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Abstract

Using highly detailed data on the loan portfolios of large U.S. banks, we document that these banks "specialize" by concentrating their lending disproportionately into one industry. This specialization improves a bank's industry-specific knowledge and allows it to offer generous loan terms to borrowers, especially to firms with access to alternate sources of funding and during periods of greater nonbank lending. Superior industry-specific knowledge is further reflected in better loan and, ultimately, bank performance. Banks concentrate more on their primary industry in times of instability and relatively lower Tier 1 capital. Finally, specialization counteracts a well-documented trend in reduced lending by large banks to opaque small and medium-sized enterprises.

Key words: bank specialization, bank concentration, asymmetric information, loan performance, bank performance

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1 Introduction

Banks are traditionally tasked with selecting high quality borrowers and monitoring their adherence to loan covenants. However, borrower selection and loan monitoring require the costly acquisition of information. Economies of scale and deeper experience may be built up through the specialization of lending to certain industries. After all, repeated interactions with individual borrowers has been shown to improve a bank's knowledge of a borrower.[1] In a similar vein, repeated lending in a specific industry can enable banks to better evaluate the business models or collateral of borrowers in that industry.[2]

In this paper, we use detailed data on the loan portfolios of stress tested banks in the United States to show that even large banks specialize in lending to specific industries. The average bank in our sample directs around 20% of its total C&I lending into a single "top" industry – far more than into any other industry. This specialization is correlated with more favourable loan terms for borrowers; as measured by loan size, rate spread, and maturity. This holds especially in times when competition, for instance from non-bank entities, is higher and in lending to firms with access to alternate sources of funding. Specialization by banks may in fact be a partly necessary answer to increased loan competition.

We argue that these generous loan terms are in part made possible through the superior information acquisition, expertise, or monitoring ability of specialized banks. We perform four broad tests to highlight the existence of this advantage. Firstly, and perhaps most importantly, we find better ex-post loan performance of loans issued by bank's specialized in the borrower's industry. This holds even when controlling for the ex-ante bank-internal loan risk rating that is unobservable to the market. Secondly, our results on the superior performance of loans originated by specialized banks are more pronounced in non-syndicated lending. A specialized bank is likely most incentivized to leverage its superior information in instances where the free-rider problem of other market participants is lowest. In a similar vein, we thirdly find that

[1] For a discussion of relationship lending see: Bernanke (1983), James (1987), Petersen and Rajan (1995), Berger and Udell (1995), or Degryse and Ongena (2005).

[2] Specialization in industries has been discussed by Paravisini et al. (2020), specialization in small bank business models has been discussed in Blickle (2018), and specialization in in bank collateral has been discussed in Gopal (2019).

banks are less likely to divest themselves fully of exposure to firms operating in industries in which they are more specialized.[3] This follows from the fact that the adverse selection discount due to the asymmetric information might be large for loans a specialized bank can judge better than the market. Finally, despite an aggregate decrease in bank lending to SMEs in recent years, specialized banks are more willing to lend to smaller – and thereby more opaque – firms in their industry of specialization. This may reflect that small borrower opacity is reduced through bank specialization.

It is, of course, possible that specialization, as we capture it, may simply be the by-product of a bank attempting to capture an industry by crowding out other banks so as to eventually extract monopoly rents. We find that an increase in specialization allows banks to better capture a large share of an industry in the following period. However, such an attempt to capture an industry would likely lead to worse, as opposed to better, loan performance. Moreover, we look at industry capture separately from specialization. We show that while specialization is correlated with industry capture, our results on specialization hold despite of – and not because of – a bank holding a dominant share of an industry.

A natural question that arises in the context of specialization is whether concentrated banks, offering generous loan terms, suffer worse performance and greater aggregate risk. On the one hand, a diversified portfolio reduces a banks' exposure to local shocks maximizing risk-sharing and minimizing the risk of runs [4]. On the other hand, however, diversification increases the correlation across banks' portfolios and the probability of systemic crises [5]. During the period of our sample, which covers 2011q3-2020q2, we find that specialized banks earn more stable, though slightly lower, returns and charge-off fewer loans on aggregate. Loans originated by banks specialized in an industry even perform better in the first half of 2020, which saw significant economic disruptions due to the spread of COVID-19. Finally, specialized banks show on average higher levels of Tier1-capital. Banks gravitate toward increased specialization in times of lower Tier-1 capital ratios and expand into other industries, with which they are

[3] Blickle et al. (2020) and Bord and Santos (2015) document a propensity of lead arrangers to fully sell out of loans they originate.

[4] See Diamond and Dybvig (1983) and Allen and Gale (1998).

[5] For a discussion see: Haldane (2009), Haldane and May (2011), Yellen (2013), Goldstein et al. (2020).

much less familiar, in times of relatively high Tier-1 capital; reflecting the perceived safety and stability of specialization. This is consistent with specialization being largely driven by banks having better information, which allows them to reduce their risks.

The analyses in this paper are based on the FR Y-14 Q archive, which tracks all C&I loans over 1 million USD in size for all stress tested US banks. Our data is the closest thing to a credit registry that exists in the United States and encompasses >75% of corporate lending. Unfortunately, we observe only originated loans and not loan applications. As such, our regressions reflect ex-post equilibrium outcomes. We are careful about interpreting our results as causal. Nevertheless, we can account for a host of loan and bank characteristics in all regressions. We can also account for firm-bank interactions (i.e. past relationships). This ensures the effects we are measuring are not driven by specific firm-related knowledge as opposed to a wider industry-level specialization.

A valid concern with the interpretation of our results may be that unobserved bank or firm characteristics drive not only the decision of a borrower to engage with a certain bank, but also the observable loan terms. Most crucially, our analysis assumes a supply-driven effect and a relatively constant loan demand. Given the detail of our data, we are able to account for firm, time, and bank fixed effects. Our effect of interest is therefore identified within a borrower with multiple loans, in a given period, and within a given bank. We are even able to include specifications with a Khwaja and Mian (2008)-style control, ultimately holding constant firm-year effects. In such specifications the effect is identified in firms obtaining two loans from two differently specialized banks in the same period. We include a number of other specifications to attempt to assuage concerns that the effects are demand- rather than supply driven.

Where possible, we attempt to address further concerns about potential loan-level differences. For instance, we are able to account for loan purpose, loan type, and even risk ratings. These risk ratings are standardized across all banks in the sample as part of the stress testing process and therefore highly comparable across the loans in our sample. Even in the face of detailed controls, endogeneity concerns about borrower-bank selection remain. We address

these openly throughout the paper and attempt a variety of robustness analyses to highlight the stability of our results.

Our work contributes to a growing literature on the importance of bank business model specialization. Given the size of their balance sheets, banks may acquire significant amounts of knowledge about an industry through specialization. The natural incentives to specialize and possibly capture an industry must be weighed against possible risks, This paper analyzes, loan, bank, and industry performance to attempt a better quantification of such risks.

2 Literature Review

This paper is related to the growing empirical literature on bank specialization. Acharya et al. (2006) find that bank diversification is not associated with superior returns or safer portfolios. Saidi and Streitz (2020) show that a bank's concentration affects the non-financial sector to which it lends. They show that concentrated lenders charge lower cost of debt for firms competing with substitute products. Tabak et al. (2011) document better bank performance and lower risk in more diversified banks in Brazil. Paravisini et al. (2020) develop an approach to identify bank specialization in lending and show that Peruvian banks specialize across export markets. This specialization, they show, has real economic and business-level effects for their borrowers.

Our paper also contributes to the wider literature on banking and bank business models in general. Broadly speaking, there are two main theories of banking.[6] On one hand, banks provide liquidity and maturity transformation to their depositors by issuing demandable deposits and investing in longer term loans. Under this view, risk averse banks will choose to diversify their loan portfolio to maximize risk-sharing among their depositors and minimize the risk of bank-runs (see Diamond and Dybvig (1983) and Allen and Gale (1998)). On the other hand, banks may have an informational advantage in lending, by screening and monitoring loans (Diamond (1984)). In this context, increasing returns to information acquisition push banks towards holding specialized loan portfolios. Understanding how specialization impacts

[6]See Battacharya and Thakor (1993) for a survey of the theories of financial intermediation.

bank riskiness is therefore key to understanding the interplay between risk related capital regulation and such specialization.

By monitoring loans and learning about a specific sector, banks can significantly increase their informational advantage relative to less informed investors or banks. This monopoly on information can translate into market power in the loan market and lead to a hold-up problem, even in a competitive banking industry (see: Broecker (1990), Sharpe (1990) and Rajan (1992), Riordan (1993), and von Thadden 1998). Alternatively, specialization may be a byproduct of banks' search for monopoly power and lead to anti-competitive behavior solely in search for rents. Which of these two forces is the main driver of bank specialization again has important implication on the regulation front.

3 Methodology

In this paper, we define a bank's industry specialization as the share of all loans "l" that bank "b" has invested in industry/sector "s" at time "t". Formally, a bank's specialization in industry s is given by $\frac{\sum_{l \in s} \text{LoanAmt}_{b,t,l}}{\sum_{s} \sum_{l \in s} \text{LoanAmt}_{b,t,l}}$, where the sum in the numerator is over all l made to borrowers in industry s at time t and the denominator represents all loans made by banks b at time t. This definition implies that the greater the share of a bank's portfolio that is invested in a single industry, the more specialized the bank is in that industry. The benefits of this definition of specialization are twofold. Firstly, it provides intuitive coefficients. Secondly, it does not rely on ranking industries within a bank's portfolio or across banks. A bank may be specialized in more than one industry or in no industry if it is highly diversified. Similarly, multiple banks could be specialized in the same industry, as we are not ranking banks relative to one another.

We showcase the robustness of our results by using alternative definitions of specialization in the Appendix. We provide results measuring specialization as the share of loans – by count– that are invested in a single industry, the share of logged loans in an industry, and binary variables denoting a bank's "most preferred" industry. These measures are less likely to be driven by massive individual loans to a single firm, while still capturing a bank's increased

exposure to a particular industry. All our main results remain valid using these alternative definitions.

Our main hypothesis is that, driven by experience and incentives, a bank becomes more knowledgeable about an industry as the share of funds it has invested in it grows. This knowledge can translate to better screening and monitoring abilities. We argue that this is the case by looking at how the loan terms offered by a bank, bank performance, and a bank's SME lending correlate with the bank's specialization in that industry.

3.1 Specialization and Loan Characteristics

Our first set of results relate the degree of a bank's specialization to loan characteristics. Loan terms offered by specialized banks may differ from those offered by non-specialized lenders for three reasons. Firstly, if a bank becomes more knowledgeable about an industry, it may be better able to accurately judge the value of a project or business. This follows from a long literature on the value of experience and relationship lending. A more accurate borrower assessment may enable a bank to offer better loan terms to high quality borrowers at the cost of driving sub-par borrowers to look for funds among less informed lenders. Secondly, banks with superior industry knowledge may also be better at monitoring and guiding a borrower, decreasing the risk of the loan, independently of its initial risk. This superior ability to ensure borrower performance may also lead to bank specialized banks offering better loan conditions than non-specialized ones. Finally, a bank may choose to specialize to capture an industry and pursue monopolistic rents. Specialization, as measured by the share of lending in an industry, may be a reflection of the bank's attempts to crowd out other lenders. In this case, the banks may offer beneficial loan terms to snare the largest number of borrowers, independently of the knowledge the bank has about the industry. We address this last point separately below by specifically analyzing and accounting for a bank's position in an industry.

In our baseline regressions, we relate the characteristics of loan "l" that firm "i" receives from bank "b" at time "t" on the degree to which "b" is specialized in the industry/sector "s" of the borrower.

$$
\begin{aligned}
Y_{l,i,b,s,t} =& \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 \mathbf{X}_{l,b} \\
&+ \theta_t + \xi_b + \gamma_i + \sigma_s + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t}
\end{aligned} \tag{1}
$$

The primary loan characteristics used as left-hand-side (LHS) variables are log loan amount, the interest rate, remaining maturity, and whether a loan is secured or unsecured. We readily acknowledge that all the loan characteristics are simultaneously determined. We therefore use those loan characteristics that are not employed as the dependent variable as additional independent regressors. That is to say that in regressions focusing on the correlation between loan size and specialization, for example, we control for the loan's interest rate, its time to maturity, and whether it is secured. We observe only equilibrium outcomes and, as such, we can measure only correlations as opposed to causal relationships. This is discussed in greater detail below.

X is a vector of these loan characteristics as well as bank controls, such as bank size or tier 1 capital. It also includes relationship variables that capture the number of times the bank and firm have interacted in our data. Previous relationships may, by themselves, build knowledge about a borrower's quality that is unrelated to industry specialization. We wish to disentangle the direct effect of information a bank has on a single borrower from the experience a bank may have in an entire industry. The regression further includes, bank, firm, year*quarter, industry, loan-rating, and loan-purpose fixed effects. In our primary analyses, we use only loans at first origination. This excludes any renegotiated loans, but allows for a cleaner discussion of the effect in question.

Given the high number of controls and fixed effects, the regressions are extremely saturated. These regressions highlights the differences in loan terms obtained by a given firm from two or more banks that are differently specialized in its industry or from the same bank at different points in time, independent of loan rating, purpose, or time effects.

Ultimately, we cannot observe an individual firm's loan demand. To the extent that it is either time-invariant or driven by aggregate trends, fluctuations in a firm's loan demand would be captured in our fixed effects. However, there may be firm-specific drivers of a firm's demand

for loans. To control for these features, we includes a firm-year fixed effect in one of our specifications. While adding firm-year fixed effects accounts for a share of a firm's demand, it also implies that our regression coefficients are identified only among firms obtaining multiple loans from different banks in the same period. It is worth noting that this specific subset of firms may not be fully representative.

We run a few additional specifications to further address the issue of supply- vs. demand-driven results, as well as concerns that may arise by interacting the variable of interest, specialization, with key bank, time, or loan characteristics. We begin by interacting specialization with a measure that tracks whether significant amounts of non-bank funding was available. Competition by non-banks may drive specialization and loan terms. Information on non-bank funding is taken from Fleckenstein et al. (2020). In a similar vein, we interact whether a borrower had access to alternate sources of funding. This is most easily, if noisily, gauged by whether a firm was publicly traded. Both of these interactions terms help distinguish between demand and supply drivers of the effects we find.

Loan terms can also be driven by a bank's availability of loanable funds. We explore how capital requirements and bank specialization interact to determine loan characteristics by interacting bank specialization with the bank's Tier 1 capital. Finally, we interact specialization with a dummy denoting whether the bank is the syndication agent in the loan. Bank specialization should matter more for agents than for participants in a syndicated loan. After all, the agent is tasked with loan selection and monitoring while the syndication participant has fewer direct obligations (see Blickle et al. (2020) for a discussion).

Industry Capture

Banks with a high degree of specialization have a significant amount of capital invested in a single industry and may capture a significant share of said industry. Many have documented an increase in bank concentration over the past years (consider: Fernholz and Koch (2016) or Laeven et al. (2016)). Therefore, specialization can be unrelated to a bank's knowledge about an industry and be driven by a bank's rent-seeking behavior. Through decreased competition, banks that capture an industry may be able to extract high rents from captive companies.

Moreover, capture may exacerbate asymmetric information problems and prevent the entry of competitive new entrants (see Cetorelli and Strahan (2006) and Bikker and Haaf (2002)).

On the other hand, capture may be a by product of knowledge-driven bank specialization. Banks with more knowledge about a certain industry, who are better suited to screening and monitoring borrowers in that industry, may organically capture an industry by offering better terms to borrowers and alleviating information asymmetries. Moreover, increasing returns to knowledge and experience may lead a bank to increase its presence in a particular industry to justify its initial investment in acquiring said expertise.

To test our hypothesis and gauge the effects of knowledge-driven specialization, divorced from any rent seeking behavior by banks, we control for a bank's industry capture. To do so, we include a bank's industry capture as additional variable in the baseline regressions discussed above. The regressions take the following form.

$$\begin{aligned} Y_{l,i,b,s,t} =& \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 Capture_{b,s,t} + \beta_3 \mathbf{X}_{l,b} \\ &+ \theta_t + \xi_b + \gamma_i + \sigma_s + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t} \end{aligned} \tag{2}$$

We define capture as the share of the Herfindahl-Hirschman index (HHI) of industry "s" that is accounted for by bank "b" at time t. HHI is a relatively common measure of competition. As such, the degree to which a single bank affects the competitiveness of an industry is a good measure of the degree to which it has captured that industry. An industry with only one bank will be perfectly captured by that bank. Similar to our measure of specialization, discussed above, the measure is continuous and bounded between 0 and 1, making it easy to interpret. There naturally exists a high degree of correlation between industry capture and specialization. However, given that these industries are defined at the two-digit NAICS code, they are extremely large and therefore, even specialization of large banks is possible without the automatic capture of an industry.

3.2 Specialization and Performance

Loan Performance A natural question that deserves to be tested is how specialization impacts loan performance and, ultimately, the performance of specialized banks. If specialization is associated with a greater ability to ex-ante select or ex-post monitor high quality loans, then one would expect specialized banks to outperform their non-specialized counterparts. On the other hand, the lower interest rates charged by specialized banks may negatively impact their profitability. We perform a series of additional tests. Firstly, we regress loan performance on the industry specialization of the bank that granted it, in the vein of the regressions discussed above:

$$\begin{aligned} Performance_{l,i,b,s,T} =& \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 \mathbf{X}_{l,b} \\ &+ \theta_t + \xi_b + \gamma_i + \sigma_s + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t} \end{aligned} \tag{3}$$

Here "Performance" are a variety of measures that capture whether the loan was ever declared non-performing or, in alternate measures, was downgraded during its term and the rating at final observation. Non-performance occurs if a loan ever becomes 90-days past due or if maturity becomes negative, as this implies the loan has not been resolved satisfactorily. Ratings are standardized and a downgrade implies that the loan has become more risky in the eyes of the lender, based on homogeneous metrics that are highly similar across lenders and identical within lenders. We make use of only one observation per loan when it is first observed in the data. We thereby allow the dependent variable to be extremely forward looking. If specialized banks are better at discerning high quality loans or otherwise better at monitoring the loan, one would expect the loan to be less likely to become risky or to default.

Bank Performance In a similar vein, we would expect banks with a high degree of specialization to have a safer more stable loan portfolio overall. Better performing loans should translate to more stable returns and fewer write-downs. We test this hypothesis by collapsing our specialization data at the bank-time level to identify the average specialization of a given bank. We then combine this data with information from Y9-C data, which is maintained

by the Federal Reserve System and tracks key balance sheet information of individual bank holding companies. This combined data allows us to relate aggregate bank performance to specialization. The regression takes the following form:

$$Y_{b,t} = \beta_0 + \beta_1 Specialization_{b,t} + \beta_2 Totalassets_{b,t} + \beta_3 Tier1CapitalRatio_{b,t} + \theta_t + \epsilon_{b,t} \quad (4)$$

The dependent variable Y reflects various measures of bank performance. We are interested in profitability, measured as net income relative to assets as well as the standard deviation of income. A high degree of stability can be of interest to banks. If specialization is correlated with managing and monitoring loans better, we further expect fewer loan defaults on average.

Industry Performance Finally, it is possible that bank specialization and or concentration impacts the industry in which such banks operate. After all, Bander and Lewis (1986) document that higher interest rates lead to more aggressive product market strategies. Asker and Ljungqvist (2010) point out that large banks, which treat borrowers as individual plants of the same whole, may pass information across competitors. Saidi and Streitz (2020) document a relationship between bank concentration and markups while Cetorelli and Gambera (2001) point out that bank concentration and product market competition could be correlated.

We relate measures of industry performance to the average degree of specialization in the industry. Hereby, we attempt to hold constant as many factors as possible to extract the component of industry performance that is affected by bank specialization.

3.3 Extension: Specialization and SME Lending

It has been well documented that large banks are somewhat less willing to lend to SMEs (see for instance discussions in Berger et al. (1998), Strahan and Weston (1998), Peek and Rosengren (1998), Berger et al. (2005), or Berger and Udell (2008)). This may in part be a consequence of the fixed cost of each loan contract, which becomes unattractive in the case of large banks able to lend to large borrowers. It may also be related, however, to the opacity of small firms and

the physical distance between loan officers and SME borrowers that prevents the buildup of soft information.

If specialization is driven by the bank's incentives to acquire industry-specific knowledge, we would expect specialized banks to be more willing to lend to small firms. If a bank has an advantage in assessing firms in an industry, it should be able to assess small firms in that industry better than competitors and ultimately be more willing to engage in lending. We test this proposition with a regression that relates the propensity of a bank to lend to small firms to its specialization in the respective industry. The regression takes the same form as those above:

$$\begin{aligned} SMELending_{l,i,b,s,t} =& \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 Capture_{b,s,t} + \beta_3 \mathbf{X}_{l,b} \\ &+ \theta_t + \xi_b + \gamma_i + \sigma_s + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t} \end{aligned} \tag{5}$$

Here, SME lending is a series of dummy variables. In our basic specification, it can take the value of 1 if the loan is smaller than a certain threshold. We make use of 3 mil. USD or 2 mil. USD. Small loans are more likely to be intended for small firms. However, it is also possible that a bank may split a multi-purpose loan into small components. For a subset of firms in the Y14, we are able to ascertain their total assets at loan origination. Using total assets we can determine whether a firm is small (<10 mil USD) and thereby whether the loan is intended for a small firm. In the subset analysis, the dependent variable takes the value of 1 if the loan is made to a firm with less than 10 mil. USD.

Our variable of interest is, as before, β_1. It measures the increased likelihood that a bank may lend to a small firm if it is highly specialized in its industry. We include a number of additional loan and bank characterisics as controls. Importantly, we include "capture" to disentangle the effects of specialization from the effects of a single bank having a near monopoly on lending in an industry. X also includes measures of firm-bank relationships. This ensures that our measure of interest is not actually identifying the impact of firm-specific knowledge that the bank has developed through past interactions.

4 Data

Our primary data set comes from the FR Y-14. This data is maintained by the Federal Reserve and used in supporting the stress testing of major financial institutions. As such, it includes a variety of details for every bank that has ever been subject to the stress tests. In this paper, we specifically use the sub-database "H.1", which contains detailed quarterly information on the C&I loans of reporting banks. Reporting institutions must file all loans with a total balance-sheet commitment of more than 1 million USD. In the sample period between 2012:Q2 and 2020:Q3 we thus observe 40 banks which report over 3.5 million loan observations. In our fully cleaned sample, we focus on about 75.000 term-loans in the quarter in which they are first reported to the Federal Reserve and for whom we can observe size, maturity, and interest rate. We naturally remove observations with interest rates or maturities that are likely the result of coding errors.

Unlike other commercially available databases, which cover a subset of the market or specialize in syndicated lending, our data contains highly detailed information on over 75% of *all* C&I lending in the United States (by USD volume) during the sample period. Moreover, it includes both syndicated and non-syndicated loans. This, in particular, allows us to look at the differential impacts of "specialization" on larger loans, which may include multiple syndicate members compared with smaller loans, which are issued and held by a single bank.

Banks report a large set of characteristics for each loan, many of which are useful for our analysis. Loan characteristics include the type of loan (credit line vs. term loan), total committed amount, total drawn amount, interest rate, whether a loan is collateralized or unsecured, loan maturity, a loan's risk rating, as well as whether a loan has become non-performing. Besides loan characteristics, the data contains additional information on borrower characteristics. These include borrower name, location and, most importantly, industry. We use a borrower's 2 and 4 digit NAICS industry classifications to define specialization (see above).

[Table 1 about here]

The average bank has 8% of its C&I term loan assets invested in an industry, though

this measure is associated with significant variance. The specialization measure is higher in credit lines, as fewer banks engage in credit line lending (not reported for brevity). In all the analyses discussed below, we run separate analyses for credit lines and term loans. We do this because the risks faced by banks for each type of lending, and consequently the benefits to specialization, may be different in each type of lending. Term loans involve acute credit risk. Credit lines involve both credit risk, for lines that are drawn, as well as liquidity risk, especially for long-maturity credit lines.

The average log-size of a loan in our sample is 15 million, which is skewed toward a few very large loans. Our data is reported in thousands of USD and logged. As can be seen on Table 1 the average size of our logged loans is 8.6. The average interest rate for loans in our sample period is 3.3%. Around 21% of loans make use of no form of collateral at first observation. Non-performing loan is a dummy that takes the value of 1 if a loan is either flagged as non-accruing by the reporting bank, more than 89 days in payment arrears, or has negative maturity. A negative maturity implies the loan was not resolved satisfactorily. Despite a liberal definition, only 3.3% of term loans ever become non-performing during their time in the sample. Loan ratings are given by the bank in accordance with standardized principles laid out by the Federal Reserve, so that the ratings are comparable. They range from 1 to 10 with 1 as the best rating. A downgrade occurs when, over the life of the loan, the rating rises, i.e. the risk of the loan increases. The average number of past interactions between a bank and a borrower is 4.7. This figure naturally rises towards the end of our sample and is driven by larger institutions. The average number of times a bank and borrower interact while in the sample is 9 times. The regressions below can make use of either variable without impacting results. Finally, the average stress tested bank has over 130 bn. USD invested in C&I lending at any given time during our sample period.

5 Results

In this section we document that even large banks specialize by concentrating into certain industries. We show that this specialization correlates with better loan terms, especially for larger firms with access to alternate sources of funding and during periods of higher competition. This seems to be facilitated by an information advantage gained through specialization, as specialization is correlated with better loan performance and bank performance. We extend our analyses along several dimensions. For instance, we show that banks revert to their preferred industry in times of relatively lower Tier-1 capital.

5.1 Documenting Specialization

We begin our analysis by documenting specialization. Figure 1 shows the share of a bank's C&I lending it has invested in its "top" industry (i.e. the industry in which it has invested the largest share of its assets), its second most preferred industry and all other industries. For the purpose of these graphs, we define industry according to 2-digit NAICS codes; there are 20 industries based on 2 digit NAICS codes. From Figure 1, it is readily evident that, on average, the share of a bank's portfolio in its most favored industry is substantially larger than in any other industry. Panel (b) of Figure 1 shows the distribution of the share of C&I lending a bank has invested in a single industry in any given quarter. Some banks appear to have no real specialization. However, it is also evident that some banks have invested a significant share of their lending in a single industry. All the data is based on term-loan lending. Patterns look very similar focusing on credit lines instead. Given data confidentiality, we cannot reveal which banks have specialized in which industries. However, it is worth noting that different banks have specialized in different industries. Moreover, there is a high degree of persistence in specialization. A bank specialized in an industry when it is first observed in the data is 90% likely to still be specialized in that industry at the end of the sample period.

[Figure 1 about here]

Figure 2 uses the averaged raw data in our sample to identify aggregate trends. In panel (a)

we plot the average concentration of a bank's C&I lending in its "top" industry to its investment in all other industries. We thereby compute a relative concentration measure that denotes the share of lending in the top industry less the average share of lending in all other industries. As can be seen, this share rises over time, implying an increased degree of specialization.

In panels (b) and (c) we repeat the exercise focusing on loan size and interest rate. Panel (b) showcases the average loan size in a bank's top industry relative to the average loan size in its other industries. The loan size in specialized industries is larger, even absent any other industry-level controls. While there appears to be a high degree of variance in relative loan size, it too has been growing over the past few years. Panel (c) similarly shows that the average rate paid by firms in a bank's specialized industry is lower and has been falling relative to the rates paid by firms in the industries in which banks are not specialized. Finally, panel (d) compares the share of loans that turn non-performing in industries in which banks are specialized with industries in which they are not specialized. Loans in a bank's specialized industry, absent any other controls, are consistently less likely to become non performing. the relative difference in performance has been growing in the latter part of the sample period.

[Figures 2 and 3 about here]

Finally, in Figure 3, we document the relationship between bank specialization in a certain industry (as a continuous variable that denotes the share of its total C&I lending) to various loan characteristics and loan performance. Each of these figures represent bin-scatters that absorb firm and time fixed effects. They thereby reflect the degree to which a firm, borrowing from multiple banks, may experience differing loan conditions based on the specialization of the bank. In panel (a) we show specialization and loan size and document a clear positive relationship. In Panel (b) we show that, even within a given firm and time period, specialization is negatively associated with interest rate paid. Finally, in panel (c) we show that specialization corresponds with fewer loan defaults. In the remainder of the paper, we continue to explore these observations to shed light to the forces behind the results and test the implications of our hypotheses.

5.2 Specialization and Loan Terms

As detailed above, the first part of our analysis focuses on how specialization of a bank in a given industry relates to standard loan characteristics. We measure specialization as the share of C&I lending a bank has invested in an industry in a given period. We hold constant as many loan characteristics as possible as well as bank, firm, time, loan purpose, and loan rating fixed effects. The effect of specialization is therefore identified across comparable loans to the same firm. This specification is very stringent. The number of observations highlight that the large number of fixed effects cause our sample to drop by over 50%, given a large number of singleton or perfectly estimated observations. The Appendix contains a few alternative specifications that use alternative fixed effects to highlight that the results discussed here are not merely identified within a narrow group of firm-loan observations. We discuss this further in Section 6. Notwithstanding the stringent specification, Table 2 shows that specialization is correlated with loan characteristics.

[Table 2 about here]

Firstly, specialization is positively correlated with loan size. The average bank invests 7.6% of its C&I loan portfolio in any given industry and over 23% in its "top" industry. Moving from an average bank to a specialized bank in a given industry would be associated with a loan-size increase of 26%, all else held equal. This is a sizeable effect given the narrow estimation parameters. Specialization is further associated with lower interest rate payments. If we again move from an average to a highly specialized bank we would expect a reduction in interest by a little over 0.6%. This would still represent 25% of the unconditional average interest rate payments made by firms in our sample that excludes singleton observations. Though the effect is insignificant, specialization is weakly associated with increased loan maturity. Finally, loans made by specialized banks are less likely to be unsecured.

In the Appendix A.1 we explore the relationships between specialization and collateral further. We separate out different forms of collateral used for a given loan, using the high degree of detail in our data. Specialization in an industry is associated with a higher likelihood

that the loan is secured with accounts receivable, fixed assets, or other assets. All three are arguably assets that are more easily priced and, if need arises, liquidated by banks with specialized knowledge.[7] Specialization is associated with a lower likelihood that the loan is secured by marketable securities, which include cash, or a blanket lien and would require less specialized knowledge.

Our results suggest that a specialized bank is able to acquire industry specific knowledge which allows it to better evaluate potential borrowers. Better loan terms are reflective of borrowers being able to extract some of the rents banks derive from specialization. This is likely to be exacerbated by competition from non-banks or other sources of funding. In Appendix Table A.3 we interact specialization with a dummy denoting whether a loan is originated/renegotiated in a time when the availability of non-bank funding is high - i.e. above the 75th percentile of available non-bank funding during the sample. In Appendix Table A.2 we use a dummy denoting whether the firm is publicly traded. Traded firms are typically large, rated, and most likely to have access to alternative sources of funding. Taking a firm's loan demand as given, we expect the competitive pressures to affect loan terms, all else equal. Specialized banks with industry specific knowledge may be best positioned to compete on terms. We find that interest rate, maturity, and whether a loan is secured are all significantly impacted by competition and specialization. In fact, it appears that the majority of the interest rate effect is driven by times in which the availability of non-bank funding is high. The effect of specialization, interacted with our dummies for competitive pressure, on loan size is positively signed, implying lager loans in the face of greater competition, but statistically insignificant. Given the saturation of the regressions, these tests are indicative evidence.

[Table 3 about here]

In Table 3 we interact the variable of interest, specialization, with a dummy that takes the value of 1 if the bank is the syndicating agent for the loan. We expect the effects of specialization to play a large role if a bank is the agent of a loan as opposed to a participant. We find that

[7] The specialization banks can develop in valuing and dealing with certain collateral is explored in part in Gopal (2019)

this is the case in our data. The interaction of specialization and syndication agent compounds our baseline results; loans are larger, less costly, and have significantly longer maturity for the borrower. Somewhat counter to our observations above, we find that the interaction of bank-industry specialization and the syndication agent dummy attenuate the likelihood that a loan will be secured with collateral somewhat. However, the aggregate effect remains negative.

[Table 4 about here]

In Table 4 we interact the variable of interest, specialization, with the Tier1 ratio of a bank. A higher Tier 1 ratio implies that a bank is further from any minimum regulatory threshold. Regulation may influence the type of loans into which a bank invests, as was discussed by Irani and Meisenzahl (2017) or Irani et al. (2020). We find that being far from a regulatory threshold attenuates the effects of specialization. A bank that is better capitalized and therefore more likely to be able to weather possible bad investments – relative to its sample average – may be more willing to invest in industries in which it has little knowledge and perceives as riskier. Conversely, a bank that is closer to regulatory thresholds may wish to re-concentrate on its primary industry by attracting borrowers. This holds most strongly for a loan's maturity, with significantly shorter loan maturities offered by well capitalized banks. Similarly, the generous loan size and interest rate terms are attenuated by high Tier-1 capital of specialized banks. Only the propensity of a loan being unsecured is influenced by tier-1 capital in the same way as through specialization directly. We discuss the impacts of Tier-1 capital on bank specialization in more detail in the following sections.

Specialization vs Capture Finally, bank specialization is correlated with industry capture. This is consistent with specialized banks being able to discern borrower quality to offer attractive terms to high-quality borrowers and, therefore, attract a larger fraction of the loans. At the same time, the larger a bank's participation in a given industry the higher the incentives the bank has to acquire knowledge in it. These increasing returns to scale to knowledge may make some industries captive, leaving them with only a few oligopolistic banks. Captive industries may see very little bank competition and an associated ability of the lead bank

to extract quasi-monopoly rents. In Appendix Table A.6 we show that specialization leads capture in a temporal sense. A bank may specialize and subsequently capture an industry. The correlation between lagged specialization on capture is large and significant while the correlation between lagged capture on specialization is largely insignificant.

We include both our measure of specialization as well as a measure that denotes "industry capture" by a single bank in a regression. We define capture as a single bank's contribution to industry HHI. An industry with one bank would be perfectly captured. An industry with many small and one very large bank may also rate as highly on our scale. Our variable of capture, as our variable of specialization, is bounded between 0 and 1.

[Table 5 about here]

In Table 5 we show that both capture and specialization affect loan characteristics. However, these effects often run counter to one another. Capture is associated with larger loans. This may in part be mechanical and related to our definition of capture and in part related to the fact that banks with a captured market are less likely to lend to small borrowers (this is explored further below). However, capture is also related to higher interest payments for loans. This is in keeping with our hypothesis on monopoly rent extraction. Similarly, capture is associated with shorter loan maturity while the effect of specialization becomes positive and significant. Capture is insignificantly related to whether a loan is unsecured or not. Importantly, from the perspective of this paper, the effects of specialization are not driven by capture and stand independently.

It is worth highlighting that, throughout this section, we use observable loan characteristics for loans that have been issued. We are unable to observe applications. In essence, we are simply highlighting ex-post equilibrium outcomes for characteristics that are jointly determined. Without an ability to observe the negotiation process, we cannot rule out some mechanics of credit rationing. Even as equilibrium outcomes, the results discussed above are worth highlighting. We explore firm-level access to credit in Section 5.4 below.

5.3 Specialization and Performance

Loan Performance A bank's industry specialization has implications for loan performance. One would expect this outcome if specialized banks are better able to select high-quality loans ex-ante and better able to monitor loans – or otherwise steer company actions – ex-post due to an informational advantage over other lenders. Table 6 shows that a loan is less likely to become non-accruing, less likely to ever be downgraded due to risk, and more likely have a better (lower) risk rating when last observed in our sample. Both loan-non-accrual as well as loan downgrades are measured as binary variables that take the value of one if the event ever occurs in any observation after the first. Loan risk is a standardized measure that, for stress testing purposes, is harmonized across banks; it takes a value between 1 and 10 with 1 being the lowest risk. Loan risk at last observation denotes the risk of the loan, after accounting for interest rates.

Non-accrual (column (1)) occurs rarely in our data and the coefficient on specialization is often imprecisely estimated in very saturated regressions. Even so, an increase in specialization would explain the majority of the variation of the dependent variable. Rating downgrades (column (2)) are more common and enforced by stress testing requirements of the Federal Reserve. This is true even for private loans held fully by the bank. Importantly, these loan ratings are standardized by stress testing examiners across banks. We find that an increase in specialization from an average to a "top" industry would imply a more than 3% reduction of the likelihood of a downgrade. This represents nearly 20% of the dependent variable mean. Column (3) shows the loan's rating at last observation in the data. As such, we can interpret the coefficient to signify that even in the face of extensive loan controls, which include size and rate, examiners find loans by bank's specialized in an industry to be less risky. Given that our regressions use the first observation, they are each forward-looking in time. The average loan to a bank's specialized industry carries a 0.3-points better rating than a loan to its non specialized industry at last observation.

[Table 6 about here]

We use the same saturated specification in our analyses of loan performance as in our

regressions on loan characteristics, discussed above. This implies that any effect is estimated within firm, across differently specialized lenders or within a lender with different specialization across time. We include rating at first observation as well as the interest rate paid on the loan in our regressions to account for ex-ante riskiness. As such, our results suggest that ex-post loan monitoring by specialized and well informed banks may be a key driver of loan performance. Appendix A.12 uses a specification without firm fixed effects to highlight both the stability of our results and the slightly increased magnitude of our coefficients. The larger magnitude may be a reflection of the combination of ex-ante loan selection and ex-post loan monitoring.

In Appendix Table A.5 we perform the same analyses as described in Table 6. However, we additionally include an interaction term that denotes whether the loan is syndicated. A syndicated loan is either originated by a different entity and/or includes participants other than the specialized bank. These other participants may share the riskiness of a loan, making specialization less necessary, while also being unable to appropriately value specialized knowledge. The specialized bank would be less incentivized to use its abilities to monitor the loan. We find, as one might expect, that the performance of loans originated by specialized banks which remain wholly on the bank's balance sheet is better than loans that are syndicated.

In Appendix Table A.4 we analyze the propensity of a bank to sell out of its exposure to a borrower. We relate this propensity to its specialization in the borrower's industry. It is possible that a high degree of knowledge about an industry may create a large asymmetric information discount in the relative price of loans. Market participants with no specialized knowledge will be unable to distinguish one loan from another. Without an ability to signal borrower quality, the bank may simply retain loans or exposure to borrowers that it considers to be of high quality. We find evidence for this in Table A.4. Banks are less likely to reduce exposure – which typically means selling a larger portion of syndicated loans – or sell out of a relationship entirely the higher the specialization in an industry[8]. Our results highlight the fact that the results on loan performance are likely the consequence of superior bank information.

[8]In these analyses we anchor a bank's specialization to the loan's origination date to avoid convolution later stage specialization with reattained exposure to certain borrowers.

Bank Performance Better loan performance of specialized banks translates to slightly better bank performance on aggregate. Table 7 shows various bank level outcomes taken from Y-9C data. A bank that is on average more specialized experiences lower returns relative to assets. This may in part be the result of lower loan rates on larger loans, which are discussed above. However, specialized banks also experience a lower variance in the structure of their returns. To borrow a concept from from asset pricing; specialized banks have slightly higher sharpe ratios – the ratio of income to variation in income – than less specialized banks. However this difference is statistically marginally significant. Importantly, specialized banks see lower C&I loan charge offs. Chargeoffs are an extreme measure that occur when the loan becomes irredeemably non-accruing. Lower charge-offs imply a better loan selection or better loan management. Similarly, the standard deviation of charge offs is lower among specialized banks.

[Table 7 about here]

Finally, Table 7 shows that banks with higher specialization show higher levels of tier 1 capital, on average. This observation is explored further in Appendix Figure A.1. Banks with high specialization have, on average, higher tier 1 capital ratios as well as lower charge-offs. However, banks grow their specialization – to a certain extent– at the cost of tier 1 capital. This implies that there may be costs associated with increasing specialization in an industry in which a bank is not yet specialized. This would be commensurate with higher loses in loans made by non-specialized banks (see tables above).

Industry Performance Some of the performance patterns discussed for specialized banks are visible at the level of entire industries. We are able to separate industries by the average specialization of banks in that respective industry. Industries served by a few highly specialized banks will see high average specialization while industries served by many diversified banks will see low average specialization. As can be seen in Table 8, this average specialization correlates with a lower average share of non-performing loans in the industry (column (3)). This corroborates the findings at the bank-level discussed above. Similarly, the share of loans

downgraded in any year is much lower if the average specialization of banks in an industry is higher (column (4)).

[Table 8 about here]

Surprisingly, the average loan size in industries with high average specialization is lower (column (1)). In a similar vein, the average rates paid in these industries is higher (column(2)). While both estimates are insignificant, the observations still seem counter-intuitive relative to the loan level results discussed above. However, it bears highlighting that the results above are estimated within borrower; implying that firms obtain larger loans from specialized banks. Specialized banks, on the other hand, may give more loans to smaller firms, which skews the estimation at the industry level. We therefore explore this observation in greater detail.

5.4 Specialization and Small Firm Lending

It is a well documented phenomenon that small firms are increasingly less able to borrow from banks in recent years. We are able to observe this phenomenon in our data. Figure 4 shows that the share of small loans, as a proportion of stress tested bank portfolios, has been falling in recent years. It is worth analyzing whether the trend holds for specialized banks as well. After all, the reason that small firm lending may have decreased lies in part in the opacity of such firms. If specialized banks are more able to evaluate firms in an industry, one would expect more small firm lending among such banks.

[Figure 4 about here]

In Figure 4, panel (b), one can observe a positive correlation between the likelihood of a small loan being granted and a bank's industry specialization. More specialized banks are more likely to grant a small loan. We explore this in greater detail in Table 9. Here we relate the likelihood of a small loan being granted to borrower and loan characteristics. We define a small loan as one that is smaller than either 3 mil. USD or 2 mil. USD. We use alternative definitions to make sure our results are not driven by the selection of our sample. For a subset

of firms in our data, we are able to determine their total size by assets. As such, we are further able to analyze whether a loan of any size is granted to a firm of less than 10 mil. USD in assets. Our controls include the standard loan characteristics discussed above, as well as bank, industry, year*quarter, and rating fixed effects.

[Table 9 about here]

As can be seen, a more specialized bank is more likely to grant a small loan – no matter the definition – or lend to a small firm. The effect size is considerable when considering the unconditional mean of the dependent variables. Going from an average to a bank's specialized industry, would lead to an almost 8%-pt increase in the likelihood of a small loan being granted. This represents one 20% of the unconditional mean of the dependent variable in columns (1) and (2).

Importantly, the analyses include a measure of industry capture in all columns after column (1). The effect of capture runs counter to the effect of specialization. Banks with a monopoly hold on an industry are less likely to lend to small borrowers. Conversely, banks with a high degree of specialization are more likely to lend to such firms.

6 Robustness

As was alluded to above, our Online Appendix includes several alternative specifications of our baseline regressions that relate specialization to loan performance. These alternative specifications highlight the stability of our results to various alternative assumptions.

Appendix Table A.7 uses an alternative definition of specialization. The baseline methodology uses the share of a bank's portfolio that is invested in a single industry. This measure could be driven by single large loans that might be one-time outliers in a bank's lending behavior. Specialization may develop not from volume but from frequency. The more frequently a borrower and lender interact, the more knowledge is gained. As such, the specification uses specialization defined by the number rather than the volume, of loans to a singe industry.

Our results are all confirmed using this specification. The scaled effects are of very similar magnitude.

Similarly, we include A.8 which uses logged loans to define specialization. As such, we are defining specialization by the volume of lending but are avoiding the impact of individual outlier loans. Our baseline results are confirmed using this specification as well. Ultimately, we observe a high degree of correlation across all of our measures of specialization.

In Appendix Table A.9 we further include firm*year fixed effects as controls in our regression. This is akin to a khwajamian style regression. We are identifying the effect of bank specialization within a borrower taking two loans – from differently specialized banks – within the same year. Even within borrower-time observations, we find that our observations hold. In fact, some of the effects are somewhat larger. Given the stringent nature of the specification, our effects are naturally identified within a group of firms that are borrowing multiple times within a short period. As such, this is likely to be a smaller sub-population of larger firms or firms with strong growth trends.

Our baseline regressions made use of new loans only. As such, we inherently excluded re-negotiations of existing loans. We do so to avoid double-counting the same loan – and associated information – in our regressions. Conversely, it can be argued that re-negotiations may similarly be influenced by a bank's specialization. We therefore include Appendix Table A.10, which includes renegotiated loans in our data. The majority of our baseline coefficients are corroborated in our full data set. The effect magnitudes are somewhat larger in some instances. Only loan interest rate is no longer significantly correlated with bank specialization, though it remains negatively signed.

Finally, we include a set of Appendix Tables (A.11 and A.12) that use the same basic regressions and samples as our baseline regressions above. However, we exclude firm fixed effects. These specifications reflect the effect of specialization across different borrowers, as opposed to within borrowers. The magnitude of our coefficients is larger than for our baseline specification, which reflects the sizeable difference in loan characteristics for borrowers able to borrow from banks specialized in their industry.

7 Conclusion

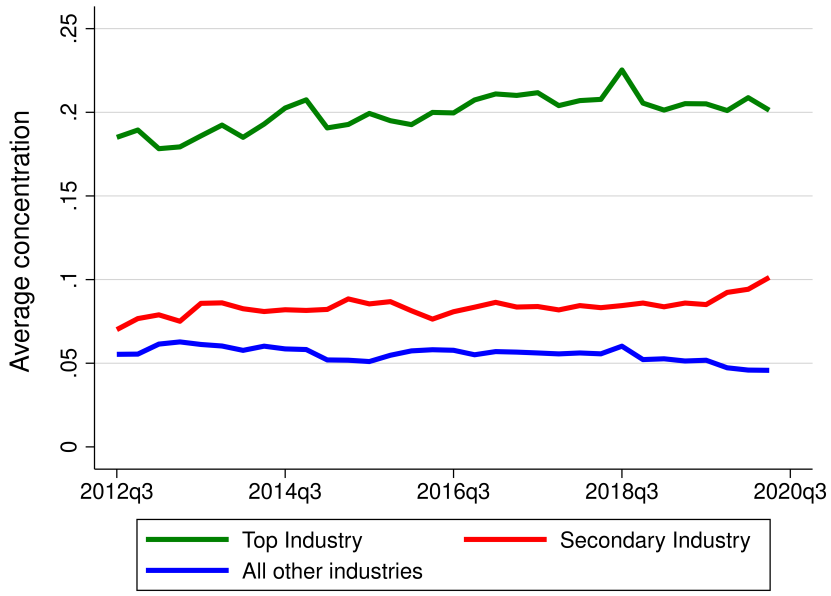
In this paper we show that even large stress tested banks specialize in certain industries. Specialized banks invest a far larger share of their portfolios in a favorite industry compared to all other industries. We further show that this specialization correlates with loan characteristics. A firm is likely to receive a larger loan, a lower interest rate, a longer maturity, and be required to post less cash-equivalent collateral for a loan from a specialized bank, all else equal. We posit that this follows from the ability of specialized banks to discern borrower quality due to a buildup of industry-specific knowledge. In an attempt to capture a large share of high quality borrowers, banks offer superior loan terms.

Commensurate with theories that suggest that specialization may improve a lender's ability to monitor an existing loan or select a high-quality loan ex ante, we find that loans from specialized banks are less likely to become non-accruing or even be downgraded prior to maturity. This effect holds even when controlling for borrower fixed-effects and loan risk at origination. Specialized lenders are also more likely to lend to SMEs, which have found bank borrowing more difficult in recent years due to their opacity.

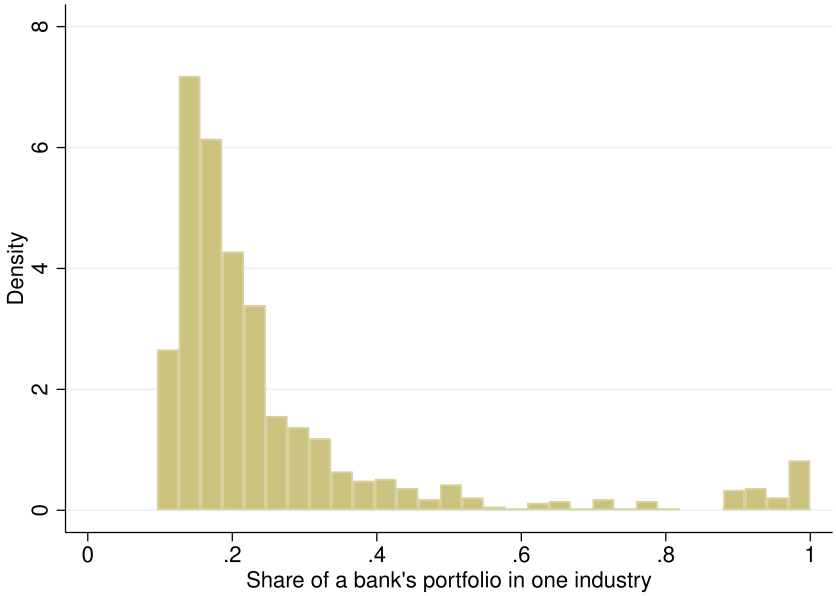
Finally, we document that specialization has industry-and bank wide implications. Specialization leads to more stable bank performance at the cost of slightly lower net interest earnings. Industries with more specialized banks also experience fewer loan down-grades and write-offs on average.

Our results speak to the role of banks as designated intermediaries. Their ability to acquire superior knowledge through specialization has implications for both borrowers in those industries in which banks specialize as well as bank stability overall.

Tables and Figures

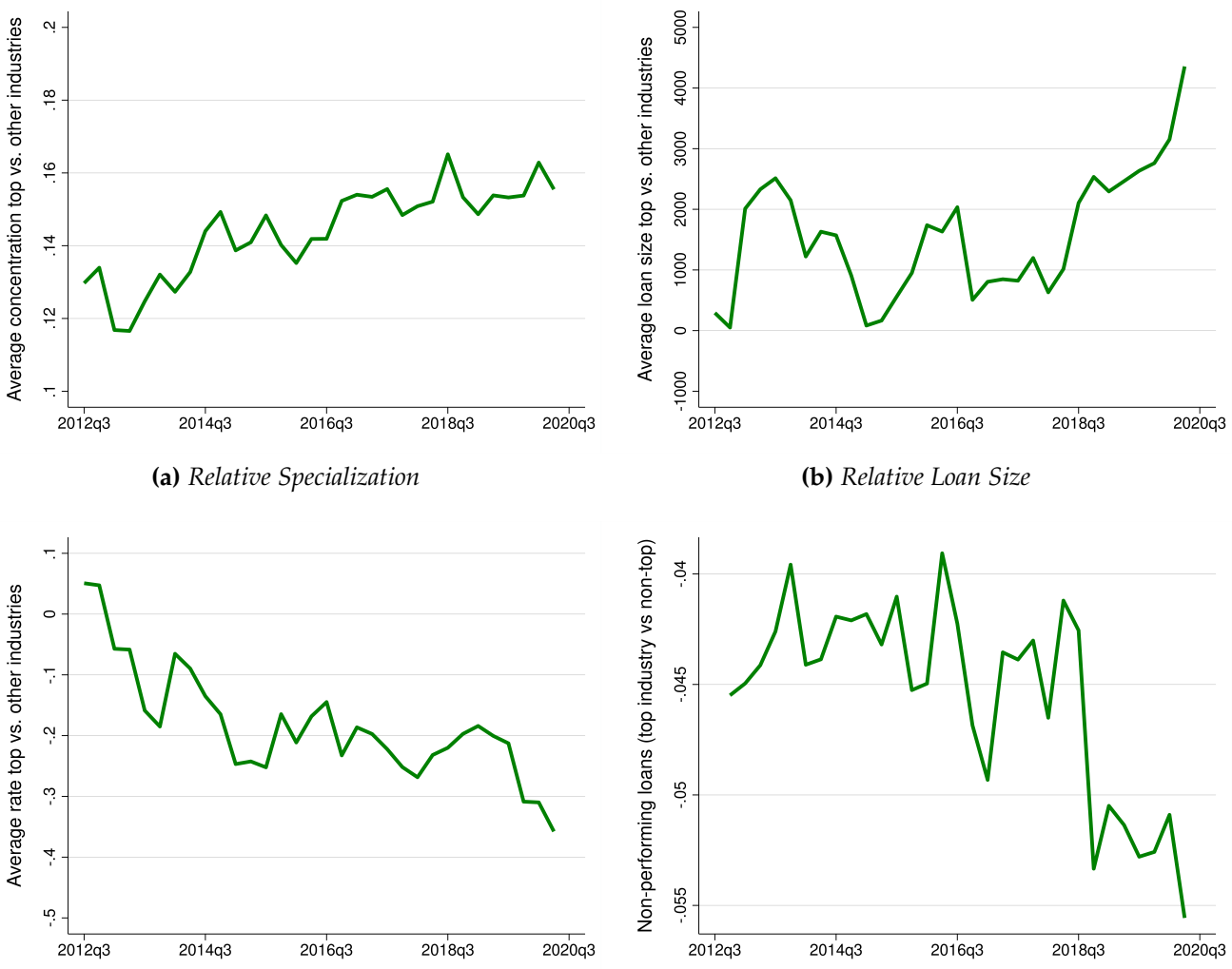


(a) *Share of Loan Portfolio in an Industry*



(b) *Distribution of Share in "Top" Industry*

Figure 1: ***Industry Specialization****. Panel a shows the average loan portfolio concentration, which is measured as the share of loans to one two-digit industry at a given point in time, for banks in the sample. Data is split into the average bank's "top" industry, it's secondary industry, and all other industries. A bank's top industry is defined as the two-digit NAICS code industry into which a bank has invested the largest share of its portfolio during its time in the sample. Panel b depicts the distribution of a bank's loan portfolio in it's "top" industry.*



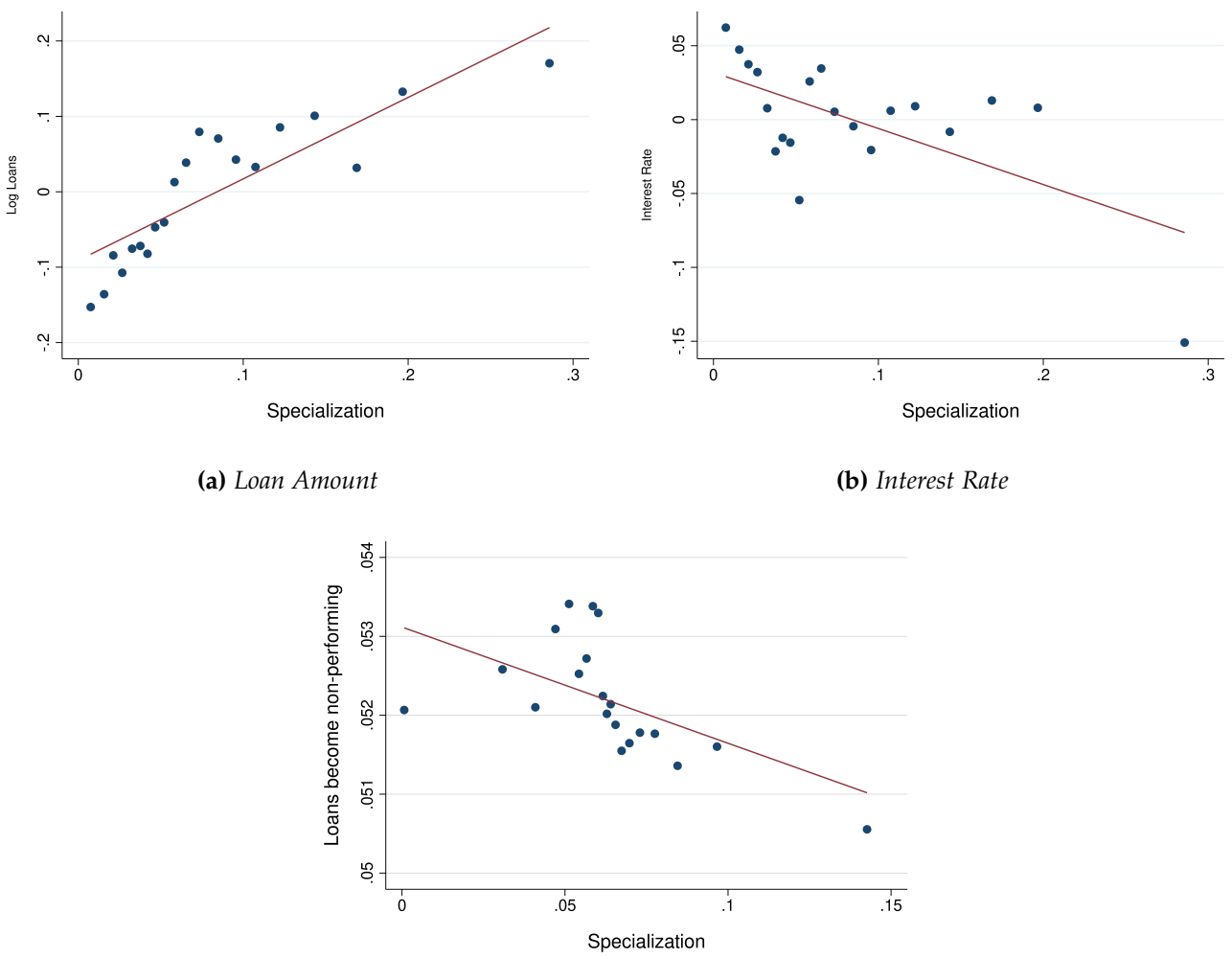
(a) *Relative Specialization*

(b) *Relative Loan Size*

(c) *Relative Loan Rate*

(d) *Relative Loan Performance*

Figure 2: ***Specialization and Loan Terms over Time****. This figure depicts concentration in - and average loan terms to the industry in which a bank has "specialized", relative to all other industries. Panel a shows average loan portfolio concentration in a bank's "top" industry relative to all other industries. A bank's top industry is the one in which it has lent the largest share of its loan portfolio over time. Panel b compares the average loan size of loans to the top industry with the average loan size of all other loans. Panel c compares the average loan rate of loans in a bank's top industry relative to its other industries. Finally, panel (d) analyzes loan performance and compares the share of loans that are non-accruing/non-performing.*

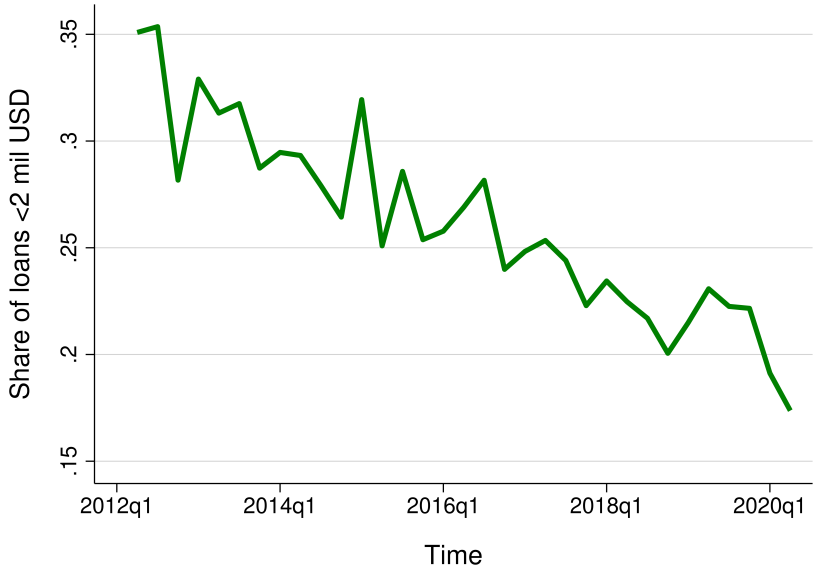


(a) *Loan Amount*

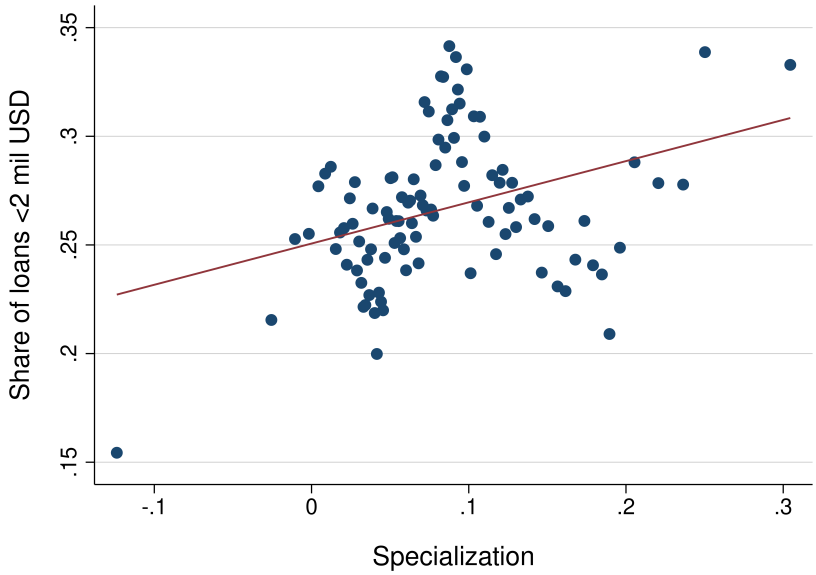
(b) *Interest Rate*

(c) *Performance*

Figure 3: ***Specialization and Loan Characteristics*** *This figure makes use of all loans in our data and depicts specialization relative to loan characteristics, after absorbing firm and time fixed effects. Specialization is measured as the concentration of the bank's loan portfolio in a given industry. Panel (a) depicts loan size relative to a bank specialization. Panel (b) depicts the interest rate charged relative to specialization and panel (c) depicts the probability that a loan becomes non-performing.*



(a) *Aggregate Lending to SMEs by Banks in Sample (portfolio share %)*



(b) *Correlation between Specialization and SME Lending*

Figure 4: ***SME lending*** *This figure makes use of new term loans in our data. Panel (a) shows the share of small loans (i.e. loans worth less than 2 mil. USD at origination), as a percentage of all lending by the average bank. Panel (b) shows the relationship between a small loan and a bank's specialization. Panel (b) accounts for bank*time fixed effects.*

Table 1: *Data Sources*

	N	Mean	S.D.	P25	P75
Share of bank's assets in industry (Specialization)	74,859	0.076	0.063	0.033	0.098
Share of bank's assets in 4-digit industry (Specialization)	74,859	0.032	0.058	0.003	0.026
Bank's contribution to industry hhi (Capture)	74,859	0.120	0.163	0.009	0.167
Bank's contribution to 4-digit industry hhi (Capture)	74,859	2.607	3.931	0.127	3.363
Interest rate	74,859	3.285	1.363	2.25	4.066
Log loan amount	74,859	8.560	1.245	7.555	9.499
Unsecured	74,859	0.212	0.409	0	0
Loan is ever non-performing	74,859	0.033	0.178	0	0
Loan rating is ever downgraded	74,859	0.194	0.395	0	0
Loan rating	74,835	5.262	1.104	5	6
Number of past interactions (relationship)	74,859	4.67	15.67	1	4
Number of bank-firm interactions (ever)	74,859	8.94	29.16	2	7
C and I lending by bank in quarter (bn. USD)	74,859	136.2	124.2	43.1	257.8

Note: This table shows summary statistics for key variables in the paper.

Table 2: ***Specialization and Loan Characteristics***

	(1) Log loan amount	(2) Interest Rate	(3) Maturity remaining	(4) Unsecured
Specialization	1.390***	-0.368***	1.648	-0.972***
	[0.201]	[0.135]	[1.510]	[0.094]
Bank FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year*Quarter FE	Yes	Yes	Yes	Yes
Loan Purpose and Rating FE	Yes	Yes	Yes	Yes
Controls	Loan and bank	Loan and bank	Loan and bank	Loan and bank
Mean of dependent variable	8.7	2.4	17	0.26
R^2	0.75	0.87	0.71	0.77
N	32805	32805	31980	32805

Note: This table shows the coefficients of interest for equation:

$$Y_{l,i,b,s,t} = \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 \mathbf{X}_{l,b} + \theta_t + \xi_b + \gamma_i + \sigma_s + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t}$$

It relates loan characteristics of loan l at time t made by bank b to firm i operating in industry/sector s. Y measures a loan's size, the interest rate paid, the maturity remaining or whether the loan is secured with collateral. All loans are measured at origination only. X are loan characteristics such as amount, spread, maturity and whether the loan is secured with collateral, unless the characteristic is also the dependent variable in question. It further includes time-varying bank controls such as size or tier 1 capital. The variable of interest is bank "specialization" in the given industry, which is measured as the share of the bank's loan portfolio devoted to the industry. The regressions include bank, firm, industry, year*quarter, loan risk and loan purpose fixed effects. Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table 3: ***Specialization and Syndicated Agents - Loan Characteristics***

	(1) Log loan amount	(2) Interest Rate	(3) Maturity remaining	(4) Unsecured
Specialization	1.288***	-0.329**	1.074	-1.022***
	[0.202]	[0.133]	[1.527]	[0.096]
Specialization * Syndication Agent	0.750**	-0.857***	9.465***	0.882***
	[0.349]	[0.313]	[2.948]	[0.195]
Syndication agent	0.272***	0.130***	-0.451	-0.047***
	[0.043]	[0.036]	[0.284]	[0.016]
Bank FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year*Quarter FE	Yes	Yes	Yes	Yes
Loan Purpose and Rating FE	Yes	Yes	Yes	Yes
Controls	Loan and bank	Loan and bank	Loan and bank	Loan and bank
Mean of dependent variable	8.7	2.4	17	0.26
R^2	0.75	0.87	0.71	0.78
N	32805	32805	31980	32805

Note: This table shows the coefficients of interest for equation:

$$Y_{l,i,b,s,t} = \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 Specialization_{b,s,t} * SyndicationAgent + \beta_3 SyndicationAgent + \beta_4 \mathbf{X}_{l,b} + \theta_t + \xi_b + \gamma_i + \sigma_s + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t}$$

It relates loan characteristics of loan l at time t made by bank b to firm i operating in industry/sector s. Y measures a loan's size, the interest rate paid, the maturity remaining, or whether the loan is secured with collateral. All loans are measured at origination only. X are loan characteristics such as amount, spread, maturity and whether the loan is secured with collateral, unless the characteristic is also the dependent variable in question. It further includes time-varying bank controls such as size or tier 1 capital. The variable of interest is β_1 which denotes the impact of bank "specialization" in the given industry. Specialization is measured as the share of the bank's loan portfolio devoted to the industry. A second variable of interest is β_2 which measures the interaction of specialization with a binary variable measuring whether the bank is syndication agent for the loan in question. The regressions include bank, firm, industry, year*quarter, loan risk and loan purpose fixed effects. Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table 4: ***Specialization and Tier 1 Capital***

	(1) Log loan amount	(2) Interest Rate	(3) Maturity remaining	(4) Unsecured
Specialization	1.459***	-0.416***	2.148	-0.933***
	[0.206]	[0.134]	[1.532]	[0.094]
Specialization * Tier1	-4.600**	2.925*	-27.442*	-2.274**
	[1.927]	[1.615]	[15.518]	[0.887]
Tier 1 Ratio	0.427	-0.597**	1.605	0.217
	[0.294]	[0.257]	[2.748]	[0.171]
Bank FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year*Quarter FE	Yes	Yes	Yes	Yes
Loan Purpose and Rating FE	Yes	Yes	Yes	Yes
Controls	Loan and bank	Loan and bank	Loan and bank	Loan and bank
Mean of dependent variable	8.7	2.4	17	.26
R^2	0.75	0.87	0.7	0.77
N	32653	32653	31845	32653

Note: This table shows the coefficients of interest for equation:

$$Y_{l,i,b,s,t} = \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 Specialization_{b,s,t} * Tier1Capital + \beta_3 Tier1Capital + \beta_4 \mathbf{X}_{l,b} + \theta_t + \xi_b + \gamma_i + \sigma_s + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t}$$

It relates loan characteristics of loan l at time t made by bank b to firm i operating in industry/sector s. Y measures a loan's size, the interest rate paid, the maturity remaining, or whether the loan is secured with collateral. All loans are measured at origination only. X are loan characteristics such as amount, spread, maturity and whether the loan is secured with collateral, unless the characteristic is also the dependent variable in question. It further includes time-varying bank controls such as size or tier 1 capital. The variable of interest is β_1 which denotes the impact of bank "specialization" in the given industry. Specialization is measured as the share of the bank's loan portfolio devoted to the industry. A second variable of interest is β_2 which measures the interaction of specialization with a variable measuring a bank's Tier 1 capital relative to risk weighted assets. The regressions include bank, firm, industry, year*quarter, loan risk and loan purpose fixed effects. Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table 5: *Specialization and Capture - Loan Characteristics*

	(1) Log loan amount	(2) Interest Rate	(3) Maturity remaining	(4) Unsecured
Specialization	1.215***	-0.492***	2.684*	-0.936***
	[0.204]	[0.141]	[1.580]	[0.098]
Industry capture	0.274***	0.193***	-1.603**	-0.056
	[0.077]	[0.066]	[0.645]	[0.045]
Bank FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year*Quarter FE	Yes	Yes	Yes	Yes
Loan Purpose and Rating FE	Yes	Yes	Yes	Yes
Controls	Loan and bank	Loan and bank	Loan and bank	Loan and bank
Mean of dependent variable	8.7	2.4	17	.26
R^2	0.75	0.87	0.71	0.77
N	32805	32805	31980	32805

Note: This table shows the coefficients of interest for equation:

$$Y_{l,i,b,s,t} = \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 Capture + \beta_3 \mathbf{X}_{l,b} + \theta_t + \xi_b + \gamma_i + \sigma_s + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t}$$

It relates loan characteristics of loan l at time t made by bank b to firm i operating in industry/sector s. Y measures a loan's size, the interest rate paid, the maturity remaining, or whether the loan is secured with collateral. All loans are measured at origination only. X are loan characteristics such as amount, spread, maturity and whether the loan is secured with collateral, unless the characteristic is also the dependent variable in question. It further includes time-varying bank controls such as size or tier 1 capital. The variable of interest is β_1 which denotes the impact of bank "specialization" in the given industry. Specialization is measured as the share of the bank's loan portfolio devoted to the industry. A second variable of interest is β_2 which measures the degree to which an industry has been captured by the bank in question. Capture is measured as a single bank's contribution to the industry's HHI. The regressions include bank, firm, industry, year*quarter, loan risk and loan purpose fixed effects. Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table 6: ***Specialization and Loan Performance***

	(1) Loan ever becomes non-performing	(2) Loan ever suffers rating downgrade	(3) Loan rating
Specialization	-0.029	-0.149**	-0.615***
	[0.030]	[0.074]	[0.155]
Bank FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Year*Quarter FE	Yes	Yes	Yes
Loan Purpose and Rating FE	Yes	Yes	Purpose Only
Controls	Loan and bank	Loan and bank	Loan and bank
Mean of dependent variable	0.027	0.17	4.3
R^2	0.48	0.42	0.89
N	32805	32815	32805

Note: This table shows the coefficients of interest for equation:

$$Y_{l,i,b,s,t} = \beta_0 + \beta_1 Specialization_{b,s,t} + \beta_2 \mathbf{X}_{l,b} + \theta_t + \xi_b + \gamma_i + \sigma_s + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t}$$

It relates loan characteristics of loan l at time t made by bank b to firm i operating in industry/sector s. Y measures whether a loan ever becomes non-performing before maturity or renegotiation, whether a loan is ever downgraded before maturity, or the rating at origination. Loans with a lower rating are considered safer. All loans are measured at origination only. X are loan characteristics such as amount, spread, maturity and whether the loan is secured with collateral. It further includes time-varying bank controls such as size or tier 1 capital. The variable of interest is bank specialization in the given industry, which is measured as the share of the bank's loan portfolio devoted to the industry. The regressions include bank, firm, industry, year*quarter, loan risk and loan purpose fixed effects. Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table 7: ***Specialization and Bank Performance***

	(1) Net income to assets	(2) SD. Interest Income	(3) Percentage of Charge-offs (CandI)	(4) SD. Charge-offs (CandI)	(5) Tier 1 Ratio
Specialization	-0.025***	-8.704***	-0.001***	-0.252***	10.954***
	[0.004]	[2.048]	[0.000]	[0.052]	[1.089]
Fixed Effects	Time	Time	Time	Time	Time
Mean of dependent variable	0.015	2.5	0.09	0.067	13
R^2	0.49	0.084	0.32	0.28	0.16
N	827	778	827	778	827

Note: This table shows the coefficients of interest for equation:

$$Y_{b,t} = \beta_0 + \beta_l Specialization_{b,t} + \beta_2 Totalassets_{b,t} + \beta_3 Tier1Capital_{b,t} + \theta_t + \epsilon_{b,t}$$

It relates various characteristics of bank b's performance at time t to its specialization. Specialization is measured as it's average loan concentration. Controls include bank size and Tier 1 capital as well as time fixed effects. Robust standard errors; *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table 8: ***Effects on Industry***

	(1) Log avg. loan size	(2) Avg. interest rate	(3) Share of non-performing loans	(4) Share of loans downgraded	(5) Mean rating
Mean specialization	-0.306	0.215	-0.317***	-0.272***	-1.008**
	[0.469]	[1.011]	[0.053]	[0.101]	[0.434]
Industry and Time FE	Yes	Yes	Yes	Yes	Yes
Mean of dependent variable	9.7	3.4	.013	.046	5.3
R^2	0.97	0.92	0.44	0.78	0.97
N	828	828	828	828	828

Note: This table shows the coefficients of interest for equation:

$$Y_{i,t} = \beta_0 + \beta_l MeanSpecialization_{i,t} + \gamma_i + \theta_t + \epsilon_{i,t}$$

It relates various characteristics of average loans in industry i at time t to the mean specialization of banks in that industry. Controls include industry and time fixed effects. Dependent variables of interest are the average loan size, the average interest rate paid, the share of non-performing loans (at time t), the share of loans downgraded (at time t) and the average loan rating. Robust standard errors; *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table 9: ***Specialization and Lending to Small Firms***

	(1) Loan < 3 mil USD	(2) Loan < 3 mil USD	(3) Loan < 2 mil USD	(4) Loan to small firm
Specialization	0.473***	0.575***	0.471***	0.296***
	[0.041]	[0.041]	[0.038]	[0.049]
Industry Capture		-0.228***	-0.188***	0.045
		[0.019]	[0.017]	[0.029]
Bank FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year*Quarter FE	Yes	Yes	Yes	Yes
Loan Rating FE	Yes	Yes	Yes	Yes
Mean of dependent variable	0.4	0.4	0.27	0.3
R^2	0.1	0.11	0.076	0.26
N	74689	74689	74689	53497

Note: This table shows the coefficients of interest for equation:

$$Y_{l,i,b,s,t} = \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 \mathbf{X}_{l,b} + \theta_t + \xi_b + \sigma_s + \phi_{loanriskrating} + \epsilon_{l,i,b,s,t}$$

It relates loan characteristics of loan l at time t made by bank b to firm i operating in industry/sector s. Y are three binary variables denoting whether the loan is smaller than 3 mil. USD smaller than 2 mil. USD or goes to a small firm. All loans are measured at origination only. X are loan characteristics such as amount, spread, maturity and whether the loan is secured with collateral, unless the characteristic is also the dependent variable in question. It further includes time-varying bank controls such as size or tier 1 capital. The variable of interest is bank "specialization" in the given industry, which is measured as the share of the bank's loan portfolio devoted to the industry. The regressions include bank, industry, year*quarter, and loan risk fixed effects. Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

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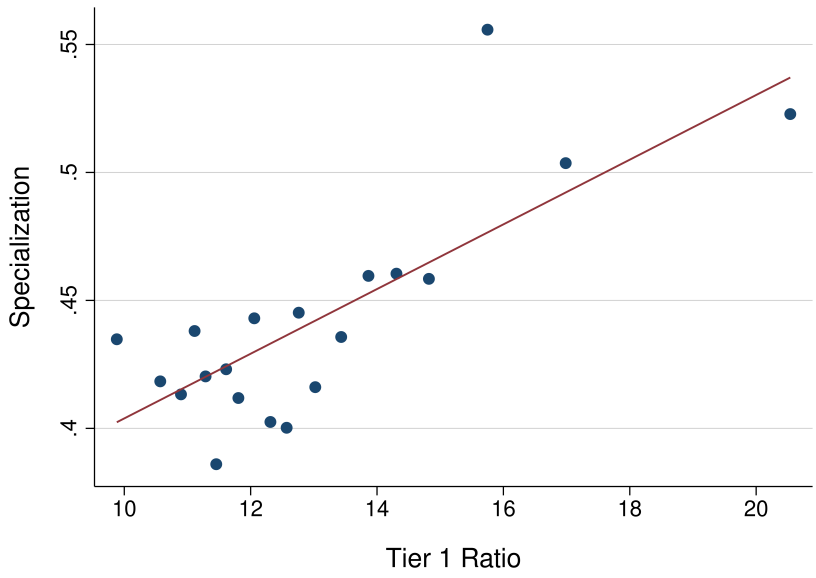
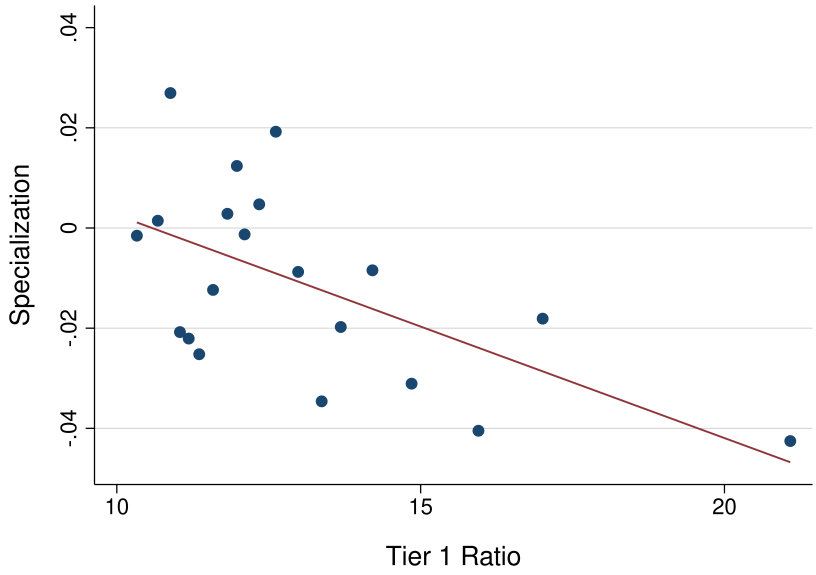
Internet Appendix for "Specialization in Banking"



(a) *Tier 1 and Specialization - across banks*



(b) *Tier 1 and Specialization - within bank*

Figure A.1: ***Tier 1 and Specialization***. *Panel a shows the relationship between the Tier 1 capital ratio specialization across banks, the graph absorbs bank size and time fixed effects. Panel b shows the relationship between the Tier 1 capital ratio specialization within banks. The graph absorbs bank size, time, and bank fixed effects.*

Table A.1: *Specialization and Collateral*

	(1) Secured by real estate	(2) Secured by marketable securities	(3) Secured by AR	(4) Secured by fixed assets	(5) Blanket lien	(6) Secured by other
Specialization	0.036	-0.253***	0.373***	0.222***	-0.622***	0.244**
	[0.077]	[0.079]	[0.091]	[0.077]	[0.118]	[0.106]
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year*Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Loan Purpose and Rating FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Loan and bank	Loan and bank	Loan and bank	Loan and bank	Loan and bank	Loan and bank
Mean of dep. var.	0.19	0.049	0.17	0.15	0.29	0.16
R^2	0.86	0.65	0.71	0.77	0.74	0.75
N	23362	23362	23362	23362	23362	23362

Note: This table shows the coefficients of interest for equation:

$$Y_{l,i,b,s,t} = \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 \mathbf{X}_{l,b} + \theta_t + \xi_b + \gamma_i + \sigma_s + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t}$$

Our data includes only those loan contracts that make use of collateral. The regressions relate the likelihood that a certain type of collateral is pledged for loan l at time t made by bank b to firm i operating in industry/sector s. Y is a binary variable denoting whether a certain type of collateral is used. All loans are measured at origination only. X are loan characteristics such as amount, spread, maturity and whether the loan is secured with collateral, unless the characteristic is also the dependent variable in question. It further includes time-varying bank controls such as size or tier 1 capital. The variable of interest is bank "specialization" in the given industry, which is measured as the share of a bank's lending by the count of outstanding loans at any given time, regardless of loan size. The regressions include bank, firm, industry, year*quarter, loan risk and loan purpose fixed effects. Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table A.2: ***Specialization interacted with Traded Firm Dummy***

	(1) Log loan amount	(2) Interest rate	(3) Maturity remaining	(4) Unsecured
Specialization	0.595***	0.035	6.457***	-0.089***
	[0.065]	[0.060]	[0.936]	[0.028]
Interaction: Specialization * Traded Firm	0.340	-0.222**	-5.889***	-1.402***
	[0.224]	[0.108]	[1.514]	[0.117]
Bank FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year*Quarter FE	Yes	Yes	Yes	Yes
Loan Purpose and Rating FE	Yes	Yes	Yes	Yes
Controls	Loan and bank	Loan and bank	Loan and bank	Loan and bank
Mean of dependent variable	8.3	2.5	16	0.14
R^2	0.85	0.9	0.73	0.81
N	997984	997984	928023	997984

Note: This table shows the coefficients of interest for equation:

$$Y_{l,i,b,s,t} = \beta_0 + \beta_1 Specialization_{b,s,t} + \beta_2 Specialization_{b,s,t} * TradedFirm_{i,t} + \mathbf{X}_{l,b} + \theta_t + \xi_b + \gamma_i + \sigma_s + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t}$$

It relates loan characteristics of loan l at time t made by bank b to firm i operating in industry/sector s. Y measures a loan's size, the interest rate paid, the maturity remaining, or whether the loan is secured with collateral. All loans are measured at origination only. X are loan characteristics such as amount, spread, maturity and whether the loan is secured with collateral, unless the characteristic is also the dependent variable in question. It further includes time-varying bank controls such as size or tier 1 capital. The variable of interest is β_2 which denotes the impact of bank "specialization" in the given industry interacted with a dummy denoting whether the firm is traded. Specialization is measured as the share of the bank's loan portfolio devoted to the industry. Traded Firm takes the value of one for firm i in periods when it has a ticker code associated with any major index. The regressions include bank, firm, industry, year*quarter, loan risk and loan purpose fixed effects. Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table A.3: *Specialization interacted with Non-Bank Funding*

	(1) Log loan amount	(2) Interest rate	(3) Maturity remaining	(4) Unsecured
Specialization	0.669***	0.001	4.818***	-0.417***
	[0.072]	[0.053]	[0.784]	[0.036]
Interaction: Specialization * High Non-Bank	0.013	-0.042***	0.394*	-0.010*
	[0.016]	[0.015]	[0.233]	[0.006]
Bank FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year*Quarter FE	Yes	Yes	Yes	Yes
Loan Purpose and Rating FE	Yes	Yes	Yes	Yes
Controls	Loan and bank	Loan and bank	Loan and bank	Loan and bank
Mean of dependent variable	8.3	2.5	16	.14
R^2	0.85	0.9	0.73	.8
N	997984	997984	928023	997984

Note: This table shows the coefficients of interest for equation:

$$Y_{l,i,b,s,t} = \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 Specialization_{b,s,t} * HighNonBankFunding_{t-1} + \mathbf{X}_{l,b} + \theta_t + \xi_b + \gamma_i + \sigma_s + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t}$$

It relates loan characteristics of loan l at time t made by bank b to firm i operating in industry/sector s. Y measures a loan's size, the interest rate paid, the maturity remaining, or whether the loan is secured with collateral. All loans are measured at origination only. X are loan characteristics such as amount, spread, maturity and whether the loan is secured with collateral, unless the characteristic is also the dependent variable in question. It further includes time-varying bank controls such as size or tier 1 capital. The variable of interest is β_2 which denotes the impact of bank "specialization" in the given industry interacted with a dummy denoting whether the period has high non-bank funding. Specialization is measured as the share of the bank's loan portfolio devoted to the industry. High non-bank funding takes the value of one for times when the level of available non-bank funding is above the 75th percentile of non-bank funding in the sample. The regressions include bank, firm, industry, year*quarter, loan risk and loan purpose fixed effects. Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table A.4: *Specialization and Exposure to Firms*

	(1) Exposure Reduced	(2) Maturity Reduced	(3) Relationship ended early	(4) Exposure Reduced	(5) Relationship ended early
Specialization	-0.014**	-0.035***	-0.004**	-0.075***	-0.006
	[0.006]	[0.004]	[0.002]	[0.024]	[0.006]
Fixed Effects	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Sample	All loans	All loans	All loans	Syndicated as agent	Syndicated as agent
Mean of dep. var.	0.8	0.93	0.011	0.72	0.0073
R^2	0.55	0.16	0.098	0.51	0.11
N	833,920	833,920	833,920	39,453	39,453

Note: This table shows the coefficients of interest for equation:

$$Y_{i,b,s,t} = \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 \mathbf{X}_{i,b} + \theta_t + \gamma_i + \epsilon_{i,b,s,t}$$

We collapse data to the firm-bank-industry-time level. The regressions relate the likelihood that a bank decreases its exposure to a borrower or sells out of its exposure entirely as a function of its specialization in the borrower's industry. Y is a binary variable denoting whether exposure is reduced or whether all contracts are terminated early (>1 year prior to maturity). X are loan characteristics such as lagged amount and, spread. The variable of interest is bank "specialization" in the given industry, which is measured as the share of a bank's lending by the count of outstanding loans at any given time, regardless of loan size, at the time loans to a borrower a first originated. The regressions include firm and year*quarter fixed effects. Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table A.5: ***Specialization and Loan Performance – Syndicated vs Non-Syndicated Loans***

	(1) Loan ever becomes non-performing	(2) Loan ever suffers rating downgrade	(3) Loan rating
Specialization	-0.044	-0.055	-0.664***
	[0.034]	[0.091]	[0.203]
Loan not syndicated * Specialization	-0.021	-0.208*	-0.019
	[0.034]	[0.112]	[0.245]
Loan not syndicated	-0.012*	-0.096***	-0.053
	[0.007]	[0.025]	[0.042]
Bank FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Year*Quarter FE	Yes	Yes	Yes
Loan Purpose and Rating FE	Yes	Yes	Purpose Only
Controls	Loan and bank	Loan and bank	Loan and bank
Mean of dependent variable	0.027	0.18	0.18
R^2	0.48	0.42	0.89
N	32805	32815	32805

Note: This table shows the coefficients of interest for equation:

$$Y_{l,i,b,s,t} = \beta_0 + \beta_1 Specialization_{b,s,t} + \beta_2 Specialization_{b,s,t} * Loannotsyndicated + \quad \beta_3 \mathbf{X}_{l,b} + \theta_t + \xi_b + \gamma_i + \sigma_s + \phi_{loanriskrating} + \omega_{loa}$$

It relates loan characteristics of loan l at time t made by bank b to firm i operating in industry/sector s. Y measures whether a loan ever becomes non-performing before maturity or renegotiation, whether a loan is ever downgraded before maturity, or the rating at origination. Loans with a lower rating are considered safer. Of interest is the interaction between whether a loan is syndicated and specialization. All loans are measured at origination only. X are loan characteristics such as amount, spread, maturity and whether the loan is secured with collateral. It further includes time-varying bank controls such as size or tier 1 capital. The variable of interest is bank specialization in the given industry, which is measured as the share of the bank's loan portfolio devoted to the industry. The regressions include bank, firm, industry, year*quarter, loan risk and loan purpose fixed effects. Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table A.6: ***Specialization vs Capture***

	(1) Specialization	(2) Specialization	(3) Industry Capture	(4) Industry Capture
Industry Capture	0.088***			
	[0.008]			
Laged Industry Capture	-0.009	0.059***		
	[0.010]	[0.008]		
Laged$_{[t-2]}$*IndustryCapture*	-0.003	0.004		
	[0.010]	[0.010]		
Laged$_{[t-3]}$*IndustryCapture*	0.006	0.009		
	[0.008]	[0.008]		
Specialization			0.454***	
			[0.043]	
Laged Specialization			-0.077	0.282***
			[0.054]	[0.043]
Laged$_{[t-2]}$*Specialization*			-0.039	-0.002
			[0.053]	[0.053]
Laged$_{[t-3]}$*Specialization*			-0.052	-0.016
			[0.041]	[0.041]
Fixed Effects	Industry and Time	Industry and Time	Industry and Time	Industry and Time
R^2	0.37	0.37	0.35	0.34
N	18,157	18,157	18,157	18,157

Note: This table shows the coefficients of interest for equation:

$$Y_{b,s,t} = \beta_0 + \beta_l Specialization_{b,s,t} + \theta_t + \sigma_s + \epsilon_{b,s,t}$$

It relates contemporaneous and lagged specialization to industry capture of bank b in industry/sector s at time t. It also relates contemporaneous and lagged industry capture on specialization. It includes industry and time fixed effects. Robust standard errors; *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table A.7: ***Specialization and Loan Characteristics - Specialization by Count***

	(1) Log loan amount	(2) Interest rate	(3) Maturity remaining	(4) Unsecured
Specialization	0.379*	-0.340**	2.939*	-0.387***
	[0.196]	[0.147]	[1.676]	[0.093]
Bank FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year*Quarter FE	Yes	Yes	Yes	Yes
Loan Purpose and Rating FE	Yes	Yes	Yes	Yes
Controls	Loan and bank	Loan and bank	Loan and bank	Loan and bank
Mean of dependent variable	8.7	2.4	17	0.26
R^2	0.75	0.87	0.71	0.77
N	32805	32805	31980	32805

Note: This table shows the coefficients of interest for equation:

$$Y_{l,i,b,s,t} = \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 \mathbf{X}_{l,b} + \theta_t + \xi_b + \gamma_i + \sigma_s + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t}$$

It relates loan characteristics of loan l at time t made by bank b to firm i operating in industry/sector s. Y measures a loan's size, the interest rate paid, the maturity remaining or whether the loan is secured with collateral. All loans are measured at origination only. X are loan characteristics such as amount, spread, maturity and whether the loan is secured with collateral, unless the characteristic is also the dependent variable in question. It further includes time-varying bank controls such as size or tier 1 capital. The variable of interest is bank "specialization" in the given industry, which is measured as the share of a bank's lending by the count of outstanding loans at any given time, regardless of loan size. The regressions include bank, firm, industry, year*quarter, loan risk and loan purpose fixed effects. Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table A.8: ***Specialization and Loan Characteristics - Specialization by Log Lending***

	(1) Log loan amount	(2) Interest rate	(3) Maturity remaining	(4) Unsecured
Specialization	0.518***	-0.367**	2.829*	-0.477***
	[0.199]	[0.149]	[1.697]	[0.096]
Bank FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year*Quarter FE	Yes	Yes	Yes	Yes
Loan Purpose and Rating FE	Yes	Yes	Yes	Yes
Controls	Loan and bank	Loan and bank	Loan and bank	Loan and bank
Mean of dependent variable	8.7	2.4	17	0.26
R^2	0.75	0.87	0.71	0.77
N	32805	32805	31980	32805

Note: This table shows the coefficients of interest for equation:

$$Y_{l,i,b,s,t} = \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 \mathbf{X}_{l,b} + \theta_t + \xi_b + \gamma_i + \sigma_s + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t}$$

It relates loan characteristics of loan l at time t made by bank b to firm i operating in industry/sector s. Y measures a loan's size, the interest rate paid, the maturity remaining or whether the loan is secured with collateral. All loans are measured at origination only. X are loan characteristics such as amount, spread, maturity and whether the loan is secured with collateral, unless the characteristic is also the dependent variable in question. It further includes time-varying bank controls such as size or tier 1 capital. The variable of interest is bank "specialization" in the given industry, which is measured as the share of a bank's lending in one industry as measured by the natural log of loan size. The regressions include bank, firm, industry, year*quarter, loan risk and loan purpose fixed effects. Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table A.9: ***Specialization and Loan Characteristics - including firm*time FE***

	(1) Log loan amount	(2) Interest Rate	(3) Maturity remaining	(4) Unsecured
Specialization	1.431***	-0.417***	-2.584*	-1.424***
	[0.236]	[0.146]	[1.456]	[0.129]
Bank FE	Yes	Yes	Yes	Yes
Firm*Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year*Quarter FE	Yes	Yes	Yes	Yes
Loan Purpose and Rating FE	Yes	Yes	Yes	Yes
Controls	Loan and bank	Loan and bank	Loan and bank	Loan and bank
Mean of dependent variable	8.8	2.3	17	0.3
R^2	0.81	0.93	0.81	0.86
N	21513	21513	20995	21513

Note: This table shows the coefficients of interest for equation:

$$Y_{l,i,b,s,t} = \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 \mathbf{X}_{l,b} + \theta_t + \xi_b + \gamma_i + \sigma_s + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t}$$

It relates loan characteristics of loan l at time t made by bank b to firm i operating in industry/sector s. Y measures a loan's size, the interest rate paid, the maturity remaining or whether the loan is secured with collateral. All loans are measured at origination only. X are loan characteristics such as amount, spread, maturity and whether the loan is secured with collateral, unless the characteristic is also the dependent variable in question. It further includes time-varying bank controls such as size or tier 1 capital. The variable of interest is bank "specialization" in the given industry, which is measured as the share of a bank's lending in one industry as measured by the natural log of loan size. The regressions include bank, firm*year*quarter, industry, loan risk and loan purpose fixed effects. Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table A.10: *Specialization and Loan Characteristics - All Loans*

	(1) Log loan amount	(2) Interest Rate	(3) Maturity remaining	(4) Unsecured
Specialization	0.674***	-0.017	4.986***	-0.421***
	[0.072]	[0.052]	[0.781]	[0.036]
Bank FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year*Quarter FE	Yes	Yes	Yes	Yes
Loan Purpose and Rating FE	Yes	Yes	Yes	Yes
Controls	Loan and bank	Loan and bank	Loan and bank	Loan and bank
Mean of dependent variable	8.3	2.5	16	.14
R^2	0.85	0.9	0.73	.8
N	997,984	997,984	928,023	997984

Note: This table shows the coefficients of interest for equation:

$$Y_{l,i,b,s,t} = \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 \mathbf{X}_{l,b} + \theta_t + \xi_b + \gamma_i + \sigma_s + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t}$$

It relates loan characteristics of loan l at time t made by bank b to firm i operating in industry/sector s. Y measures a loan's size, the interest rate paid, the maturity remaining or whether the loan is secured with collateral. All loans are at time t, the sample includes renegotiation. X are loan characteristics such as amount, spread, maturity and whether the loan is secured with collateral, unless the characteristic is also the dependent variable in question. It further includes time-varying bank controls such as size or tier 1 capital. The variable of interest is bank "specialization" in the given industry, which is measured as the share of a bank's lending in one industry as measured by the natural log of loan size. The regressions include bank, firm*year*quarter, industry, loan risk and loan purpose fixed effects. Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table A.11: *Specialization and Loan Characteristics - No Firm FE*

	(1) Log loan amount	(2) Interest rate	(3) Maturity remaining	(4) Unsecured
Specialization	1.863***	-0.946***	0.836	-0.099*
	[0.114]	[0.095]	[0.924]	[0.053]
Bank FE	Yes	Yes	Yes	Yes
Firm FE	No	No	No	No
Industry FE	Yes	Yes	Yes	Yes
Year*Quarter FE	Yes	Yes	Yes	Yes
Loan Purpose and Rating FE	Yes	Yes	Yes	Yes
Controls	Loan and bank	Loan and bank	Loan and bank	Loan and bank
Mean of dependent variable	8.5	2.6	19	.23
R^2	.23	.43	.23	.38
N	59025	59025	56707	59025

Note: This table shows the coefficients of interest for equation:

$$Y_{l,i,b,s,t} = \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 \mathbf{X}_{l,b} + \theta_t + \xi_b + \sigma_s + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t}$$

It relates loan characteristics of loan l at time t made by bank b to firm i operating in industry/sector s. Y measures a loan's size, the interest rate paid, the maturity remaining or whether the loan is secured with collateral. All loans are at time t, the sample includes renegotiation. X are loan characteristics such as amount, spread, maturity and whether the loan is secured with collateral, unless the characteristic is also the dependent variable in question. It further includes time-varying bank controls such as size or tier 1 capital. The variable of interest is bank "specialization" in the given industry, which is measured as the share of a bank's lending in one industry as measured by the natural log of loan size. The regressions include bank, industry, loan risk and loan purpose fixed effects. Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table A.12: *Specialization and Loan Performance - No Firm FE*

	(1) Loan ever becomes non-performing	(2) Loan ever suffers rating downgrade	(3) Loan rating
Specialization	-0.018	-0.074**	-1.165***
	[0.012]	[0.029]	[0.133]
Bank FE	Yes	Yes	Yes
Firm FE	No	No	No
Industry FE	Yes	Yes	Yes
Year*Quarter FE	Yes	Yes	Yes
Loan Purpose and Rating FE	Yes	Yes	Yes
Controls	Loan and bank	Loan and bank	Loan and bank
Mean of dependent variable	.033	.19	.19
R^2	.15	.097	.23
N	59025	59040	59025

Note: This table shows the coefficients of interest for equation:

$$Y_{l,i,b,s,t} = \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 \mathbf{X}_{l,b} + \theta_t + \xi_b + \sigma_s + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t}$$

It relates loan characteristics of loan l at time t made by bank b to firm i operating in industry/sector s. Y measures whether a loan ever becomes non-performing before maturity or renegotiation, whether a loan is ever downgraded before maturity, or the rating at origination. Loans with a lower rating are considered safer. All loans are measured at origination only. X are loan characteristics such as amount, spread, maturity and whether the loan is secured with collateral. It further includes time-varying bank controls such as size or tier 1 capital. The variable of interest is bank specialization in the given industry, which is measured as the share of the bank's loan portfolio devoted to the industry. The regressions include bank, firm, industry, year*quarter, loan risk and loan purpose fixed effects. Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.