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BANK SIZE AND LENDING SPECIALIZATION

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Bank size and lending specialization

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Abstract

Using micro-level data on the entire population of business loans of a bank-based economy, we empirically test some of the core predictions of the SME financing literature, examining banks' lending specializations in firm size and lending technologies. Rejecting the conventional belief that smaller banks focus more on relationship loans than do larger banks, we find that banks of different sizes dedicate similar proportions of loans to relationship lending. However, supporting the SME finance theories on the organizational advantages of small banks, we find that smaller banks provide more access to relationship loans to small firms, though such loans are usually more expensive.

Key words: relationship banking, bank specialization, small and medium firms, SME finance.
JEL Codes: G21, G30

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Introduction

We empirically examine two dimensions of bank lending specialization: the firm-size specialization and the lending technology specialization. Specifically, we wish to know if there are clear patterns in firm-size/bank-size specializations, investigating if large and small banks focus on lending to firms of certain size groups. In addition, we explore whether banks of different sizes strategically focus on soft-information-based relationship lending or, alternatively, on hard-information-based transaction lending. More importantly, we seek to understand if these lending technologies are associated with specific lending conditions, such as access to loans and loan pricing.

While bank lending specialization has been gaining interest and research attention, the current academic paradigm seems to have reached a consensus. Small and niche banks should have a competitive advantage in relationship lending to informationally opaque (typically small and risky) firms by collecting "soft" information on these firms. In turn, large banks are expected to excel at making fast and cost-efficient evaluations based on "hard" information and grant transaction-based loans to informationally transparent firms (Berger and Udell, 2002; Berger et al., 2005, Uchida et al., 2008, Shimizu, 2012). Against this background, an intense debate among researchers and policy makers has emerged, discussing whether the increased concentration in the banking industry could hinder small firms' access to bank loans (for example, Strahan and Weston, 1998, Scott and Dunkelberg, 2003, Berger et al. 2005; Craig and Hardee, 2007; Montoriol-Garriga, 2008).

However, the extent to which banks are specialized in their lending practices remains unclear. For example, there is some evidence that large banks are also important participants in small business lending, as these banks are able to provide small business loans using various hard information based technologies (Berger and Udell, 2006; Berger et al., 2007). These banks provide large amounts of funding to small and medium enterprises (SMEs), as the latter are perceived as a core and strategic business (De La Torre et al., 2010). Indeed, Berger and Black (2011) report that about 60% of all small business loans in the U.S. are granted by large banks. Furthermore, recent studies show that bank specialization could be affected by various factors, such as loan officer authority (Benvenuti et al., 2009), the ownership of the bank (Delgado et al., 2007), and bank orientation (Ongena and Sendeniz-Yuncu, 2011).

Given that some of these recent findings challenge the prevailing wisdom on bank specialization and suggest that small banks are not necessarily the core providers of relationship loans to SMEs, in this paper we shed more light on this relevant issue for SME financing decisions. We do this by exploring a unique comprehensive dataset from Portugal, a typical European bank-based

economy with many small and medium enterprises, where banks are the main source of funding to the vast majority of firms. The dataset covers the entire population of firms with bank loans in the country from 2005 to 2007, including information on the firms, the banks, and the firm-bank relationships (the number of bank relationships for each firm and the duration of each relationship). The richness of our dataset allows us to test some of the core hypotheses in the SME banking literature for the first time, since most earlier empirical works have been constrained by data limitations.

Through a comprehensive descriptive analysis of the credit market, we find that large banks' loan portfolios focus on larger firms, while small and medium banks' lending practices concentrate more on medium firms. However, the composition of loan portfolios by lending technologies is largely similar among banks of various sizes. In contrast to the predictions of the current research paradigm, our findings show that large banks grant at least as many relationship loans as small and medium banks do. Furthermore, we find that the banks that dedicate the highest proportion of their loans to transaction lending are the smallest ones. Their loans to large firms are dominated by transaction lending, probably as a result of their lack of capacity to be the main relationship lender to such firms.

We further investigate banks' specialization in lending technology by estimating a set of regressions to examine the linkages between the size of a firm's main bank and the firm's loan terms (i.e., access to credit and interest rate), conditional on the lending technology that the main bank uses with the firm. Our chief findings are:

First, firms engaged in relationship lending from small banks show significantly higher leverage levels than those obtaining transaction loans from banks of the same size, all other things controlled for. We find this effect to be weaker with larger banks. The finding is consistent with the hypothesis that small banks provide more access to bank funding through soft-information-based relationships than hard-information-based loans. This result is stronger for smaller firms.

Second, among firms that are engaged in relationship lending, those that borrow mainly from smaller banks are found to have significantly greater leverage than those borrowing from larger banks. This finding supports the argument that small banks have competitive advantages in handling soft information collected from close firm-bank relationships, when compared with large banks. As before, these findings are stronger in subsamples containing smaller firms. This suggests that smaller firms, which are more informationally opaque, are able to obtain more access to credit through relationship lending, especially when borrowing from smaller banks.

Combining these two results with our earlier finding that large banks grant at least as many relationship loans as small banks do, we can draw a conclusion that while large and small banks differ only slightly in relationship lending in terms of loan quantity measured by overall loan composition, there are significant differences in the quality of relationship loans provided by small vs. large banks.

Third, we find that firms engaged in relationship lending generally pay higher interest rates than those taking out transaction loans, indicating that soft-information based relationship lending is more costly than hard-information based transaction lending.

Fourth, while in relationship lending we observe a strong negative link between the size of the bank and the cost of the loans it grants, this negative correlation is not observed for transaction loans. We therefore cannot argue that the negative link observed in relationship loans is associated with the higher cost of funding faced by smaller banks. However, both patterns are consistent with information asymmetry theories, which predict that the cost of a loan should increase with its information intensity. Our finding provides evidence in favor of the argument that relationship lending adds value to banks by shielding them from price competition.

Lastly, we document special patterns in the lending practices of the largest banks. Among the firms that use these banks as their main banks, the leverage of those that secure a transaction loan is significantly greater than that of firms obtaining relationship loans. In addition, the average interest rate of the former is considerably lower than the latter. We argue that this result reflects intense competition among the largest banks when granting loans to become the dominant lender of new business customers. However, these banks are much less active in lending to loyal customers who have been seeking relationship loans for a long time.

To the best of our knowledge, this study is the first attempt to obtain a "bird's-eye-view" of a banking market, employing the full population of all business loans over a certain period of time to analyze bank size and lending specialization strategies. We use micro-level data to address a broader macro-economic question: How does bank credit get allocated across the economy via banks of different sizes with different lending technologies? We are able to examine the strategic focus of banks of different dimensions in the market and to empirically investigate a few core predictions of the relationship banking literature, including some that have never been tested before due to data limitations. Moreover, our results are also important to the policy makers and firm managers who need to know the channels through which small and medium enterprises obtain funding, and the associated costs.

The remainder of the paper is organized as follows. Section 1 briefly reviews the literature and presents our main testable hypotheses. Section 2 describes the data used. In Section 3 we first present a general overview of the credit market, and then descriptively analyze banks' specializations on firm size and lending strategies. In Section 4 we explore in a multivariate setting the correlations between bank size, lending technology, and firms' access to loans, and we conduct a similar analysis on bank size and interest rates in Section 5. Section 6 summarizes our main findings and concludes.

1 Literature and testable hypotheses

There is great heterogeneity among financial intermediaries in terms of organizational complexity (e.g., Berger and Udell, 2002; Stein, 2002), or in terms of the cost advantage in dealing with soft vs. hard information (e.g., Degryse et al. 2009). Given this, the current research paradigm on bank lending specialization seems to have reached a consensus: small and niche banks have a competitive advantage in granting relationship loans to informationally opaque (typically small and risky) firms, while large banks excel at making fast and cost-efficient evaluations based on "hard" information-based transaction loans to informationally transparent firms (e.g., Cole et al., 2004; Berger et al. 2005, among others).

A relationship loan is associated with a lasting and concentrated lending relationship between a firm and a bank. Through this close relationship, banks gradually obtain soft information on the firm, mitigating the information asymmetry between borrower and lender, which can improve the firm's access to credit if the information conveyed is positive. However, relationship loans come with costs for both banks and firms: for the former, the direct cost of face-to-face personal contacts and other expenses incurred by close monitoring; for the latter, the potential indirect cost of being informationally "held up" by the exclusive lender (as in Sharpe, 1990 and Rajan, 1992). Relationship lending is assumed to be more feasible with small and niche banks that are not only close enough to monitor the borrower's business, but also small enough to incorporate soft information into lending decisions, while large banks, on the other hand, might find it harder to handle and pass on such soft information, as they rely on more complex and hierarchical decision systems (e.g., Berger and Udell, 1995a; Strahan and Weston, 1996).

In turn, transaction lending relies on large scale hard information processing, quantitatively assessing the creditworthiness of a borrower at lower costs. Hence, a borrower with high quality hard information, such as solid financial reports, long track record, or good financial ratios, may benefit from obtaining a transaction-based loan at a lower cost. Typically large banks are considered

to be the best providers of transaction loans due to their superior techniques in processing hard information, associated with their ability to provide lower transaction costs derived from economies of scale (e.g., Hannan, 1991,1997; Berger and Udell, 1995a, 1995b; Carter et al., 2004; Berger, 2006).

Based on the predictions of this current paradigm, we state the following testable hypotheses:

First, regarding firm size specialization, we expect to find that:

H1a: Large banks lend proportionally more loans to large firms than small banks do.

H1b: Small banks lend proportionally more loans to small firms than large banks do.

In Berger and Udell's (2006) new conceptual framework for small business lending, the authors argue that both small and large banks can lend to small firms, but employing different lending technologies. While small banks anchor relationship lending decisions on soft information that is not reflected in financial reports, large banks rely on hard information such as financial reports, personal credit history, asset structure of the firm, etc. This framework may raise some expectations that depart from the current paradigm. For example, it should imply that both small and large banks lend to small firms, which could lead to the rejection of **H1b**.

Second, regarding lending technology specialization, according to the current paradigm, we expect that:

H2a: Large banks engage in more transaction lending than small banks do.

H2b: Small banks engage in more relationship lending than large banks do.

Finally, the current paradigm implies that an informationally opaque firm with unobservable favorable soft information should prefer to borrow via information-intensive lending from a small bank, which is more likely to incorporate such soft information into loan decisions than large banks, all other things controlled for. To the contrary, an opaque firm without such positive information that could help to improve its borrowing terms should borrow instead from large banks that would provide the loan at market average conditions given the hard information available on the firm. [3] However, the improved loan availability provided by small banks does not come without costs: The collection of soft information by small banks should make these relation-

[3] See for example Berger and Udell's (2002) discussion on small banks' advantage in dealing with information due to their simple organizational structure.

ship loans more expensive, compared with those granted by large banks based on hard information, which is easier to collect, analyze, and process. Against this background, the testable hypotheses are:

H3a: Small banks grant larger relationship loans to informationally opaque firms than large banks do.

H3b: When lending to informationally opaque firms, small banks grant larger loans through relationship lending than through transaction lending.

H4a: Small banks grant more expensive relationship loans to informationally opaque firms than large banks do.

H4b: When lending to informationally opaque firms, small banks charge higher interest rates on relationship loans than on transaction loans.

2 Data

2.1 Source of Data

Two large datasets are used in this work. All information concerning the number of bank relationships comes from the Central Credit Register of *Banco de Portugal*. This extensive database includes information on all credit exposures above 50 euros, reported monthly by all Portuguese credit institutions. The reporting is mandatory. The main objective of this database is to disseminate information among participating institutions in order to improve their credit risk assessment on current and potential borrowers. Participating banks can observe, for each borrower, the number of bank relationships this borrower has, the total outstanding debt, as well as the status of the loans.[4] For the period analyzed, this database does not include any information regarding loan maturity, collateral, or interest rates. Using this dataset we are able to compute the number and duration of bank relationships, thus allowing us to construct a measure of lending relationships.

We obtain firm-level accounting information from another large dataset: the Central Balance Sheet Database of *Banco de Portugal*. This database provides detailed yearly accounting information, including firm age, economic sector, profitability, leverage, etc. The firms also report their annual total interest payments on loans from banks, from which we obtain a measure of the cost of

[4] It is also possible to know whether credit has become overdue, if it was renegotiated, or if it is an off-balance sheet risk, such as the unused part of a credit line or a bank guarantee.

loans for each firm in each year. Since 2005, reporting to the Central Balance Sheet Database has become compulsory for all firms.[5] Hence, our dataset covers the entire population of Portuguese firms with bank loans.

Using end of year data for the period between 2005 and 2007, the Central Credit Register includes 3,717,080 records (a record being defined as a firm-bank-year observation)[6] reported by 244 Portuguese credit institutions.[7] Over the same period of time, the Central Balance Sheet Database includes 738,766 records (a record being defined as a firm-year observation).

We exclude all firms whose outstanding bank debts are less than 2000 Euros, as well as those whose bank loans are more than twice their total assets.[8] Unincorporated businesses are not included in this analysis, as their assets are not autonomous from those of the owner.[9] Holding companies are eliminated due to a frequent mismatch between their total assets, which is typically small, and the large quantity of loans that they borrow for their daughter companies. Financial and utility firms are also not considered in the analysis, due to their specific nature and the regulatory constraints they face. Merging the two databases with the aforementioned filters, we obtain 1,112,156 firm-bank-year observations, and 501,962 firm-year observations, pertaining to 213,791 firms.

Table 1 shows some summary statistics of the sample. The total assets of the median firm of the sample are about €248,910, a typical medium firm according to international standards[10]. Only a very small proportion of the sample would be regarded as large firms. We are therefore looking at an economy that is, as usual, dominated by SMEs.

The median leverage ratio in the sample is 19.3 per cent, though there is large variability. Most corporate debt is short term and a quarter of firms' total

[5] Prior to 2005, this was a survey-based database collecting information from a large sample of Portuguese firms, which was more representative for large firms.

[6] If a firm keeps a credit line with a bank, we regard it as a valid record, even if the firm does not use the full amount available.

[7] These credit institutions include banks, savings banks, mutual agricultural credit banks, credit financial institutions, investment companies, leasing companies, factoring companies, mutual guarantee companies, as well as branches of foreign credit institutions. Throughout the paper, we broadly refer to this set of financial institutions as "banks".

[8] These firms should be regarded as in the stage of financial insolvency. We consider that the characteristics of bank relationships of these firms should be substantially different from the others, and deserve to be addressed as a separate research topic.

[9] For statistical purposes, these businesses are usually classified as households.

[10] In some studies for the US (e.g., Berger and Black (2011)), a small firm has total assets less than $100,000, a medium firm has total assets between $100,000 and $1 million, and a large firm has total asset greater than $1 million.

debt comes from suppliers. The average ROA in the sample is -2.42%.

2.2 Firm and bank sizes

We divide the firm/year observations into ten firm size groups according to the firms' total assets, using the $1^{st}, 5^{th}, 10^{th}, 25^{th}, 50^{th}, 75^{th}, 90^{th}, 95^{th}$ and 99^{th} percentiles of the firm size distribution as dividing thresholds. We choose not to use conventional arbitrary definitions of large and small firms, since we believe that a continuous measure should produce more precise results.

In addition, we divide the banks into five groups. The first group is the "Big Five" which includes the five largest banks in Portugal, which represent more than 60% of the domestic banking market. Then we sort the remaining banks into four quartiles according to their size, measured by the banks' total business credit portfolios.

3 Descriptive analysis

3.1 Bank specialization on firm size

Table 2 reports corporate loan distributions across firm and bank size in the Portuguese credit market from 2005 to 2007.

Panel A reports average end-of-year outstanding loans across firm/bank size groups, which provides a general overview of the corporate credit market. Each row of the table stands for a certain bank size group, and each column for a certain firm size group. Since we define 10 firm size groups and 5 bank size groups, we obtain 50 cells in the firm-bank-size matrix.

We observe that the largest banks are the prevailing source of loans for firms (Panel A): The Big Five banks provide 62.4% of loans on the corporate credit market; banks in the top quartile of the rest of the market lend 34.9% of the loans; and the remaining smaller banks in the lower three quartiles contribute in total only 2.67% of the credit outstanding. For firms of all sizes, including the smallest firms of the economy, the loans granted by the Big Five and banks in the top quartile generally represent more than 85% of their loan portfolio. This proportion is higher (between 92% and 99.5%) for large firms in the top quartile.

We further analyze the firm size specialization of the banks in Table 2 Panel B. The banking sector lends almost half of the loans to the top 1% largest

firms of the economy, and the top 5% largest firms have around 75% of the outstanding loans, with the remaining 95% of the firms sharing one quarter of the total loans. Furthermore, as also illustrated in Figure 1, we find distinctively different lending patterns among banks of different sizes. The Big Five and top quartile banks focus on the large-firm sector of the market, allocating respectively 50.8% and 41.7% of their loan portfolios to the top 1% largest firms, and 76.6% and 71.8% respectively to the top 5% largest firms, i.e., large banks lend proportionally more loans to large firms than small banks do. Smaller banks on the other hand seem to concentrate more on medium-sized firms. Banks of the lower three quartiles make more than half of their outstanding loans to firms that are within the 50% to 95% range of the firm size distribution (54.9%, 71.4% and 59.0% respectively for banks in the 1^{st}, 2^{nd}, and 3^{rd} quartiles, respectively). These patterns are consistent with **H1a** and **H1b**, i.e., large (small) banks lend proportionally more loans to large (small) firms than small (large) banks do, as the result is stronger for medium than for small firms.

3.2 Bank specialization on lending technologies

We next turn to examine whether the banks grant loans using specific lending technologies. More specifically, we are interested in finding out if large banks' lending relies mainly on hard-information-based transaction lending (**H2a**), and whether small banks' loans are characterized by long-term concentrated relationship lending (**H2b**).

3.2.1 Definition of lending technologies

Earlier researchers have adopted various measures of relationship lending. For example, the strength of relationship lending has been measured, *inter alia*, by the exclusivity of the lending relationship (Harhoff and Korting, 1998; Berger et al., 2001), the duration (Ongena and Smith, 2000), the scope of bank services provided (Degryse and van Cayseele, 2000), and the presence of a main bank (Elsas and Krahnen, 1998). We consider that the duration and the concentration of lending are the two essential elements of relationship lending. Soft information on a firm can only be observed gradually over time. It is through lending relationships that are long enough that bank managers collect sufficient private knowledge about the firms upon which they can anchor loan decisions (Uchida et al., 2011). Furthermore, banks' knowledge on firms is most efficiently accumulated via concentrated lending relationships. Through such close lending relationships, banks are likely to host checking accounts of the firms, allowing bank managers to attentively monitor business activities, which will be more difficult if the firm holds a number of dispersed relationships

with multiple banks.

Hence we expect that banks relying on the relationship lending technology are more likely to hold long-term concentrated lending relationships with firms, while banks that specialize in transaction loans should have more short-term and/or dispersed relationships.

We define that a firm has a concentrated lending relationship if the firm has a "main bank" which is the lender of 50% or more of the firm's loans. We define a lending relationship as "durable" if it lasts more than two years. Based on these two thresholds, we define the following four types of lending relationships:

- Long-term concentrated lending, if the relationship between a firm and its main bank has lasted for at least two consecutive years and the bank holds more than 50% of the firms' total outstanding loans;

- New dominant lending, if the relationship between a firm and its main bank was established less than two years ago and the bank holds more than 50% of the firms' total loans;

- New exclusive lending, if a firm borrows from only one bank, yet the lending relationship is less than two years old.

- Dispersed lending relationship, where a firm does not obtain more than half of its outstanding loans from the bank.

The four types of lending relationships cover the entire sample: all firm-bank relationships have to fall into one of the categories. However, they are not mutually exclusive, as a firm could have two types of lending relationships simultaneously: e.g., long-term concentrated (or new dominant) loans from its main bank and dispersed loans from other banks.

We consider that banks engaged in the long-term concentrated lending relationship are more able to collect soft information from the borrowing firms. Hereinafter, we regard such loans as "relationship loans". In contrast, we consider that new dominant lending is not likely to be based mainly on the firm's soft-information collected by the new bank. Since the lending relationship is short in duration, the loan decision should be based mostly on the firm's hard information. Rather, we consider it more likely to be associated with banks attracting new customers, in an environment of intense market competition. In turn, we consider it unlikely that dispersed lending is associated with the intensive use of soft-information. Hence, we regard that both new dominant loans and dispersed loans are transaction-based loans.

Firms with new exclusive lending relationships are special. Some of these firms

were previously fully funded by equity. By introducing leverage into its capital structure, the firm passes through one of its most significant financial decisions. Therefore, it is reasonable to assume that the financing decisions of such a firm might be very different from the other firms, which have had bank debt for at least two years. The remaining firms with new exclusive banks are those that abruptly terminate their previous borrowing relationships and switch to a new one, which implies large underlying changes in financing decisions of these firms. The exclusivity of the new lending relationship would allow the bank to extract a considerable amount of soft-information about the firm; however the relationship is still too young to allow for a reasonable accumulation of such information. As a result, we find it hard to categorize new exclusive loans as "relationship" or "transaction", and choose to keep them as a separate category in our analysis.

3.2.2 Descriptive analysis on lending technology specialization

Table 3 Panel A shows the distribution of loan amounts across the four lending categories: relationship lending, new dominant lending, new exclusive lending, and dispersed lending, while Panel B reports the proportion of loans granted in each relationship type given the firm size. The last column of Panel B shows the average proportions of the four lending technologies for the entire sample. We see that about 37.6% of the bank credits are granted through relationship lending, and 49.9% are related to dispersed lending. As also illustrated by Figure 2, when we compare the results among firm size groups, we find some interesting patterns.

First, we find that loans granted via long-term concentrated lending relationships account for between 30% and 50% of outstanding loans for firms of all sizes. The current research paradigm indicates that informationally opaque (typically small and risky) firms should benefit more from relationship loans. As the firm becomes larger and informationally more transparent, the benefits of relationship loans fade away. However, we find in the data that the proportion of relationship lending is not monotonously negatively associated with firm size. The largest proportion of relationship loans, 49.6%, is among medium firms in the 50% to 75% asset distribution range instead of with the smallest firms.

Second, dispersed lending steadily gains a larger proportion of outstanding loans as the firm size grows, from less than 4% for the 1% smallest firms to over 60% for the top 1% largest firms. This pattern is consistent with the prediction of the current paradigm that, as firms become larger, they find it more beneficial to seek transaction loans based on their hard information (e.g., Berger and Udell, 2002).

Third, as the firm size increases, the proportion of new exclusive loans decreases from over 50% for the1% smallest businesses to less than 3% for the top 1% largest corporations. Among the firms with new exclusive loans, about two thirds were previously all-equity firms that have just become leveraged with bank loans, and the remaining one third are firms that chose to switch from old bank relationships to a new exclusive bank. This proportion remains more or less constant across the firm size groups.

Fourth, the correlation between the proportion of new dominant loans and the firm size appears to be concave: firms at the two ends of the size distribution spectrum have lower proportions of new dominant loans (2.9% for the bottom 1% and 5.5% for the top 1%), while small and medium firms (between 10% and 50% of the firm size distribution) are observed to have the highest proportion (about 17%) of new dominant loans. This is a signal that the small and medium firms are at the center of the battlefield of market share competition among banks. The micro firms are probably not important enough for the banks to compete for; and the competition for larger firms is probably fierce enough to make it less likely that a new lender becomes the new dominant bank of these firms.

Next, in Table 4, we examine the lending technology specialization for each of the five bank size categories, reported separately in Panel A, B, C, D and E. As shown in the last columns of these panels, we find that the composition of bank loan portfolios is generally not too different among banks of various sizes: relationship loans and dispersed loans each take up 25% to 50% of the loan portfolios of the banks, with new dominant and new exclusive loans accounting for 0% to 10% only. Against the prediction of **H2a**, we do not find that large banks hold more transaction loans than small and medium banks.

Surprisingly, small banks in the bottom quartile lend about two thirds of loans via dispersed lending relationships, and only 25% of their loan amounts are related to relationship lending. This contradicts the prediction of the current paradigm, which argues that small banks should hold more relationship loans in their loan portfolio than large banks do (**H2b**).

When examining the lending technology proportions across the firm size groups, as also illustrated in Figure 3, we find again that the distribution patterns across banks of different sizes are generally rather similar, except for the fact that the loans from smaller banks in the bottom two quartiles of the bank size distribution to large firms are almost exclusively dispersed loans. This is likely the result of small banks's inability to become the main banks of large firms due to size and capital restrictions.

3.3 Access to loans

So far we have examined the distribution of corporate loans in the Portuguese credit market from a "macro" viewpoint: We analyzed how credit has been granted through different banks to different firms, using different lending technologies. Now we turn our focus on the relationship between bank size and the availability of bank loans to firms at a "micro" level, i.e., the firm level.

As discussed above in Section 1, we hypothesize that an informationally opaque firm with unobservable favorable soft information should prefer to borrow from a small bank, which is more likely to incorporate this information in loan decisions in relationship lending than a large bank, all other things controlled for. To the contrary, a firm without such information should seek transaction loans at market average conditions based on hard information of the firm.

In order to measure a firm's access to loans we use *Leverage*, calculated as the total outstanding amount of loans granted to firm j by banks by the end of year t divided by the total assets of firm i at the end of year t.

We acknowledge that the extent to which a bank is willing to lend to a firm does not equal the observed bank loan leverage that the firm has. Financially constrained firms might choose to borrow up to their limits, while cash-rich firms could choose to borrow much less than their debt capacities as perceived by their credit providers. However, these two quantities are nevertheless correlated: the observed leverage must be upper-bounded by the amount that the bank is willing to grant. In our robustness analysis, we will exclude all firms with unused credit lines, thus limiting our sample to firms that are more likely to be financially constrained, borrowing up to their debt capacities (Section 4.3).

Table 5 reports the average firm leverage for our sample. In the last row of Panel A we see that leverage is not monotonically related to firm size. While the average leverage is as high as 60% for the smallest firms, it decreases to around 23% for the medium firms, and increases again to above 30% for the largest firms. Regarding the entire sample, an average firm funds 26% of the firm's total assets with bank debt.

Table 5 Panel A compares the average leverage ratios across firm sizes for different lending technologies. For firms that are smaller than the median, leverage seems to be unrelated to the type of lending technology that they are engaged in. However, we observe a distinctively different pattern for firms that are larger than the median: large firms that are using new exclusive loans are associated with high leverage ratios of around 45%, while those with dispersed relationships show lower leverage ratios of about 27%, with firms using relationship lending and new dominant lending placed in the middle.

This finding is also illustrated in Figure 4.

In Table 5 Panels B, C, and D, we further explore the linkage between the size of the main bank and the firm's leverage ratio for each relationship type (except for dispersed lending, since there is no main bank in this kind of lending). We obtain a few additional important results:

1. As reported in Panel B, among firms that are engaged in relationship lending with their main banks, the small and medium firms ($1\% < \text{assets} < 75\%$) that use smaller banks (in the bottom two quartiles of the bank size distribution) as their main banks appear to have persistently higher leverage than those who have large main banks, consistent with **H3a**: the collection of soft information helps small and niche banks overcome information opaqueness and provide better loan accessibility, while large banks' lending decisions are restricted by hard information such as financial reports and tangible assets.

2. For large firms (assets $> 75\%$) in our sample, however, the above pattern is reversed: firms associated with larger relationship banks have higher leverage levels. This is likely related to the fact that smaller banks are financially constrained from being the main relationship banks of large firms.

3. In Panel C, we find that the Big Five banks granting new dominant loans are associated with the most highly leveraged firms in 7 out of 10 firm size groups. This might support the belief that the largest banks aggressively grant loans to new customers in order to compete for market share. We expect that such loans should also be related to lower interest rates, which we will investigate in Section 5.

4. Panel D shows that when obtaining new exclusive loans, small and medium firms (assets $< 75\%$) are likely to have higher leverage when borrowing from smaller banks, and the top quartile large firms are associated with higher leverage when borrowing from large banks. The finding is somewhat similar to that in Table 5 Panel B for relationship loans, and is consistent with our assumption that new exclusive loans carry certain traits of relationship lending, despite their short duration. In the following regression analyses we will exclude this type of lending relationship due to its ambiguous status.

4 Regression analysis on access to loans

4.1 Model description

In this section, we focus on testing **H3a** and **H3b**, i.e., whether in relationship lending small banks provide more access to loans to SMEs than large banks do, and whether relationship lending gives more access to bank loans to these firms than transaction based lending. We first test these two hypotheses for the entire sample and later we analyze whether these results hold in particular for more informationally opaque firms, which are usually more reliant on relationship lending.

Our basic regression model is:

$$Leverage_{it} = \delta + \sum_{n=1}^{4} \alpha_n * n^{th} quartile\_bank + \beta_1 * relationship + \beta_2 * new\_dominant + \sum_{n=1}^{4} \chi_n * n^{th} quartile\_bank * new\_dominant + \Pi_1 * firm\_controls_{it-1} + \Pi_2 * industry\_dummies$$

The dependent variable is $Leverage_{it}$, which we define, as before, as total outstanding bank loans of firm i at the end of year t as a percentage of firm i's total assets in year t. Our main variables of interest are bank size dummies, relationship type dummies, and their interactions. The regression sample includes three relationship types: relationship lending, new dominant lending, and dispersed lending. [11] Dispersed lending is set as the default type in the regression model. We use a dummy variable *Relationship* to indicate firms with relationship banks, and *New Dominant* as a signal for firms that have new dominant main banks. When only the two relationship type dummies are used in the regression, the effect of having dispersed lending on leverage is reflected in the regression intercept.

As before, we use five size categories for the main bank: the Big Five banks plus four quartiles of the bank size distribution for the remaining banks. Given that firms with the omitted dispersed relationship type do not have any main banks, when we employ only the five main bank size dummies in the regression, the regression intercept still captures the impact of dispersed lending.

When both the relationship type dummies and main bank size dummies are included in the regression, we set *Big Five* as the default size, since it is the prevalent category. The regression coefficient of n^{th} *Quartile Bank*, α_n, reflects the main effect of borrowing from a main bank of a respective given

[11] As discussed above, we exclude new exclusive lending from the regression analysis due to its ambiguous interpretation.

size, depending on the type of the bank relationship. The impact of borrowing from a Big Five bank as the main bank on firm leverage will be reflected in either $\beta_1$or β_2, also depending on the type of the bank relationship. The intercept will again include the influence of dispersed lending.

In addition, we also add to the regression model four interactions of the dummies: n^{th} *Quartile Bank*New Dominant*, $n \in [1, 2, 3, 4]$. [12] These interactions show, given the main bank size and the relationship type, what the marginal effect of the bank relationship on the firm leverage is if the firm has a new dominant loan from a bank in the n^{th}quartile.

If a firm is engaged in relationship lending, the total impact of being associated with a main bank in quartile n should be equal to $\alpha_n + \beta_1$ [13]: α_n reflects the main effect of the bank size, and β_1 represents the main effect of relationship lending. In turn, for a firm that has a new dominant bank relationship, the total effect from the bank relationship should be equal to $\alpha_n + \beta_2 + \chi_n$. In addition to the main impacts of bank size and lending relationships represented by α_n and β_2 respectively, χ_n reflects the marginal effect of a new dominant lending relationship with a bank from the n^{th} Quartile. We expect to find the following patterns:

First, **H3a** predicts that firms with relationship loans are able to obtain more loans from small banks than from large banks, i.e.

$$\alpha_1 + \beta_1 > \alpha_2 + \beta_1 > \alpha_3 + \beta_1 > \alpha_4 + \beta_1 > \beta_1.$$

By subtracting β_1 from the expression, we find that it is equivalent to testing:

$$\alpha_1 > \alpha_2 > \alpha_3 > \alpha_4 > 0.$$

H3a also implies that relationship lending from large banks should not be information-intensive. Hence, we expect that the regression coefficient of *Relationship*, β_1, which represents the difference between the leverages of firms using dispersed lending and relationship lending from Big Five banks, should not be significantly different from zero:

[12] As there are two relationship type dummies and four bank size dummies, usually there should be eight interactions of the dummy variables. However, since firms with the omitted relationship type "dispersed lending" have no main banks, there exists no variation in these firms' dummy interactions of relationship type and bank size. Hence, four interactions are sufficient.

[13] The total effect of obtaining a certain type of loan from a main bank of a certain size is equivalent to the corresponding coefficient obtained from a regression model where the independent variables are the ten interactions between the five bank sizes and the two relationship types. The intercept of the regression model will include the effect of dispersed lending which is the omitted relationship type.

$\beta_1 = 0$.

Second, based on **H3b**, which posits that firms borrowing mainly from small banks can obtain more loans via relationship lending than through transaction lending, we expect to find that $\alpha_n + \beta_1 > \alpha_n + \beta_2 + \chi_n$, or $\beta_1 - \beta_2 > \chi_n$, for small banks. To the contrary, large banks are not expected to have such a comparative advantage in relationship lending, i.e., we expect that the expression $\beta_1 - \beta_2 > \chi_n$ does not necessarily hold for larger banks. Hence, given β_1 and β_2, we expect to find:

$\chi_1 < \chi_2 < \chi_3 < \chi_4$.

In addition, as indicated by **H3b**, the largest banks are not expected to provide more access to loans by relationship lending than by new dominant loans. Hence we expect that for the Big Five banks, β_1 and β_2 should not be significantly different from each other, i.e.:

$\beta_1 - \beta_2 = 0$.

Combining the two above predictions of **H3b**, we expect to find that:

$\chi_1 < \chi_2 < \chi_3 < \chi_4 < 0$.

Lastly, **H3a** and **H3b** predict that the above effects should be stronger with informationally opaque (typically small) firms. We therefore expect that the magnitude and economic significances of the above patterns should be stronger in the regression models using subsamples of smaller firms.

Beyond these dummy variables, we also control for a number of firm characteristics, which may be relevant in determining the observed leverage ratio. All firm controls are lagged by one year in order to mitigate any simultaneity issues. Furthermore, we consider that banks make loan decisions based on available information on the firms, which makes the contemporaneous firm characteristics less appropriate, since they might not be observable at the time of the loan decision.

The first set of firm controls captures the firms' need for external funding. We use a dummy variable *D_RD* [14] to proxy for the firms' R&D activities and the associated future growth potential as well as their future need for external funding. In addition, we include a dummy variable *D_Export* [15] to distinguish firms that are export-oriented. We consider that firms with intensive export activities might be different from other firms since they could have special

[14] *D_RD* takes the value one when a firm reports R&D investment in their balance sheet.

[15] *D_Export* takes the value one when a firm reports exports in their balance sheet.

funding needs for their business operations. In addition, they might have access to more diversified funding sources, thus reducing their dependence on bank funding.

We expect that firms' ability to generate cash-flows should be an important determinant of leverage ratios, since cash-rich firms should face less severe funding constraints. We control for two different measures of cash-flow creation: *ROA* [16] and *Turnover* [17]. Furthermore, we control for *Liquidity* [18], which measures the proportion of liquid assets held by each firm, as this may also influence funding decisions.

We consider that firms' previous debt structure, i.e., how much the firms owe to whom and under what terms, should influence the firms' need for future bank loans as well as banks' decisions on granting loans. We therefore control for the proportion of short-term debt in total debt (*ST_Debt*) and the proportion of trade credit in total debt (*TC_Debt*). Given that the costs faced by firms as a result of their indebtedness are likely an important determinant of leverage, we control for *Interest_Coverage*, defined as net profits as a percentage of interest paid, as well as for the interest rate on bank loans (*Bank_Rate*), defined as interest paid on bank loans as a percentage of the outstanding amount of these loans.

To complement the characterization of the credit risk profile of firms, we control for the existence of defaults on bank loans (*D_Default* [19]), and asset tangibility (*Asset_Tang* [20]). The latter may be considered as a proxy for available collateral to use in bank loans. Furthermore, we control for firm size, using *ln(Assets)*.

We also control for the duration of the ongoing firm-bank relationship (*Duration* [21]), since this could be a strong proxy for the intensity of soft information collected by the bank over time.

Finally, we control for the sector in which the firm operates [22].

[16] *Return on Assets* is defined as net profits as a percentage of assets.
[17] *Turnover* is defined as sales and services as a percentage of total assets.
[18] *Liquidity* is defined as cash, deposits, inventories and tradable securities as a percentage of short-term debt.
[19] *D_Default* is a dummy variable that takes the value one when the firm has a record of credit overdue or in litigation in the Central Credit Registry.
[20] *Asset_Tang* is defined as the proportion of tangible assets in total assets.
[21] *Duration* is defined by the number of years that the firm has been borrowing from the bank. We start our calculation for duration in 2002. Therefore, the maximum duration observed in our sample is upper-truncated at 5 years.
[22] The sectors include: agriculture, commerce, construction, education, fishing, healthcare, manufacturing, mining, other public services, real estate, tourism, transports and communications, and utilities.

In order to eliminate the impact of extreme outliers, we winsorize all variables (except for the dummies) at the 1% level. Since we use lagged firm characteristics as control variables, this will take observations from 2005 out of our regression sample. We run the regression model using clustered standard errors, to capture firm fixed effects or unobserved heterogeneity [23] .

4.2 Main results analysis

Table 6 Panel A reports coefficients for the bank size dummies, relationship type dummies, and their interactions. Panel B reports the total effects in regressions with interaction terms. Coefficients of the firm controls are included in the regressions but not reported. [24]

In models 1 and 2, we conduct OLS regressions using the full sample, employing in turn the bank size dummies and the relationship type dummies. We find that firms using smaller banks as their main banks have significantly higher leverage levels, whereas the firms borrowing mainly from the largest five banks display the lowest leverage ratios. While both relationship lending and new dominant lending appear to be associated with lower leverage ratios than dispersed lending, this negative effect is stronger with relationship lending. This means that firms engaged in relationship lending usually have lower leverage ratios.

In regression model 3, we include not only the dummy variables but also their interactions.

We find supporting evidence for $\alpha_1 > \alpha_2 > \alpha_3 > \alpha_4 > 0$ (i.e., firms with relationship loans should be able to obtain more loans from small banks than from large banks): the coefficients for bank size dummies are all significantly positive, and their magnitudes are negatively related to the size of the bank. This pattern is consistent with **H3a**, suggesting that smaller banks are better able to handle soft information than large banks. However, it could also be the result of smaller banks being less risk-averse than large banks and consequently lending to more highly-leveraged firms. To check this possibility, we should compare these results with those obtained for new dominant loans. If the risk preference (or lack of risk management) scenario is true, we should find smaller banks lending to highly leveraged firms with new dominant loans as well, i.e., $\alpha_1 + \beta_2 + \chi_1 > \alpha_2 + \beta_2 + \chi_2 > \alpha_3 + \beta_2 + \chi_3 > \alpha_4 + \beta_2 + \chi_4 > \beta_2$.

[23] Our dataset includes annual data from 2005 to 2007. As the regressions use lagged explanatory variables, the dataset does not have a sufficiently long time span to allow for fixed effects panel estimation.

[24] The coefficients of the firm control variables are presented in another table that can be provided upon request.

Table 6 Panel B presents the total effects of bank relationship interacted with bank size, with the first four rows reporting the results for new dominant bank relationships. The leverage of a firm obtaining a new dominant loan from the bottom quartile bank is on average 2.34% lower (9.28% + 2.47% - 14.08%) than that of a firm with dispersed bank relationships. However, this total effect is not significantly different from zero. Similarly, the total effect of new dominant lending from 3^{rd} quartile banks, too, is not different from zero, indicating that firms borrowing from these banks are not more leveraged than those securing dispersed loans. The total effect with the 2^{nd} quartile bank is 3.16% and significant at the 1% level; and the total effect with the 4^{th} quartile bank is -4.24% and significant at the 0.1% level. In addition, the total effect of new dominant lending from the Big Five, as indicated by the coefficient of *New Dominant*, is 2.47% and also significant at the 0.1% level. Apparently, there does not exist a negative relationship between the firm leverage and the size of the new dominant bank. We conclude that small banks' loans to highly leveraged firms are probably not related to their preference for highly risky firms or lack of risk management. Hence, the soft-information based theory is still the more likely explanation for the linkage between small bank relationship lending and high firm leverage.

We also find evidence that is partly consistent with $\chi_1 < \chi_2 < \chi_3 < \chi_4 < 0$ (i.e., firms borrowing mainly from small banks should obtain more loans via relationship lending than through transaction lending, and this difference in loan amounts should decrease with the bank size). The interaction terms all have significantly negative impacts on the firm leverage, showing that firms with new dominant loans on average have lower leverage than those with relationship loans, all other things equal. In addition, this difference in leverage is largest among firms borrowing from the smallest banks in the bottom quartile of bank size distribution: A firm borrowing from a new dominant small bank on average has 14.08% lower leverage than its peer borrowing from a small relationship bank. While the difference ranges from 6.5% to 9.6% for firms borrowing from banks in larger size groups, we find that the pattern is not completely consistent with the prediction that it should decline linearly as the bank size increases, as $\chi_2 > \chi_3 > \chi_4$.

The regression results show evidence that is against the predictions that $\beta_1 = 0$ (i.e. the largest banks should provide the same access to loans by relationship lending as by dispersed lending) and $\beta_1 = \beta_2$ (i.e., the largest banks should provide the same access to loans by relationship lending as by new dominant loans). When we control for bank size and their interactions with lending technologies, the leverage of a firm that obtains a new dominant loan from a Big Five bank is on average 2.47% higher than that of a firm with dispersed lending relationships, and the leverage of a firm that borrows a relationship loan from a Big Five bank is in turn 2.90% lower. It appears that the Big Five banks aggressively grant loans in order to become the dominant lender of

their new business customers; however, they are much less active in lending to their loyal customers who have been borrowing concentrated loans for a long time. These findings differ from what was predicted by the current research paradigm.

Both **H3a** and **H3b** indicate that information-intensive relationship lending should be most important to informationally opaque firms, which are usually small firms. Since large firms are less likely to benefit from close relationship lending due to their informational transparency, we expect that the impacts that bank size and lending technology have on these firms' leverage will not likely be explained by theories based on asymmetric information.

In order to check this firm size effect, we run the full regression for four subsamples defined by the firm size quartiles. The results are presented in Models 4 to 7 in Table 6. While the previous regression results for the full sample generally remain robust in the subsamples, the statistical and economic significances of small bank relationship lending are greater for smaller firms in the bottom two firm size quartiles.

We first focus on testing **H3a,** which predicts that $\alpha_1 > \alpha_2 > \alpha_3 > \alpha_4 > 0$. In the subsample of the smallest firms (Model 5), we find that α_1= 10.38, α_2= 6.05, α_3= 2.67, and α_4= 1.15, with declining statistical significance, which is highly consistent with **H3a**. However, as shown in Model 6, in the subsample for the 3^{rd} quartile firms, which could be described as large medium-size firms, we find that the largest coefficient of the bank size dummies is now below 7.8, showing that the advantage of small bank lending is weaker for these larger firms. Finally, as shown in Model 7, when we run the same regression using the top quartile firms, we find that the relationship $\alpha_1 > \alpha_2 > \alpha_3 > \alpha_4$ no longer holds. In fact, banks in the top two quartiles lend to more leveraged firms than those in the lower two quartiles, which is clearly against the prediction of **H3a**.

Next we examine the results testing **H3b**, i.e. $\chi_1 < \chi_2 < \chi_3 < \chi_4 < 0$. While the coefficients of the interaction terms are all negative as predicted, their statistical significance reaches its peak in the subsample for the bottom quartile firms (Model 4), and its the lowest level in the subsample of the top quartile firms (Model 7). In addition, the negative impact on firm leverage associated with the smallest banks in new dominant lending, represented by χ_1, is negatively related to the firm size. It takes the value of -18.23, -12.42, and -9.39 in Model 4, 5 and 6 respectively. This pattern is again consistent with the prediction of the theory. However, in the subsample of the top quartile firms (Model 7), χ_1 is -27.43. We think that it is probably due to a few extreme observations in which the smallest banks become the dominant lenders of very lightly leveraged large firms (as we saw earlier that smaller banks are rarely the new main lenders of the largest firms).

4.3 Restricted sample with financially constrained firms

As discussed above, the observed leverage of a firm does not necessarily represent its access to bank loans. For example, a cash-rich firm may choose to borrow much less than its real debt capacity perceived by banks. Including such firms in our sample could undermine the validity of our empirical findings. For robustness purposes, we exclude all firms with unused credit lines, limiting our sample to firms that are more likely to be financially constrained, for whom the leverage level is likely to represent their true access to debt. After applying this filter, our sample size decreases from 156,900 to 47,372 observations. We employ the same set of regression models using the restricted sample. The results are shown in Table 7.

We find that most of the previous findings remain valid, but now with much greater economic significances, indicating that our empirical findings are considerably strengthened by using the restricted sample.

For example, as shown by Models 11 and 12, we now find that the main effect of 1^{st} *Quartile Bank*, i.e. , α_1 is associated with a 14.64% to 17.25% increase in leverage for small and medium firms in the bottom two quartiles of firm size distribution, compared with a 10.38 % to 12.47% increase using the unrestricted sample in Models 4 and 5.

In Model 11, which uses the subsample of the smallest firms, we also find for the first time that the coefficients of the interaction terms between the bank size and the relationship type are not only strongly negative, but also have absolute values negatively related to the bank size, such that the expression $\chi_1 < \chi_2 < \chi_3 < \chi_4 < 0$ generally holds (though we find that χ_3 is slightly higher than χ_4). In the sample of financially restricted small and informationally opaque firms, we find strong evidence that relationship lending provides firms with more access to bank loans than transaction loans, and this effect linearly decreases with bank size, thus validating **H3b**.

In these robustness tests there is one important result that is not entirely consistent with those obtained using the unrestricted sample. In regression Models 2 and 9 we include only the two relationship type dummies as the explanatory variables. While the coefficient of *Relationship* has a significantly negative value of -1.65 in the unrestricted sample of Model 2, it has a significantly positive coefficient of 0.99 in the restricted sample in Model 9. We interpret this new finding as evidence indicating the importance of relationship lending to financially constrained firms: the leverage of a financially constrained firm can be increased by 0.99% if the firm borrows from a relationship bank, while relationship lending appears to be negatively related with leverage to an average firm in the economy.

5 Bank size and the cost of borrowing

According to **H4a** and **H4b**, the main bank size might also have an impact on the cost of loans. If small banks indeed provide more access to loans to informationally opaque firms via relationship lending, such loans should be more costly due to the extra costs incurred in information collection and to lock in effects.

We define the interest rate r_{it} as $r_{it} = \frac{IP_{it}}{D_{it}}$,

where IP_{it} is firm i's interest payments on bank loans during year t, and D_{it} its total debt to banks at the end of year t. r_{it} is therefore a measure of the average interest rate of firm i in year t across all of the firm's bank loans. [25] We further refine our sample by discarding observations where the firm reports zero bank loans and/or zero interest payments. Our definition of interest rate assumes that IP_{it} is interest paid over an entire year. However, for new loans with a duration of less than one year, our measure will likely underestimate the cost of loans. Therefore, we also filter away firms that have newly initiated lending relationships that are less than one year old. We obtain a final dataset containing 134,647 firm-year observations for 95,572 firms between 2005 and 2007.

5.1 Descriptive analysis on interest rates

Table 8 presents some summary statistics on interest rates and banks' size and lending specialization. The simple average interest rate across all firms is 7.57%, though the bank debt weighted average interest rate is 4.50%. [26] We find that the interest rate declines considerably with the firm size, as shown in the last row of Table 8. While the 1% smallest firms pay an average interest rate as high as 9.6%, the average cost of loans for large firms in the top decile of the firm size distribution is around 5.8%.

In Table 8 Panel A, we partition the sample into four sub-samples: firms with dispersed loans, new exclusive loans, new dominant loans, and relationship loans. As also illustrated in Figure 5, firms engaged in dispersed lending pay the highest average interest rates in 9 out of 10 firm size groups, and those securing new exclusive loans are persistently associated with the lowest average interest rates, thus suggesting that firms may obtain lower borrowing costs when they switch banks (as also found by Ioannidou and Ongena, 2010, and

[25] We have truncated the right and left hand tails of the distribution of r_{it} at the 5^{th} percentile.
[26] Not reported in Table 8.

Barone et al., 2011). The costs of new dominant and relationship loans are in between. This pattern holds for all firm sizes except for the 1% smallest firms of the economy.

Panels B, C, and D of Table 8 compare the average interest rates of firms with relationship loans, new dominant loans, and new exclusive loans across the size of the main bank.

Panel B shows that the banks below the median consistently provide information-intensive relationship loans at higher costs than the larger banks do. However, this pattern is not observed in Panel C among firms borrowing new dominant loans, where the loan decisions are assumed to be based on hard information of the firms. The two observations are consistent with the prediction of **H4a**, i.e., in relationship lending, informationally intensive loans from small banks to small firms should be more expensive than those based on less information.

For almost all firm size groups, through all lending technologies, we observe that the Big Five banks grant loans at the lowest interest rates, most likely reflecting the fact that large banks have lower funding costs than small banks do, as well as scale and efficiency advantages.

5.2 Regression model description

We now test **H4a** and **H4b** in a regression analysis framework. Our basic regression model is:

$$r_{it} = \delta + \sum_{n=1}^{4} \theta_n * n^{th}quartile\_bank + \gamma_1 * relationship + \gamma_2 * new\_dominant + \sum_{n=1}^{4} \lambda_n * n^{th}quartile\_bank * new\_dominant + \Pi_1 * firm\_controls_{it-1} + \Pi_2 * industry\_dummies$$

The dependent variable is r_{it}, our measure of the average interest rate paid by firm i in year t. As before, we include the bank size and relationship type dummies and their interactions. In the regression model, γ_1 and γ_2 show the direct impact of relationship lending and new dominant lending on the interest rate of firms; θ_n represents the main effect of using a main bank of a given size on the borrowing cost; and λ_n indicates the marginal impact of new dominant lending on the interest rate, given the size of the new dominant bank.

If a firm is engaged in relationship lending, the total impact of being associated with a main bank in quartile n on the interest rate should be equal to $\theta_n + \gamma_1$: while θ_n reflects the main impact of the bank size, γ_1 represents the main effect of relationship lending. When a firm is characterized by a new dominant

bank relationship, the total effect from the bank relationship on the interest rate should be equal to $\theta_n + \gamma_2 + \lambda_n$. In addition to the main impacts of bank size and lending relationship represented by θ_n and γ_2, respectively, λ_n reflects the marginal effect of a new dominant lending relationship with a bank from the n^{th} quartile. We expect to find several patterns.

H4a predicts that relationship loans from small banks should be more expensive than relationship loans from large banks, i.e.

$\theta_1 + \gamma_1 > \theta_2 + \gamma_1 > \theta_3 + \gamma_1 > \theta_4 + \gamma_1 > \gamma_1$, or

$\theta_1 > \theta_2 > \theta_3 > \theta_4 > 0$.

H4a also implies that relationship lending from large banks should not be information-intensive. Hence, we expect that the regression coefficient of *Relationship*, γ_1, which represents the difference between the interest rates of firms using dispersed lending and relationship lending from Big Five banks, should not be significantly different from zero, namely,

$\gamma_1 = 0$.

Based on **H4b**, which posits that firms obtaining relationship loans from small banks should pay higher interest rates than those with transaction loans, we expect to find that $\theta_n + \gamma_1 > \theta_n + \gamma_2 + \lambda_n$, or $\gamma_1 - \gamma_2 > \lambda_n$ for the small banks. To the contrary, since large banks are not expected to be highly involved in costly soft-information processing in relationship lending, we do not expect that large banks' relationship loans should be much more expensive than their transaction loans. Hence, we expect that the expression $\gamma_1 - \gamma_2 > \lambda_n$ does not necessarily hold for the large banks. Given γ_1 and γ_2, we expect to find that:

$\lambda_1 < \lambda_2 < \lambda_3 < \lambda_4$.

Also, as indicated by **H4b**, the largest banks are not expected to provide significantly different interest rates in relationship lending and new dominant loans. We therefore expect that for the Big Five banks, γ_1 and γ_2 should not be significantly different from each other, i.e.

$\gamma_1 - \gamma_2 = 0$.

We could combine the two above predictions of H4b and rewrite them as

$\lambda_1 < \lambda_2 < \lambda_3 < \lambda_4 < 0$.

Lastly, **H4a** and **H4b** also predict that the above effects should be stronger with informationally opaque (typically small) firms. Hence we expect that the magnitude and economic significance of the above patterns should be stronger in the regression models using subsamples of smaller firms.

We employ a set of firm controls similar to those we used earlier in the firm leverage regressions.

5.3 Regression results analysis

Table 9 reports the main results from the OLS regressions. The coefficients of firm controls and industry controls are not reported in the table.

In Model 15, the interest rate is found to be negatively related to the size of the bank: the smaller a bank is, the more expensive its loans will be. On average, the interest rate of a firm that borrows from a bottom quartile bank as its main bank will be 83 bps higher than that of a firm with dispersed lending, which is in turn 39 bps higher than that of a firm mainly borrowing from a Big Five bank.

When only the relationship type dummies are included in the regression (Model 16), both *Relationship* and *New Dominant* have significantly negative coefficients: firms with dispersed lending relationships have higher interest rates than those who mainly borrow from relationship banks or new dominant banks, confirming our descriptive findings shown in Table 8 Panel A.

In Model 17, we run the full regression model including not only the dummy variables, but also their interactions. While Panel A reports the regression coefficients, Panel B shows the total effects.

Our main findings are:

First, the coefficients for the bank size dummies are always positive, and their magnitudes are generally declining with the bank size, i.e. $\theta_1 > \theta_2 > \theta_3 > \theta_4 > 0$ (even though we find that θ_3 is slightly smaller than θ_4). Thus, we find strong evidence supporting **H4a**. i.e., firms with relationship loans pay much higher interest rates when they borrow from small banks than from large banks.

However, this pattern could also support the argument that small banks charge higher interest rates simply because they have higher costs of funding than large banks. In order to investigate this possibility, we look at the interest rates paid by firms obtaining new dominant loans. As shown in Table 9 Panel B, new dominant loans granted by the 1^{st} and 3^{rd} quartile banks are not significantly different from dispersed loans in terms of loan pricing. However, new dominant loans granted by the 2^{nd} and 4^{th} quartile banks and by the Big Five banks are significantly cheaper, with average interest rates 99 bps, 27 bps, and 131 bps lower than dispersed loans. To conclude, we do not find any correlation between the main bank size and the interest rate in new dominant

lending in any of the regression samples, thereby providing evidence against the argument that smaller banks have higher costs of funding and should therefore charge higher interest rates.

Nevertheless, we do find that both γ_1 and γ_2 are strongly negative, showing that the Big Five banks provide cheaper loans to firms of all sizes, via both relationship lending and non-relationship new dominant loans. This could be partially related to the lower cost of funding for these largest banks. In addition, against the hypothesis that $\gamma_1 = \gamma_2$, we see that γ_2 is lower than γ_1, showing that these large banks offer much cheaper loans to new customers than to their customers who have been using them as main banks for a long time, all other things controlled for. We argue that this again provides evidence for large banks competing to gain new market share while on the other hand not necessarily providing existing customers with the best loan conditions, which is again consistent with the results of Ioannidou and Ongena (2010) and Barone et al. (2011).

We do find evidence that is partially supportive of hypothesis **H4b**, according to which $\lambda_1 < \lambda_2 < \lambda_3 < \lambda_4$. While the interaction coefficients for the 1^{st} and 2^{nd} quartile banks are negative but not significantly different from zero, λ_3 and λ_4 are both significantly positive in Model 17, showing that the pricing differences between relationship and transaction loans are more pronounced among smaller banks. This pattern could also be found by comparing the total effect reported in Panel B of Table 9. When using a 1^{st} quartile small bank as the main bank, the average interest rate of a new dominant loan would be 49 bps lower (1.23 - 1.31 - 0.41) than a dispersed loan, and the average cost of borrowing a relationship loan would be 93 bps higher (1.23 - 0.30) than the latter. However when the main bank is a 4^{th} quartile large bank, the difference in the total impact between new dominant lending and relationship lending would be -0.27 (0.37 -1.31 +0.67) versus 0.07 (0.37 – 0.30), thus much smaller in scale.

The predictions of **H4a** and **H4b** are expected to be more important for informationally opaque (typically small) firms. We further explore this by running the regression using subsamples of different firm sizes (Models 18 to 21).

We find that:

First, the relationship $\theta_1 > \theta_2 > \theta_3 > \theta_4 > 0$ generally holds throughout all subsamples, showing that small banks charge higher interest rates than larger banks on relationship loans. We find that this pattern is much stronger for larger firms, in contrast with the theoretical prediction. Among the top quartile large firms, those that are securing relationship loans from the smallest banks are paying interest rates 198 bps (1.76 + 0.22, in Model 21) higher than those

obtaining relationship loans from the Big Five banks, while the premium is only 104 bps (0.94 – 0.10, in Model 18) for a small firm in the bottom quartile.

Second, γ_1 is almost always significantly negative, indicating that the relationship loans from Big Five banks are generally cheaper than dispersed loans. The only exception is observed in the subsample including the smallest firms, as shown in Model 18: the Big Five banks indeed price their relationship loans and dispersed loans similarly when they lend to these small and informationally opaque firms.

Third, we observe that $\lambda_1 < \lambda_2 < \lambda_3 < \lambda_4$ generally holds across the different firm sizes, with λ_1 and λ_2 usually negative and not significantly different from zero, and λ_3 and λ_4 generally significantly positive, indicating that the pricing difference between relationship and transaction loans is larger with smaller banks than with larger banks.

Lastly, we do not find evidence that $\gamma_1 = \gamma_2$. Although both are strongly negative, γ_2 is persistently smaller than γ_1 , demonstrating that, to firms of all sizes, the Big Five banks provide much cheaper loans when granting new dominant loans than when lending to their relationship customers.

6 Conclusions

We empirically examine banks' lending specializations in firm size and lending technologies. The richness of our dataset, which covers all firms with bank loans in a bank-based economy, allows us to test some of the core hypotheses in the SME banking literature for the first time, since most earlier empirical works have been constrained by their data limitations.

Our data show that small and medium banks focus essentially on lending to medium firms, and large banks allocate most loans to large firms. We find that while large and small banks do not differ greatly in relationship lending in terms of loan quantity measured by overall loan composition of the banks, there do exist significant differences in the quality of relationship loans provided by small vs. large banks: we observe that small firms most likely obtain more loans from small banks via long-term concentrated lending relationships, and these relationship loans are usually much more expensive than transaction loans. In contrast, large banks competitively take aggressive roles in granting loans to become the dominant lender of their new business customers. However, they offer less competitive pricing conditions to their loyal customers who have been borrowing relationship loans for a long time, thus suggesting lock-in effects.

Our findings provide evidence that informationally opaque firms have easier access to bank loans through smaller banks, though at higher costs. This suggests that small banks extract rents from relationship lending, which shield them from price competition.

A natural extension of this study is to examine these research questions using data from 2008-2011, covering the global financial crisis, when access to bank loans became much more constrained.

7 References

Barone, G., R. Felici, and M. Pagnini, 2011, Switching costs in local credit markets, *International Journal of Industrial Organization*, 29, 694-704.

Benvenuti, M., L. Casolaro, S. Del Prete, and P.E. Mistrulli, 2009, Loan Officer Authority and Small Business Lending. Evidence from a Survey. Banca d'Italia, *mimeo*.

Berger, A., 2006, Potential competitive effects of Basel II on banks in SME credit markets in the United States, *Journal of Financial Services Research* 28, 5–36.

Berger, A. and L. Black, 2011, Bank Size, Lending Technologies, and Small Business Finance, *Journal of Banking and Finance* 35, 724-735..

Berger, A., L. Klapper, and G. Udell, 2001, The ability of banks to lend to informationally opaque small businesses, *Journal of Banking and Finance* 25, 2127-2167.

Berger, A., N. Miller, M. Petersen, R. Rajan, and J. Stein, 2005, Does Function Follow Organizational Form? Evidence from the Lending Practices of Large and Small Banks, *Journal of Banking and Finance* 76, 237-269.

Berger, A., R. Rosen, and G. Udell, 2007, Does market size structure affect competition? The case of small business lending, *Journal of Banking and Finance*, 31, 11-33.

Berger, A. and G. Udell, 1995a, Relationship lending and lines of credit in small firm finance, *Journal of Business* 68, 351–382.

Berger, A. and G. Udell, 1995b, Universal Banking and the Future of Small Business Lending, Center for Financial Institutions Working Papers 95-17, Wharton School Center for Financial Institutions, University of Pennsylvania.

Berger, A. and G. Udell, 2002, Small Business Credit Availability and Relationship Lending: The Importance of Bank Organisational Structure, *Economic Journal* 112, 32–53.

Berger, A. and G. Udell, 2006, A More Complete Conceptual Framework for SME Finance, *Journal of Banking and Finance* 30, 2945-2966.

Carter, D.A., J. E. McNulty, and J.A. Verbrugge, 2004, Do small banks have an advantage in lending? An examination of risk-adjusted yields on business loans at large and small banks, *Journal of Financial Services Research* 25, 233–252.

Cole, R. A., L G. Goldberg, and L. J. White, 2004, Cookie Cutter vs. Character: The Micro Structure of Small Business Lending by Large and Small Banks, *Journal of Financial and Quantitative Analysis* 39, 227-251.

Craig, S. G., and P Hardee, 2007, The Impact of Bank Consolidationon Small Business Credit Availability, *Journal of Banking and Finance* 31, 1237-1263.

De la Torre, A., M. Peria, and S. Schmukler, 2010, Bank Involvement with SMEs: Beyond Relationship Lending, *Journal of Banking and Finance* 34, 2280-2293.

Degryse, H. and P. van Cayseele, 2000, Relationship Lending within a Bank-based System: Evidence from European Small Business Data, *Journal of Financial Intermediation* 9, 90-109.

Degryse, H., L. Laeven, and S. Ongena, 2009, The Impact of Organizational Structure and Lending Technology on Banking Competition, *Review of Finance* 13, 225-259.

Delgado, J., V. Salas, and J. Saurina, 2007, Joint Size and Ownership Specialization in Bank Lending, *Journal of Banking and Finance* 31, 3563-3583.

Elsas, R. and J. Krahnen, 1998, Is relationship lending special? Evidence from credit-file data in Germany, *Journal of Banking and Finance* 22, 1283 – 316.

Hannan, T.H., 1991, Bank commercial loan markets and the role of market structure: Evidence from surveys of commercial lending, *Journal of Banking and Finance* 15, 133–149.

Hannan, T.H., 1997, Market share inequality, the number of competitors, and the HHI: An examination of bank pricing, *Review of Industrial Organization* 12, 23–35.

Harhoff, D. and T.Körting, 1998, How many creditors does it take to tango? Discussion paper, Conference on Industrial Structure and Input markets, Cen-

tre for Economic Policy Research, Deutsche Forschungsgemeinschaft, Zentrum fur EuropaischeWirtschaftsforschung, Mannheim Germany.

Ioannidou, V. and S. Ongena, 2010, "Time for a Change": Loan Conditions and Bank Behavior when Firms Switch Banks, *Journal of Finance* 65, 1847-1877.

Montoriol-Garriga, J., 2008, Bank mergers and lending relationships, ECB Working Paper No 934.

Ongena, S. and I. Sendeniz-Yuncu, 2011, Which Firms Engage Small, Foreign, or State Banks? And Who Goes Islamic? *Journal of Banking and Finance* 35, 3213-3224.

Ongena, S. and D. Smith, 2000, The duration of banking relationships, *Journal of Financial Economics* 29, 449 – 75.

Rajan, R., 1992, Insiders and outsiders: The choice between informed and arm's length debt, *Journal of Finance* 50, 1113–1146.

Scott, J. and W. Dunkelberg, 2003, Bank mergers and small firm financing, *Journal of Money, Credit and Banking* 35, 999-1017.

Sharpe, S., 1990, Asymmetric information, bank lending, and implicit contracts: A stylized model of customer relationships, *Journal of Finance* 45, 1069–1087.

Shimizu, K., 2012, Bankruptcies of small firms and lending relationship, *Journal of Banking and Finance* 36, 857-870.

Stein, J., 2002, Information Production and Capital Allocation: Decentralized versus Hierarchical Firms, *Journal of Finance* 57, 1891-1922.

Strahan, P. and J. Weston, 1996. Small business lending and bank consolidation: Is there cause for concern? Current Issues in Economics and Finance 2, Federal Reserve Bank of New York, pp. 1–6.

Strahan, P. and J. Weston, 1998, Small business lending and the changing structure of the banking industry, *Journal of Banking and Finance* 22, 821-845.

Uchida, H., G.F. Udell, and W. Watanabe, 2008, Bank Size and Lending Relationships in Japan, *Journal of the Japanese and International Economies* 22, 242-267.

Uchida, H., G.F. Udell, and N. Yamori, 2011, Loan officers and relationship lending to SMEs, *Journal of Financial Intermediation* 21, pp. 97-122.

Table 1 Summary statistics

TABLE 1 Summary Statistics								
	N	mean	p1	p25	p50	p75	p99	sd
Assets	501962	2.076.712	13.590	98.655	248.910	725.810	22.000.000	44.700.000
Leverage	350170	26,89	0,09	8,35	19,32	37,61	109,56	28,09
Number of bank relationships	501962	2,22	1	1	2	3	9	1,67
Short-term Debt/ Total Debt	501283	79,32	0	62,92	100	100	100	30,87
Trade Credit/ Total Debt	501283	25,97	0	3,37	18,809	42,41	93,55	25,31
Interest Coverage	463900	606	-52.140	-175	59	417	74.973	11.044
ROA	501962	-2,42	-103,26	-3,11	0,91	4,36	37,03	19,55
Turnover	501962	53,94	0	0	10,68	84,38	397,37	80,95
Asset Tangibility	501962	28,78	0	6,43	21,15	45,53	95,56	26,27

Table 2 Lending across firm and bank size groups

All firm/bank/year observations are pooled and classified according to the firm size (total assets) and the bank size (total credit outstanding). Panel A shows for each firm size group the proportion of loans granted by bank size groups. Panel B shows for each bank size group the distribution of loans outstanding across firm size.

TABLE 2A Loan amount distribution across bank size given firm size

	Firm size group according to total assets distribution										
group	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
min assets (%)	>0	>1	>5	>10	>25	>50	>75	>90	>95	>99	
max assets (%)	<=1	<=5	<=10	<=25	<=50	<=75	<=90	<=95	<=99	<=100	
Bank size											
1	1.6%	1.0%	0.7%	1.0%	1.2%	1.2%	0.8%	0.6%	0.4%	0.0%	0.3%
2	2.2%	2.7%	2.6%	2.7%	3.0%	2.6%	1.7%	0.8%	0.3%	0.0%	0.5%
3	9.0%	9.8%	9.9%	8.9%	7.9%	6.7%	4.8%	3.0%	1.4%	0.5%	1.8%
4	39.4%	40.2%	39.9%	39.4%	37.9%	36.7%	37.2%	37.9%	38.7%	31.3%	34.9%
5	47.8%	46.2%	46.9%	48.0%	50.1%	52.8%	55.5%	57.8%	59.2%	68.2%	62.4%
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

TABLE 2B Loan amount distribution across firm size given bank size

	Firm size group according to total assets distribution										
group	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
min assets (%)	>0	>1	>5	>10	>25	>50	>75	>90	>95	>99	
max assets (%)	<=1	<=5	<=10	<=25	<=50	<=75	<=90	<=95	<=99	<=100	
Bank size											
1	0.0%	0.0%	0.1%	1.0%	4.8%	15.0%	22.7%	17.2%	33.0%	6.2%	100.0%
2	0.0%	0.1%	0.3%	1.8%	8.1%	22.1%	33.0%	16.3%	16.0%	2.3%	100.0%
3	0.0%	0.1%	0.3%	1.6%	6.2%	16.3%	26.0%	16.7%	20.8%	12.0%	100.0%
4	0.0%	0.0%	0.1%	0.4%	1.5%	4.6%	10.5%	11.1%	30.1%	41.7%	100.0%
5	0.0%	0.0%	0.0%	0.3%	1.1%	3.7%	8.8%	9.5%	25.7%	50.8%	100.0%
Total	0.0%	0.0%	0.1%	0.3%	1.4%	4.4%	9.9%	10.3%	27.1%	46.5%	100.0%

Table 3 Distribution of loans across different relationship types

All firm/bank/year observations are pooled and classified according to the firm size (total assets) and the bank size (total credit outstanding). Panel A reports annual average outstanding amounts of loans and Panel B shows the percentage of relationship types in each firm size category.

TABLE 3A distribution of loans across lending relationship types (in million €)

	Firm size group according to total assets distribution										
group	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
min assets (%)	>0	>1	>5	>10	>25	>50	>75	>90	>95	>99	
max assets (%)	<=1	<=5	<=10	<=25	<=50	<=75	<=90	<=95	<=99	<=100	
dispersed	0.0	1.0	5.5	51.9	309.0	1189.9	3401.3	4264.1	14213.5	30208.9	53645.3
new exclusive	0.3	7.9	24.2	109.5	276.4	534.4	867.9	674.2	1397.0	1423.6	5315.4
new dominant	0.0	1.7	7.9	60.8	252.8	661.3	1227.0	1085.7	2120.3	2757.9	8175.4
relationship	0.2	6.9	21.4	137.3	691.8	2346.6	5100.3	5014.8	11450.6	15645.0	40414.9
Total	0.5	17.5	59.1	359.5	1530.1	4732.2	10596.5	11038.8	29181.4	50035.4	107551.0

TABLE 3B proportions of lending relationship types given firm size

	Firm size group according to total assets distribution										
group	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
min assets (%)	>0	>1	>5	>10	>25	>50	>75	>90	>95	>99	
max assets (%)	<=1	<=5	<=10	<=25	<=50	<=75	<=90	<=95	<=99	<=100	
dispersed	3.9%	5.9%	9.4%	14.4%	20.2%	25.1%	32.1%	38.6%	48.7%	60.4%	49.9%
new exclusive	50.6%	45.3%	41.0%	30.5%	18.1%	11.3%	8.2%	6.1%	4.8%	2.8%	4.9%
new dominant	2.9%	9.7%	13.4%	16.9%	16.5%	14.0%	11.6%	9.8%	7.3%	5.5%	7.6%
relationship	42.6%	39.2%	36.2%	38.2%	45.2%	49.6%	48.1%	45.4%	39.2%	31.3%	37.6%

Table 4 Proportions of lending relationship types across bank size groups

TABLE 4A Big 5 banks: proportion of loans across relationship types

Firm size group according to total assets distribution

group	1	2	3	4	5	6	7	8	9	10	Total
min assets (%)	>0	>1	>5	>10	>25	>50	>75	>90	>95	>99	
max assets (%)	<=1	<=5	<=10	<=25	<=50	<=75	<=90	<=95	<=99	<=100	
dispersed	3.8%	5.1%	7.4%	11.2%	15.3%	21.3%	30.5%	38.3%	49.6%	59.3%	50.2%
new exclusive	58.5%	47.7%	41.6%	30.1%	18.4%	11.3%	8.4%	6.2%	5.1%	3.0%	4.9%
new dominant	1.0%	6.9%	10.7%	13.7%	13.2%	11.1%	9.6%	8.9%	6.4%	4.6%	6.3%
relationship	36.7%	40.3%	40.3%	45.0%	53.1%	56.2%	51.6%	46.7%	38.9%	33.1%	38.6%

TABLE 4B 4th Quartile banks: proportion of loans across relationship types

Firm size group according to total assets distribution

group	1	2	3	4	5	6	7	8	9	10	Total
min assets (%)	>0	>1	>5	>10	>25	>50	>75	>90	>95	>99	
max assets (%)	<=1	<=5	<=10	<=25	<=50	<=75	<=90	<=95	<=99	<=100	
dispersed	4.7%	5.9%	10.6%	17.4%	25.6%	30.6%	34.7%	38.3%	45.9%	62.5%	49.7%
new exclusive	44.2%	42.1%	39.7%	30.7%	18.2%	11.8%	8.5%	6.3%	4.6%	2.4%	4.9%
new dominant	4.5%	11.8%	15.9%	20.0%	20.6%	18.6%	15.0%	11.6%	8.7%	7.5%	9.9%
relationship	46.7%	40.2%	33.8%	31.9%	35.5%	39.0%	41.8%	43.7%	40.7%	27.6%	35.5%

TABLE 4C 3rd Quartile banks: proportion of loans across relationship types

Firm size group according to total assets distribution

group	1	2	3	4	5	6	7	8	9	10	Total
min assets (%)	>0	>1	>5	>10	>25	>50	>75	>90	>95	>99	
max assets (%)	<=1	<=5	<=10	<=25	<=50	<=75	<=90	<=95	<=99	<=100	
dispersed	1.5%	7.1%	11.7%	18.1%	26.3%	27.3%	30.3%	38.6%	68.4%	66.1%	42.9%
new exclusive	43.5%	48.3%	43.6%	32.9%	16.7%	9.6%	5.7%	4.7%	0.1%	16.7%	7.6%
new dominant	4.4%	14.2%	16.5%	21.2%	18.5%	13.0%	9.3%	9.1%	5.8%	2.6%	9.1%
relationship	50.6%	30.3%	28.2%	27.8%	38.6%	50.1%	54.6%	47.6%	25.8%	14.7%	40.4%

TABLE 4D 2nd Quartile banks: proportion of loans across relationship types

Firm size group according to total assets distribution

group	1	2	3	4	5	6	7	8	9	10	Total
min assets (%)	>0	>1	>5	>10	>25	>50	>75	>90	>95	>99	
max assets (%)	<=1	<=5	<=10	<=25	<=50	<=75	<=90	<=95	<=99	<=100	
dispersed	0.3%	9.2%	13.9%	15.8%	18.1%	20.3%	25.6%	44.2%	71.4%	99.9%	35.6%
new exclusive	40.2%	40.7%	44.2%	28.9%	15.4%	9.5%	4.9%	0.7%	0.0%	0.0%	5.8%
new dominant	9.6%	9.9%	13.0%	16.6%	15.9%	10.2%	9.4%	5.7%	6.5%	0.0%	9.0%
relationship	49.8%	40.2%	28.9%	38.6%	50.6%	60.0%	60.2%	49.4%	22.1%	0.0%	49.6%

TABLE 4E 1st Quartile banks: proportion of loans across relationship types

Firm size group according to total assets distribution

group	1	2	3	4	5	6	7	8	9	10	Total
min assets (%)	>0	>1	>5	>10	>25	>50	>75	>90	>95	>99	
max assets (%)	<=1	<=5	<=10	<=25	<=50	<=75	<=90	<=95	<=99	<=100	
dispersed	9.0%	14.5%	22.5%	15.0%	19.3%	25.3%	49.9%	83.4%	94.5%	96.7%	67.7%
new exclusive	26.8%	44.4%	29.7%	22.4%	12.4%	6.5%	2.9%	0.0%	0.0%	40.2%	0.0%
new dominant	0.0%	9.5%	15.7%	10.6%	13.3%	10.5%	6.3%	0.8%	0.3%	0.3%	4.0%
relationship	64.2%	31.6%	32.0%	52.0%	55.0%	57.7%	40.9%	15.8%	5.2%	3.0%	25.8%

Table 5 Average leverage (%)

All firm/bank/year observations are pooled and classified according to the firm size (total assets) and the bank size (total credit outstanding). Leverage is calculated by dividing a firm's total loans from credit institutions by the firm's total assets.

TABLE 5A Average bank leverage

	Firm size group according to total assets distribution										
group	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
min assets (%)	>0	>1	>5	>10	>25	>50	>75	>90	>95	>99	
max assets (%)	<=1	<=5	<=10	<=25	<=50	<=75	<=90	<=95	<=99	<=100	
dispersed	51.5	37.7	33.5	27.1	22.0	21.5	24.2	27.1	27.9	27.3	24.3
new exclusive	58.4	42.5	31.8	27.4	26.8	32.7	42.0	42.4	47.4	47.4	33.0
new dominant	54.4	38.9	30.6	24.3	21.4	23.1	29.7	34.0	35.0	30.8	25.6
relationship	60.8	38.4	30.8	25.3	22.5	22.7	26.9	31.7	33.8	33.4	25.7
Total	59.0	40.0	31.1	25.6	22.8	23.4	27.7	31.1	32.3	31.1	26.5

TABLE 5B Average bank leverage of firms with relationship loans

	Firm size group according to total assets distribution										
group	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
min assets (%)	>0	>1	>5	>10	>25	>50	>75	>90	>95	>99	
max assets (%)	<=1	<=5	<=10	<=25	<=50	<=75	<=90	<=95	<=99	<=100	
Bank size											
1	80.6	38.8	46.4	33.1	33.3	29.6	28.0	22.2	17.7	0.0	32.6
2	74.2	41.6	35.6	31.5	30.3	29.7	28.5	25.7	15.0	0.0	30.9
3	54.6	36.9	29.7	28.0	27.7	28.0	30.6	30.9	25.3	23.8	28.9
4	64.0	38.3	30.6	25.9	23.5	25.4	33.1	40.8	43.1	40.8	28.9
5	58.4	38.5	30.5	24.2	20.9	20.6	23.9	27.7	29.5	30.8	23.6
Total	60.8	38.4	30.8	25.3	22.5	22.7	26.9	31.7	33.8	33.4	25.7

TABLE 5C Average bank leverage of firms with new dominant loans

	Firm size group according to total assets distribution										
group	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
min assets (%)	>0	>1	>5	>10	>25	>50	>75	>90	>95	>99	
max assets (%)	<=1	<=5	<=10	<=25	<=50	<=75	<=90	<=95	<=99	<=100	
Bank size											
1	66.4	48.2	16.6	27.7	29.7	27.6	19.8	2.1	0.0	0.0	28.7
2	44.1	33.5	29.9	26.1	26.5	30.0	28.4	32.2	21.2	0.0	27.9
3	40.7	31.5	21.0	21.1	20.3	24.4	29.9	34.7	22.6	18.2	22.9
4	52.6	33.2	25.6	20.2	18.5	20.3	27.1	30.7	33.3	32.0	22.3
5	60.2	48.4	39.4	29.4	24.3	25.4	32.1	36.7	37.0	30.1	29.3
Total	54.4	38.9	30.6	24.3	21.4	23.1	29.7	34.0	35.0	30.8	25.6

TABLE 5D Average bank leverage of firms with new exclusive loans

	Firm size group according to total assets distribution										
group	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
min assets (%)	>0	>1	>5	>10	>25	>50	>75	>90	>95	>99	
max assets (%)	<=1	<=5	<=10	<=25	<=50	<=75	<=90	<=95	<=99	<=100	
Bank size											
1	68.9	45.2	38.6	35.3	33.5	35.5	22.2	5.2	0.0	0.0	36.9
2	61.3	39.8	35.4	29.8	30.3	30.2	29.2	4.9	0.0	0.0	32.6
3	50.6	38.8	30.0	26.1	27.1	32.7	35.4	11.4	0.1	56.9	30.3
4	56.7	40.9	29.8	26.9	27.3	35.1	44.1	43.4	47.0	40.1	33.1
5	59.8	43.9	32.8	27.6	26.2	31.5	41.5	43.2	47.8	50.6	33.2
Total	58.4	42.5	31.8	27.4	26.8	32.7	42.0	42.4	47.4	47.4	33.0

Table 6 Leverage: OLS Regression Coefficients of the Bank Size Dummies, the Bank Relationship Dummies, and Interactions

We estimate the following regression model: $Leverage_{it} = constant + \sum_{n=1}^{4} \alpha_n * n^{th}\ Quartile\ Bank + \beta_1 * Relationship + \beta_2 * New\ Dominant + \sum_{n=1}^{4} \chi_n * n^{th}\ Quartile\ Bank * New\ Dominant + \prod_1 * firm\ controls_{it-1} + \prod_2 * industry\ dummies.$

The dependent variable, *Leverage*, is defined as a firm's total bank loans as a percentage of its total assets. We define five bank size dummies: the largest five banks (set as the omitted category) and four quartiles for the remaining banks according to their total business credit portfolios. We define three bank relationship types: *Dispersed* (set as default), *Relationship*, and *New Dominant*. All of the firm controls are lagged for one year, including bank relationship duration, dummy for default, short-term debt as a percentage of total debt, trade credit as a percentage of total debt, interest coverage, ROA, turnover, tangible asset as a percentage of total asset, dummy for R&D, dummy for export, liquidity measure, ln of total assets, and average cost of bank debt. We run the regressions for the full sample and for each of the firm-size quartiles with robustness errors. The following table only reports regression coefficients for the dummy variables and interactions of the dummies. a, b, and c stand for statistical significance at 0.1%, 1%, and 5% levels respectively.

Regression model		1	2	3	4	5	6	7
Sample		ful	full	full	1st quartile firms	2nd quartile firms	3rd quartile firms	4th quartile firms
N		156900	156900	156900	26205	37542	43694	49459
R2		0.1912	0.1877	0.196	0.1461	0.1364	0.1837	0.3108
Panel A: coefficients								
Big Five Bank	α5	-2.31 *a*						
1st Quartile Bank	α1	5.45 *a*		9.28 *a*	10.38 *a*	12.47 *a*	7.32 *a*	3.41
2nd Quartile Bank	α2	4.10 *a*		7.19 *a*	6.05 *a*	9.05 *a*	7.79 *a*	3.50 *b*
3rd Quartile Bank	α3	1.70 *a*		5.21 *a*	2.67 *b*	6.16 *a*	6.16 *a*	5.00 *a*
4th Quartile Bank	α4	-1.00 *a*		2.89 *a*	1.15 *c*	1.55 *a*	2.16 *a*	4.51 *a*
Relationship	β1		-1.65 *a*	-2.90 *a*	-1.76 *b*	-2.70 *a*	-3.13 *a*	-3.75 *a*
New Dominant	β2		-0.91 *a*	2.47 *a*	2.34 *b*	1.63 *b*	2.36 *a*	2.04 *a*
1st Quartile Bank*New Dominant	χ1			-14.08 *a*	-18.23 *a*	-12.42 *b*	-9.39 *c*	-27.43 *a*
2nd Quartile Bank*New Dominant	χ2			-6.50 *a*	-9.53 *a*	-6.88 *a*	-4.10	-2.30
3rd Quartile Bank*New Dominant	χ3			-8.52 *a*	-11.94 *a*	-7.80 *a*	-6.09 *a*	-0.76
4th Quartile Bank*New Dominant	χ4			-9.60 *a*	-10.24 *a*	-8.17 *a*	-8.15 *a*	-9.31 *a*
Panel B: total effects								
1st Quartile Bank*New Dominant	α1+β2+χ1			-2.34	-5.51 *c*	1.68	0.29	-21.97 *a*
2nd Quartile Bank*New Dominant	α2+β2+χ2			3.16 *b*	-1.13	3.81 *c*	6.05 *c*	3.24
3rd Quartile Bank*New Dominant	α3+β2+χ3			-0.85	-6.93 *a*	-0.01	2.42	6.28 *a*
4th Quartile Bank*New Dominant	α4+β2+χ4			-4.24 *a*	-6.75 *a*	-4.98 *a*	-3.63 *a*	-2.76 *a*
Big Five Bank*New Dominant	β2			2.47 *a*	2.34 *b*	1.63 *b*	2.36 *a*	2.04 *a*
1st Quartile Bank*Relationship	α1+β1			6.38 *a*	8.62 *a*	9.77 *a*	4.19 *b*	-0.33
2nd Quartile Bank*Relationship	α2+β1			4.29 *a*	4.29 *b*	6.35 *a*	4.66 *a*	-0.25
3rd Quartile Bank*Relationship	α3+β1			2.31 *a*	0.91	3.46 *a*	3.03 *a*	1.25
4th Quartile Bank*Relationship	α4+β1			-0.01	-0.61	-1.15 *b*	-0.97 *b*	0.76 *c*
Big Five Bank*Relationship	β1			-2.90 *a*	-1.76 *b*	-2.70 *a*	-3.13 *a*	-3.75 *a*

Table 7 Robustness Test of Leverage using restricted sample of financially constrained firms

We estimate the following regression model: $Leverage_{it} = constant + \sum_{n=1}^{4} \alpha_n * n^{th}\ Quartile\ Bank + \beta_1 * Relationship + \beta_2 * New\ Dominant + \sum_{n=1}^{4} \chi_n * n^{th}\ Quartile\ Bank * New\ Dominant + \prod_1 * firm\ controls_{it-1} + \prod_2 * industry\ dummies.$

The dependent variable, *Leverage*, is defined as a firm's total bank loans as a percentage of its total assets. We define five bank size dummies: the largest five banks (set as the omitted category) and four quartiles for the remaining banks according to their total business credit portfolios. We define three bank relationship types: *Dispersed* (set as default), *Relationship*, and *New Dominant*. All of the firm controls are lagged for one year, including bank relationship duration, dummy for default, short-term debt as a percentage of total debt, trade credit as a percentage of total debt, interest coverage, ROA, turnover, tangible asset as a percentage of total asset, dummy for R&D, dummy for export, liquidity measure, ln of total assets, and average cost of bank debt. We run the regressions for the full sample and for each of the firm-size quartiles with robustness errors. The following table only reports regression coefficients for the dummy variables and interactions of the dummies. a, b, and c stand for statistical significance at 0.1%, 1%, and 5% levels respectively.

Regression model		8	9	10	11	12	13	14
Sample		ful	full	full	1st quartile firms	2nd quartile firms	3rd quartile firms	4th quartile firms
N		47372	47372	47372	12950	14986	12650	6786
R2		0.1719	0.1677	0.1782	0.1592	0.158	0.194	0.2741
Panel A: coefficients								
Big Five Bank	α5	0.53						
1st Quartile Bank	α1	13.08 *a*		14.34 *a*	14.64 *a*	17.25 *a*	9.88 *a*	9.45
2nd Quartile Bank	α2	6.32 *a*		6.97 *a*	4.65 *b*	8.90 *a*	7.53 *a*	5.15
3rd Quartile Bank	α3	3.36 *a*		4.51 *a*	1.51	6.63 *a*	5.62 *a*	2.11
4th Quartile Bank	α4	0.36		1.76 *a*	0.70	1.01 *c*	1.86 *a*	2.96 *a*
Relationship	β1		0.99 *b*	-0.11	-0.81	-0.33	-0.80	-1.66
New Dominant	β2		0.48	5.15 *a*	3.43 *c*	2.78 *a*	5.56 *a*	6.01 *a*
1st Quartile Bank*New Dominant	χ1			-17.03 *a*	-20.13 *a*	-16.19 *b*	-13.49 *c*	-10.32
2nd Quartile Bank*New Dominant	χ2			-8.86 *a*	-13.32 *a*	-5.53	-9.08	1.33
3rd Quartile Bank*New Dominant	χ3			-10.19 *a*	-10.07 *a*	-9.54 *a*	-8.71 *b*	1.46
4th Quartile Bank*New Dominant	χ4			-11.11 *a*	-12.70 *a*	-7.84 *a*	-9.17 *a*	-13.29 *a*
Panel B: total effects								
1st Quartile Bank*New Dominant	α1+β2+χ1			2.47	-2.06	3.85	1.96	5.14 *a*
2nd Quartile Bank*New Dominant	α2+β2+χ2			3.26	-5.24	6.15 *c*	4.02	12.49 *b*
3rd Quartile Bank*New Dominant	α3+β2+χ3			-0.53	-5.13 *b*	-0.12	2.48	9.58
4th Quartile Bank*New Dominant	α4+β2+χ4			-4.20 *a*	-8.57 *a*	-4.05 *a*	-1.75	-4.32 *b*
Big Five Bank*New Dominant	β2			5.15 *a*	3.43 *c*	2.78 *a*	5.56 *a*	6.01 *a*
1st Quartile Bank*Relationship	α1+β1			14.24 *a*	13.84 *a*	16.92 *a*	9.09 *b*	7.80
2nd Quartile Bank*Relationship	α2+β1			6.86 *a*	3.85	8.57 *a*	6.74 *a*	3.50
3rd Quartile Bank*Relationship	α3+β1			4.40 *a*	0.70	6.30 *a*	4.83 *a*	0.45
4th Quartile Bank*Relationship	α4+β1			1.66 *a*	-0.11	0.68	1.06	1.30
Big Five Bank*Relationship	β1			-0.11	-0.81	-0.33	-0.80	-1.66

Table 8 Average interest rate (%)

All firm/bank/year observations are pooled and classified according to the firm size (total assets) and the bank size (total credit outstanding). Interest rate is calculated by dividing a firm's total interest payments to banks by its total bank debts. Panel A reports the average interest rates for the entire sample, while Panels B, C, and D contain the averages for relationship loans, new dominant loans, and new exclusive loans, respectively.

TABLE 8A Average interest rate across lending types

	Firm size group according to total assets distribution										
group	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
min assets (%)	>0	>1	>5	>10	>25	>50	>75	>90	>95	>99	
max assets (%)	<=1	<=5	<=10	<=25	<=50	<=75	<=90	<=95	<=99	<=100	
dispersed	6.28	11.70	9.40	9.11	9.21	8.38	7.10	6.41	6.04	6.71	7.62
new exclusive	9.05	8.21	8.23	7.54	6.91	5.98	4.92	4.56	4.92	4.85	6.96
new dominant	10.79	9.53	8.70	8.89	8.25	7.07	6.10	5.45	4.87	5.04	7.60
relationship	9.85	9.47	9.02	8.65	8.16	7.40	6.51	5.79	5.66	5.64	7.63
Total	9.63	9.18	8.85	8.54	8.12	7.38	6.49	5.86	5.70	5.95	7.57

TABLE 8B Average bank leverage of firms with relationship loans

	Firm size group according to total assets distribution										
group	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
min assets (%)	>0	>1	>5	>10	>25	>50	>75	>90	>95	>99	
max assets (%)	<=1	<=5	<=10	<=25	<=50	<=75	<=90	<=95	<=99	<=100	
Bank size											
1	9.91	12.13	9.76	9.61	8.89	7.81	8.27	6.40	6.36	0.03	8.76
2	6.94	10.11	10.05	9.29	8.67	7.48	7.38	5.53	7.25		8.35
3	11.99	9.70	9.63	8.92	8.41	7.44	6.77	6.05	5.14	4.08	8.08
4	9.71	9.75	9.41	8.80	8.26	7.57	6.62	5.74	5.51	5.53	7.74
5	9.83	9.24	8.71	8.50	8.05	7.31	6.40	5.80	5.73	5.69	7.50
Total	9.85	9.47	9.02	8.65	8.16	7.40	6.51	5.79	5.66	5.64	7.63

TABLE 8C Average bank leverage of firms with new dominant loans

	Firm size group according to total assets distribution										
group	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
min assets (%)	>0	>1	>5	>10	>25	>50	>75	>90	>95	>99	
max assets (%)	<=1	<=5	<=10	<=25	<=50	<=75	<=90	<=95	<=99	<=100	
Bank size											
1	13.66	0.23	8.07	7.75	8.92	4.51	5.27				8.00
2	10.33	9.38	8.00	8.35	7.08	9.54	4.71	2.70			8.17
3	10.11	10.68	10.36	9.93	8.98	6.77	6.73	9.00	4.65		8.73
4	11.81	10.13	9.18	9.43	8.99	7.64	6.33	6.03	4.69	4.54	8.17
5	9.13	8.53	7.84	8.32	7.38	6.56	5.83	4.96	5.00	5.36	6.92
Total	10.79	9.53	8.70	8.89	8.25	7.07	6.10	5.45	4.87	5.04	7.60

TABLE 8D Average bank leverage of firms with new exclusive loans

	Firm size group according to total assets distribution										
group	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
min assets (%)	>0	>1	>5	>10	>25	>50	>75	>90	>95	>99	
max assets (%)	<=1	<=5	<=10	<=25	<=50	<=75	<=90	<=95	<=99	<=100	
Bank size											
1	8.74	10.56	9.16	8.32	7.19	7.09	19.00				8.43
2	6.99	10.74	9.11	9.27	7.33	4.99	5.74				7.96
3	8.16	8.97	8.96	8.22	7.88	5.88	5.58	3.69		5.35	7.80
4	9.46	7.99	8.52	7.21	6.45	5.86	4.62	3.72	5.15	3.70	6.69
5	9.04	8.10	7.99	7.49	6.99	6.07	4.98	4.89	4.77	5.36	6.94
Total	9.05	8.21	8.23	7.54	6.91	5.98	4.92	4.56	4.92	4.85	6.96

Table 9 Interest Rate: OLS Regression Coefficients of the Bank Size Dummies, the Bank Relationship Dummies, and Interactions

We estimate the following regression model: r_{it} = *constant* + $\sum_{n=1}^{4} \theta_n$ * n^{th} *Quartile Bank* + γ_1 * *Relationship* + γ_2 * *New Dominant* + $\sum_{n=1}^{4} \lambda_n$ * n^{th} *Quartile Bank * New Dominant* + $\prod_1$ * *firm controls*$_{it-1}$ + $\prod_2$ * *industry dummies.*

The dependent variable, r_{it}, is a firm's total interest payments for bank loans as a percentage of its total bank loans. We define five bank size dummies: the largest five banks (set as the omitted category) and four quartiles for the remaining banks according to their total business credit portfolios. We define three bank relationship types: dispersed (set as default), relationship, and new dominant. All of the firm controls are lagged for one year, including bank relationship duration, dummy for default, short-term debt as a percentage of total debt, trade credit as a percentage of total debt, interest coverage, ROA, turnover, tangible asset as a percentage of total asset, dummy for R&D, dummy for export, liquidity measure, and ln of total assets. We run the regressions for the full sample and for each of the firm-size groups with robustness errors. The following table only reports regression coefficients for the dummy variables and interactions of the dummies. a, b, and c stand for statistical significance at 0.1%, 1%, and 5% levels, respectively.

Regression model		15	16	17	18	19	20	21
Sample		ful	full	full	1st quartile firms	2nd quartile firms	3rd quartile firms	4th quartile firms
N		70886	70886	70886	11786	16691	19524	22885
R2		0.0577	0.057	0.06	0.0268	0.0328	0.0321	0.0359
Panel A: coefficients								
Big Five Bank	θ5	-0.39 *a*						
1st Quartile Bank	θ1	0.83 *a*		1.23 *a*	1.03 *c*	0.84 *c*	1.57 *a*	1.98 *b*
2nd Quartile Bank	θ2	0.43 *b*		0.91 *a*	0.89 *b*	1.07 *a*	0.47	1.17 *a*
3rd Quartile Bank	θ3	0.10		0.32 *a*	0.32	0.45 *b*	0.30	0.26
4th Quartile Bank	θ4	0.01		0.37 *a*	0.43 *a*	0.43 *a*	0.31 *a*	0.33 *a*
Relationship	γ1		-0.16 *a*	-0.30 *a*	-0.10	-0.42 *b*	-0.58 *a*	-0.22 *b*
New Dominant	γ2		-0.70 *a*	-1.31 *a*	-1.02 *a*	-1.18 *a*	-1.54 *a*	-1.10 *a*
1st Quartile Bank*New Dominant	λ1			-0.41	-0.71	-0.73	1.12	-3.69 *a*
2nd Quartile Bank*New Dominant	λ2			-0.58	-1.01	0.06	-0.99	-0.48
3rd Quartile Bank*New Dominant	λ3			1.39 *a*	1.67 *a*	0.67	1.69 *a*	0.74
4th Quartile Bank*New Dominant	λ4			0.67 *a*	0.67 *c*	0.92 *a*	0.74 *b*	0.26
Panel B: total effects								
1st Quartile Bank*New Dominant	θ1+γ2+λ1			-0.49	-0.70	-1.07	1.14	-2.81 *a*
2nd Quartile Bank*New Dominant	θ2+γ2+λ2			-0.99 *c*	-1.15	-0.05	-2.06 *b*	-0.41
3rd Quartile Bank*New Dominant	θ3+γ2+λ3			0.40	0.97 *c*	-0.06	0.45	-0.10
4th Quartile Bank*New Dominant	θ4+γ2+λ4			-0.27 *b*	0.08	0.17	-0.49 *c*	-0.51 *b*
Big Five Bank*New Dominant	γ2			-1.31 *a*	-1.02 *a*	-1.18 *a*	-1.54 *a*	-1.10 *a*
1st Quartile Bank*Relationship	θ1+γ1			0.93 *a*	0.94	0.42	0.99 *c*	1.76 *b*
2nd Quartile Bank*Relationship	θ2+γ1			0.61 *a*	0.79 *c*	0.65 *c*	-0.10	0.95 *b*
3rd Quartile Bank*Relationship	θ3+γ1			0.02	0.23	0.03	-0.27	0.03
4th Quartile Bank*Relationship	θ4+γ1			0.07	0.33	0.01	-0.26 *c*	0.11
Big Five Bank*Relationship	γ1			-0.30 *a*	-0.10	-0.42 *b*	-0.58 *a*	-0.22 *b*

Figure 1 Proportion of outstanding loans across firm size groups given bank size

Each row in the diagram represents one bank size group. 1-4 stand for 1st to 4th quartiles of bank size, and 5 is the Big Five group. For each bank size group, we show the distribution of loans across ten firm size groups.

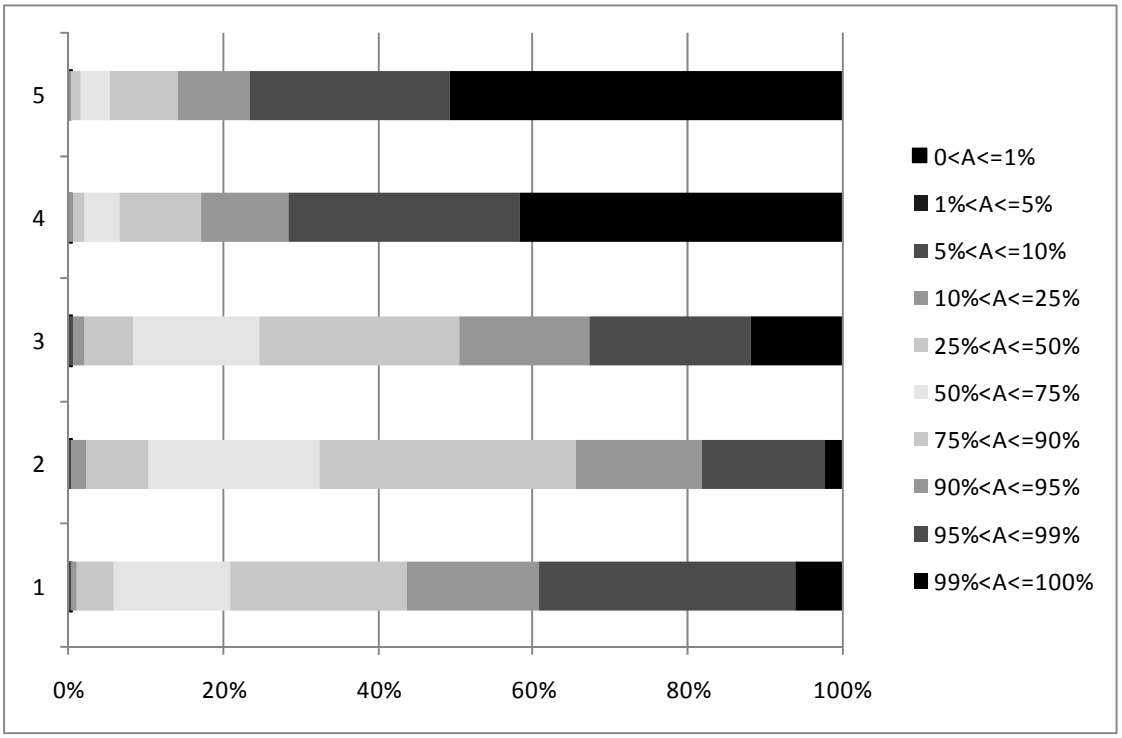


Figure 2 Lending relationships given firm size

In each row, which represents one firm size, we show the distribution of lending relationship types.

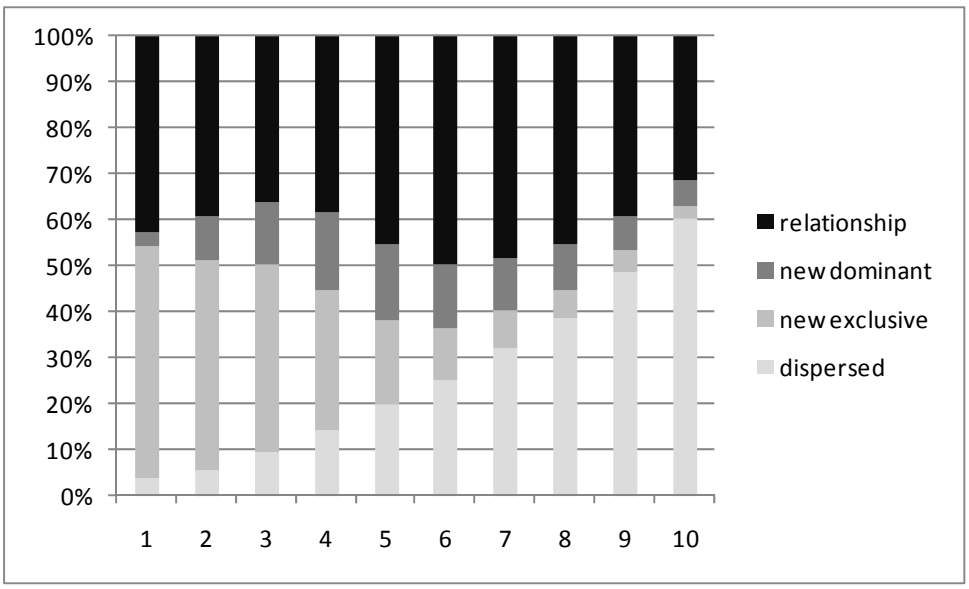
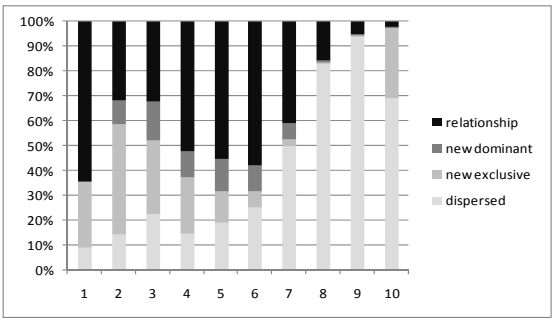


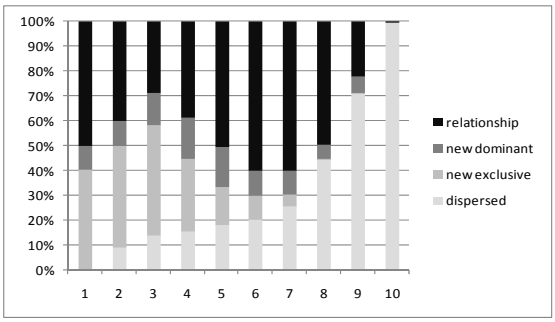
Figure 3 Proportion of lending relationship type for each bank size group

For each of the five bank sizes, we show their distribution of lending relationship types across the ten firm sizes.

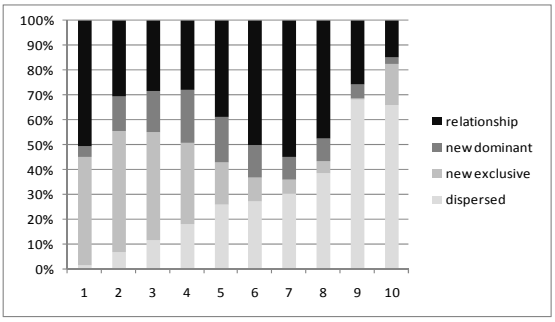
1st Quartile banks



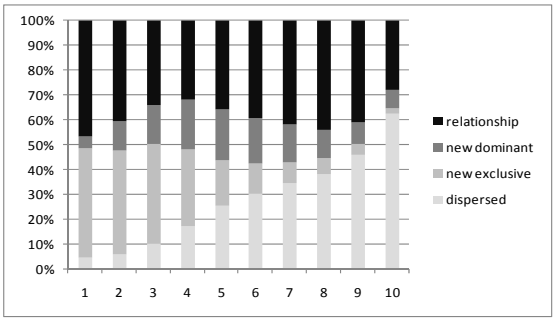
2nd Quartile banks



3rd Quartile banks



4th Quartile banks



Big Five banks

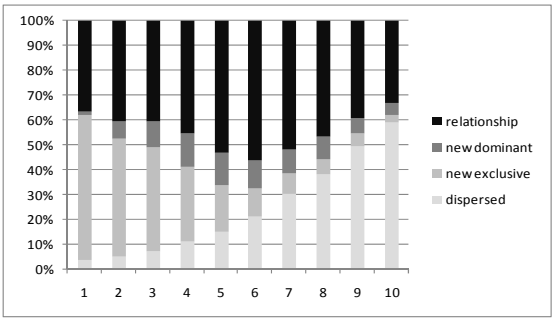


Figure 4 Leverage and relationship type across the firm size groups

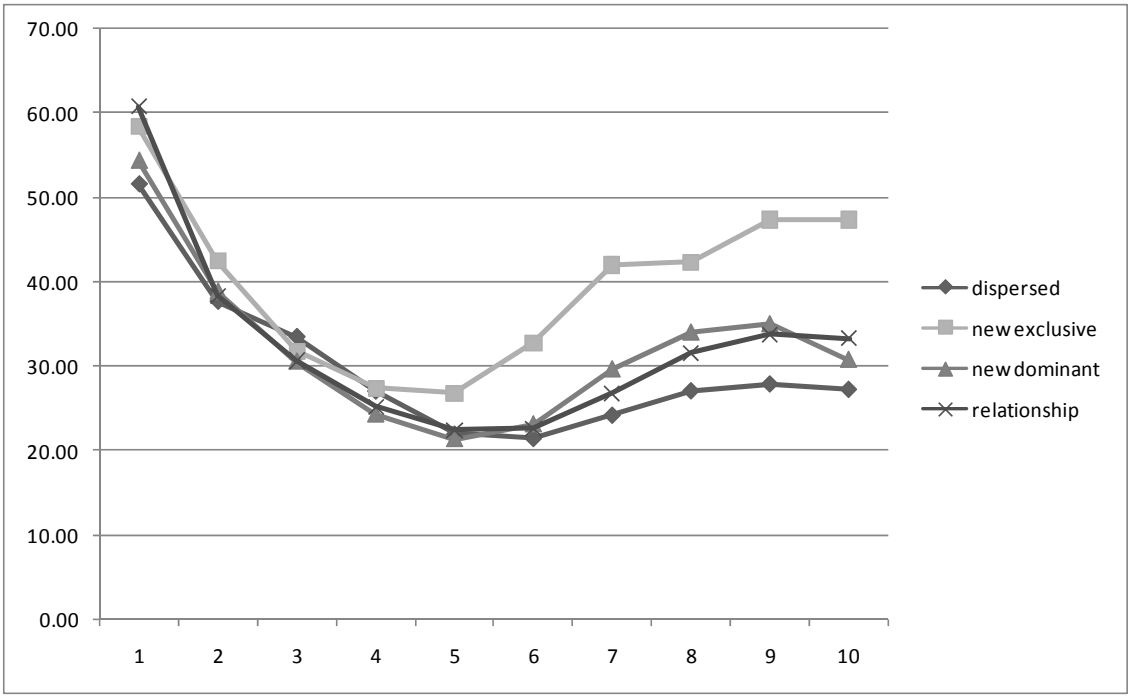
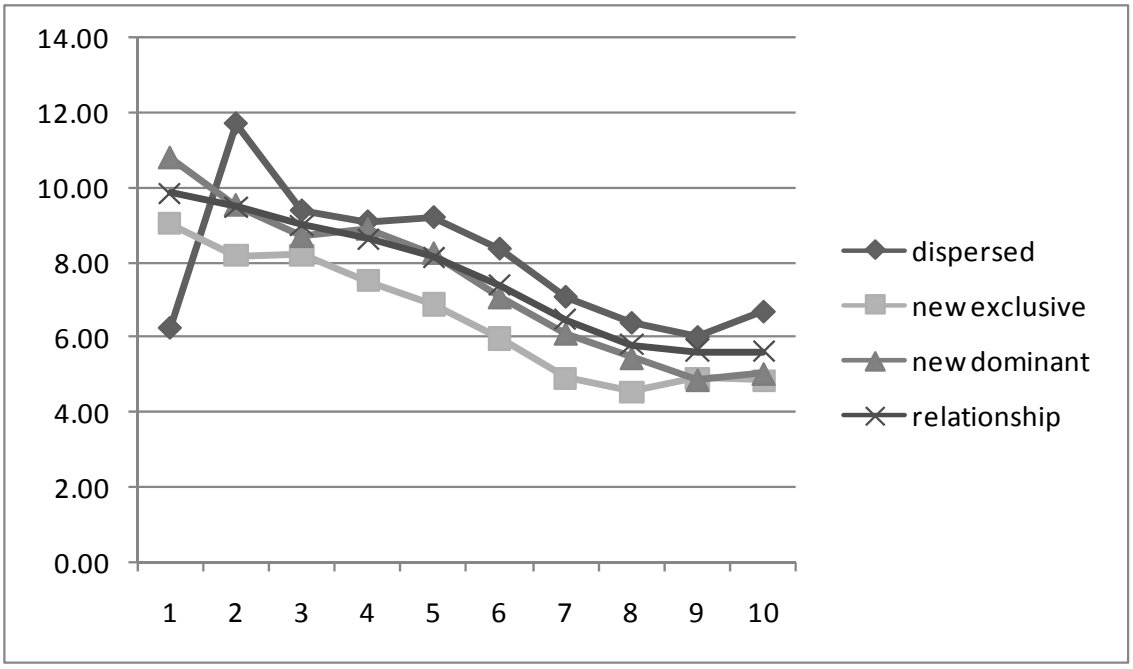


Figure 5 Interest rate and relationship type across the firm size groups



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