)	(0.209)	(0.116)	(0.088)	(0.086)	(0.111)
Firm Location in Yerevan		-0.970***				
		(0.214)				
Wholesale Retail Trade		-0.162				
Industry Firm		(0.295)				
Other Fields of Service		-0.608**				
Industry Firm		(0.266)				
Private Firm		-0.021				
		(0.309)				
Crisis Dummy				3.468***		
				(0.132)		
Loan Location in Yerevan						-0.153
						(0.362)
Wholesale Retail Trade						0.850**
Industry Loan						(0.398)
Other Fields of Service						1.379***
Industry Loan						(0.272)
Loan in USD						-1.807***
						(0.229)
Constant	28.821***	29.405***	18.991***	17.474***	21.617***	16.734***
	(2.614)	(2.571)	(2.826)	(1.955)	(1.620)	(2.643)

Table 9 (continued): Relationship Lending and Information Use

Panel B: Variance Equation	(1)	(2)	(3)	(4)	(5)	(6)
Corporate Loan Relationship Bank	-0.356**	-0.342**	-0.109	-0.151	-0.016	-0.175
	(0.175)	(0.167)	(0.174)	(0.148)	(0.176)	(0.170)
SME Loan Mixed Bank	-0.252**	-0.248*	-0.696***	-0.564***	-0.416**	-0.741***
	(0.124)	(0.131)	(0.157)	(0.162)	(0.178)	(0.152)
Corporate Loan Mixed Bank	0.144	0.137	-0.088	0.068	-0.222	-0.061
	(0.191)	(0.197)	(0.258)	(0.250)	(0.283)	(0.269)
Constant	2.518***	2.490***	2.040***	1.556***	1.221***	1.978***
	(0.092)	(0.095)	(0.103)	(0.092)	(0.118)	(0.093)
Firm Fixed Effects	No	No	Yes	Yes	Yes	Yes
Pseudo R-squared	0.083	0.087	0.204	0.278	0.323	0.221
VWLS R-squared	0.382	0.396	0.699	0.797	0.841	0.727
Observations (Loan Level)	4,441	4,441	4,441	4,441	4,441	4,441
Corporate Loan × Relationship Bank = Corporate Loan × Mixed Bank	0.113	0.126	0.950	0.521	0.618	0.744

Figure 1: Identification strategy

The Figure illustrates the identification strategy for the main analysis, presenting bank types, loan types and corresponding lending techniques. The two bank types are *Relationship Banks* (control group) and *Mixed Banks* (treatment group). Each bank reports the importance of relationship lending by SME and corporate loan separately. *Relationship Banks* rely on relationship lending for both loan types, while *Mixed Banks* use relationship lending only for corporate loans and transactional lending (based on fundamental/cash flow analysis and collateral) for SME loans. The arrows indicate that loan performance of the *same firm* is compared for SME loans of the two bank types, when lending techniques differ (relationship vs. transactional lending), and for corporate loans, when both rely on relationship lending.

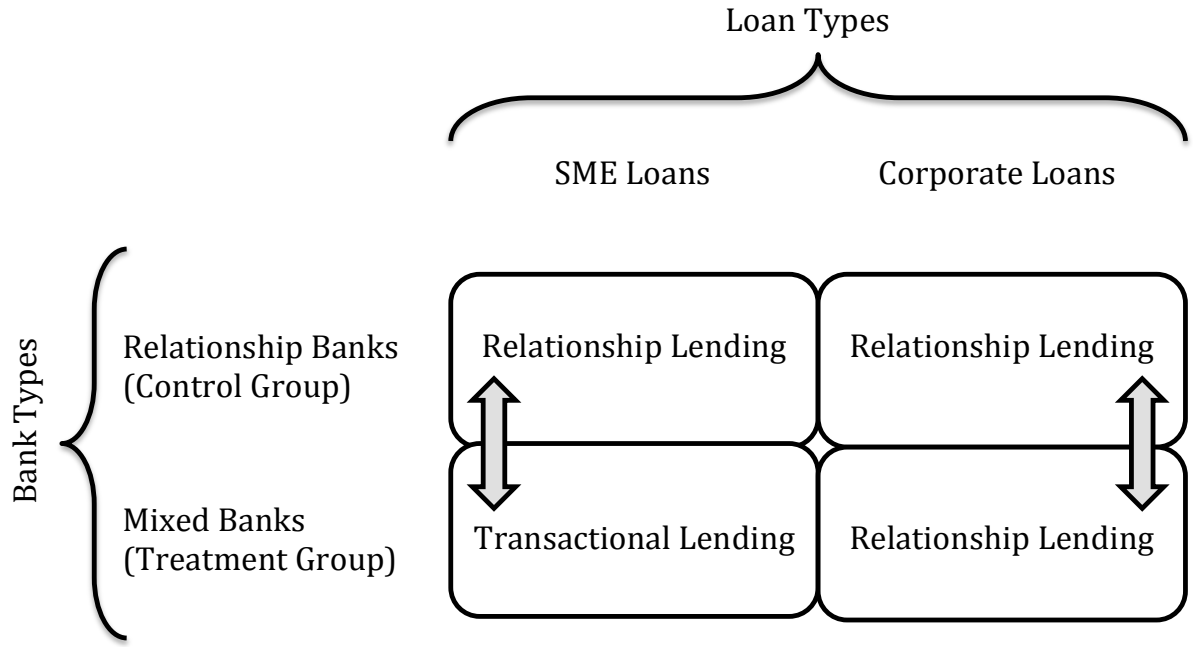
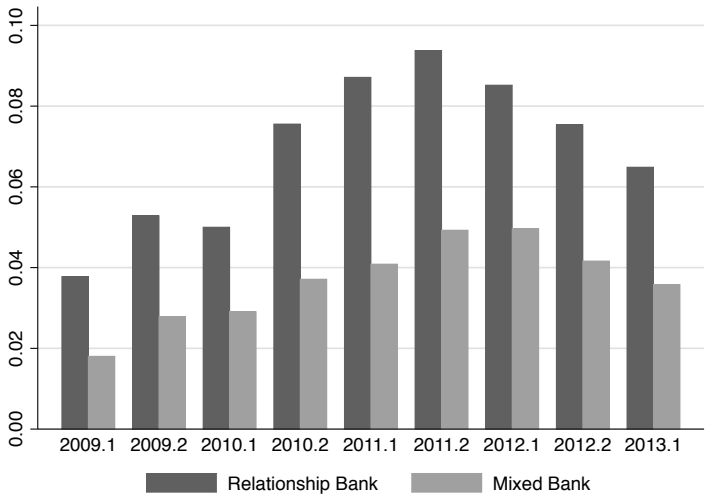


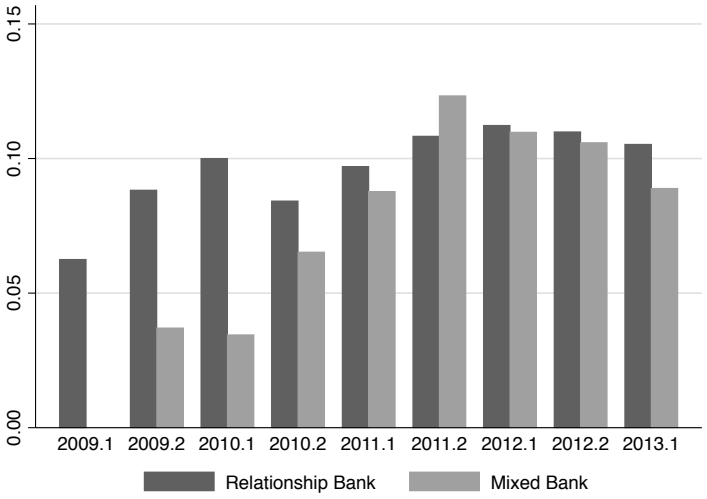
Figure 2: Loan Performance over Time for Sub-sample

The Figure shows the average percentage of loans in delinquency over 90 days for a sub-sample of 4,441 loans to 271 firms that received loans from both *Relationship* and *Mixed Banks* between January 2009 and June 2013. The upper figure shows average non-performance over time for SME loans for both *Relationship* and *Mixed Banks* (relationship vs. transactional lending), while the lower figure shows average non-performance for corporate loans for both bank types (both relationship lending).

(a) SME Loans (Relationship vs. Transactional Lending)



(b) Corporate Loans (Relationship vs. Relationship Lending)



A Variable Definitions

Table A.1: Variable Definitions

The Table reports variable definitions.

Variable Names	Definitions
Loan Performance	
Non-Performance	= 1 if a loan has overdue payments on the principal and interest rate amount or overdue days, and = 0 otherwise.
Non-Performance 0-90 days	= 1 if a loan is non-performing for less than 90 days, and = 0 otherwise.
Non-Performance 90 days	= 1 if a loan is non-performing for more than 90 days, and = 0 otherwise.
Non-Performance 180 days	= 1 if a loan is non-performing for more than 180 days, and = 0 otherwise.
Default (loss/written-off)	= 1 if a loan has a loss/written-off status, and = 0 otherwise.
Loan Characteristics	
SME Loan	= 1 if a loan is classified as an SME loan based on the loan amount definition of a bank, and = 0 otherwise.
Corporate Loan	= 1 if a loan is classified as a corporate loan based on the loan amount definition of a bank, and = 0 otherwise.
Credit Classification	Credit classification of a loan (1 (worst rating) and 5 (best rating)).
Interest Rate	Annual contractual interest rate at loan origination.
Loan Spread	Loan interest rate minus the refinancing rate of the Central Bank of Armenia.
Loan Amount in US$	Loan amount at loan origination in US dollars.
Collateral	= 1 if collateral was pledged at loan origination, and = 0 otherwise.
Guarantee	= 1 if a guarantee was given at loan origination, and = 0 otherwise.
Loan Maturity in Months	Number of months between loan origination and maturity.
Other Loan Characteristics	
Loan Location in Yerevan	= 1 if the location of the loan is in Yerevan, and = 0 otherwise.
Wholesale and Retail Trade Industry Loan	= 1 if the industry of the loan is in the whole and retail trade industry, and = 0 otherwise.
Other Fields of Service Industry Loan	= 1 if the industry of the loan is in other fields of the service industry, and = 0 otherwise.
Loan in USD	= 1 if the currency denomination of the loan is in USD, = 0 otherwise.
Relationship Characteristics	
Relationship in Months	Duration of a bank-firm relationship in months.
Scope	= 1 if the firm has additional products (e.g., credit lines, leasing, factoring, overdrafts) with a bank, and = 0 otherwise.
Primary Bank	=1 if more than 50% of a firm's outstanding debt is originated by one bank, and = 0 otherwise.
Number of Relationships	Number of banks with which a firm has outstanding loans.
Multiple Relationships	= 1 if the firm has outstanding loans from multiple banks, and = 0 otherwise.
Firm Characteristics	
Firm Location in Yerevan	= 1 if the location of the firm is in Yerevan, and = 0 otherwise.
Wholesale and Retail Trade Industry Firm	= 1 if the industry of the firm is in the whole and retail trade industry, and = 0 otherwise.
Other Fields of Service Industry Firm	= 1 if the industry of the firm is in other fields of the service industry, and = 0 otherwise.
Private Firm	= 1 if the firm is a private firm, and = 0 otherwise.
Bank Characteristics	
Relationship Bank	= 1 if a bank reports a high importance (frequency of use) of relationship lending for SME and corporate loans, and = 0 otherwise.
Mixed Bank	= 1 if a bank reports a high importance (frequency of use) of relationship lending for corporate loans but less importance for SME loans, and = 0 otherwise.

B Test for Discontinuity at the Threshold

In this section, I examine the distribution of loans around the threshold that determines a loan to be an SME or corporate loan. A natural question that arises is whether banks or firms are manipulating loan amounts in order to give out or receive either SME or corporate loans. *Mixed Banks*, for example, could intentionally give out loans with loan amounts just below the threshold in order to avoid giving out a corporate loan that might be associated with higher costs since relationship lending becomes more important. Likewise, firms could apply for loans just below the threshold in order to circumvent possibly higher screening and monitoring activities of banks.

In general, only complete manipulation but not partial manipulation results in identification problems. While complete manipulation assumes that the assignment rule is under complete control of agents, partial manipulation occurs when agents can only partially influence the assignment rule and the rest remains idiosyncratic (McCrary (2008), p 700).[39] In the present case, threshold definitions are not publicly known and differ across banks in amount and currency. Half of the banks set thresholds in USD, while the rest sets it in AMD. At the same time, loans are issued in different currencies. For firms, it is more difficult to manipulate their loan amounts, as they are less likely to know the exact thresholds for each bank. At banks, loan officers might be able to manipulate loan amounts. Exchange rate fluctuations might, however, still add an idiosyncratic component (see Garmaise and Natividad (2014) for similar ideas), suggesting partial manipulation.

Even if complete manipulation occurs, it should not influence the main results, since the identification comes from loans further away from the threshold and not around the threshold. Most likely, for *Mixed Banks* lending techniques do not just switch from transactional to relationship lending once a loan passes the loan amount threshold but rather get less transaction-based and more relationship-based with the loan size. Therefore, the further away a loan is from the threshold the more prominent the difference in lending techniques will be for *Mixed Banks* across loan types and for SME loans between *Relationship* and *Mixed Banks*. In unreported results, I confirm that leaving out loans exactly at or around the threshold does not alter the main results.

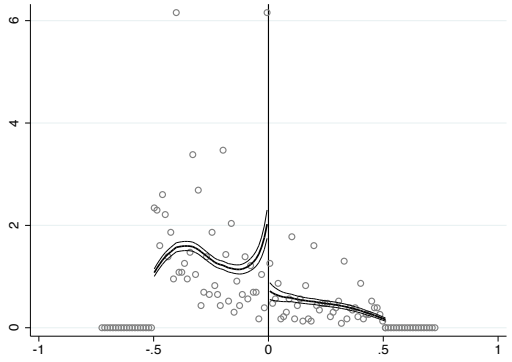
In order to formally check for manipulation around the threshold, I rely on a methodology developed by McCrary (2008) that tests for the discontinuity at the threshold in the density function of the running variable (loan amount threshold). The upper panel of Figure A.1 plots the density functions of loan amounts with the threshold normalized to zero and a range of 50% around the threshold for the total sample and the sub-sample. Both figures reveal a discontinuous jump at the threshold which is confirmed by coefficients of -1.06 (-1.46) and standard errors of 0.14 (0.28). Errors in the assignment of loans to SME and corporate loans might occur since banks do no explicitly specify whether the threshold is an upper or lower bound or might give approximate amounts. The lower panel of Figure A.1 plots the same density functions as above, leaving out loans exactly at the threshold. The discontinuous jump disappears with coefficients of 0.02 (-0.11) and standard errors of 0.14 (0.30).

[39] Van der Klaauw (2002), DiNardo and Lee (2004), and Lee (2008) present some examples of plausible partial manipulations that do not influence results.

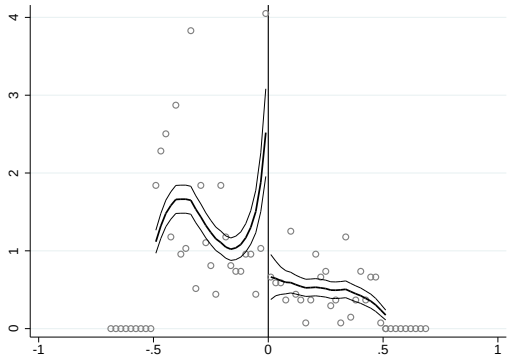
Figure A.1: Density of Loan Amounts around Threshold

The Figure shows the density of loan amounts at the threshold that is normalized to zero and in a range of 50% based on McCrary (2008). The upper figures show the density for the total sample of 19,332 loans to 6,649 firms and the sub-sample of 4,441 loans to 271 firms that received loans from both *Relationship* and *Mixed Banks* between January 2009 and June 2013. The lower figures repeat the analysis for the total and sub-sample, excluding loan amounts directly at the threshold.

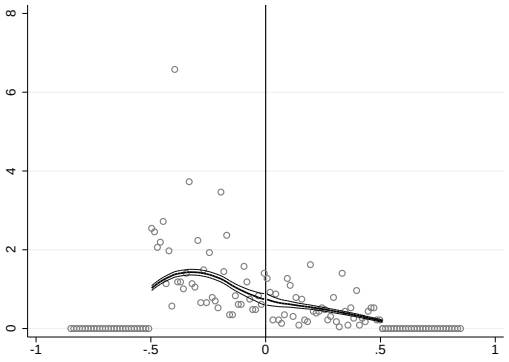
(a) Total Sample



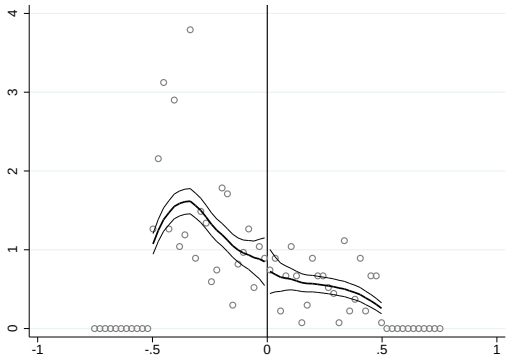
(b) Sub-sample



(c) Total Sample



(d) Sub-sample



C Regression Model with Multiplicative Heteroskedasticity

The regression model with multiplicative heteroscedasticity based on Harvey (1976) is defined as:

$$y_i = \beta' X_i + u_i, \tag{A.1}$$

$$Log(\sigma_i^2) = \gamma' Z_i, \tag{A.2}$$

where (1) is the mean equation and (2) the variance equation. The identifying assumptions for the model are:

$$E(u_i|X_i) = 0, \tag{A.3}$$

$$E^2(u_i|Z_i) \equiv \sigma_i^2 = \exp(\gamma' Z_i), \tag{A.4}$$

where y_i is the depending variable, X_ia vector of explanatory variables in the mean equation, u_i is a disturbance term, σ_i^2 the residual variance, and Z_i a vector of explanatory variables in the variance equation.

Under the normality assumption, the conditional distribution of y_i is given by:

$$y_i|X_i, Z_i \overset{d}{\rightarrow} N(\beta^{'} X_i, \exp(\gamma^{'} Z_i)), \tag{A.5}$$

The heteroscedastic regression model is estimated with Maximum-Likelihood (MLE) by maximizing the following log-likelihood with respect to β and γ:

$$LogL = \frac{n}{2}\log(2\pi) - \frac{1}{2}\sum_{i=1}^{n}\gamma' Z_i - \frac{1}{2}\sum_{i=1}^{n}\exp(-\gamma' Z_i)(y_i - \beta' X_i)^2 \tag{A.6}$$

Harvey (1976) shows that this approach is analogous to estimating the mean Eq. (1), and taking the squared-residuals as the raw estimates of the individual variances, which are subsequently used to estimate Eq. (2). This two-step approach leads to a substantial loss of efficiency vis-à-vis the MLE.