Specialization in Banking*

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Abstract

Using supervisory data on the loan portfolios of large US banks, we document that these banks specialize by concentrating their lending disproportionately in a few industries. This specialization is consistent with banks having industry-specific knowledge, reflected in reduced risk of loan defaults, lower aggregate charge-offs, and higher propensity to lend to opaque firms in the preferred industry. Banks attract high-quality borrowers by offering generous loan terms in their specialized industry, especially to borrowers with alternative options. Banks focus on their preferred industry in times of instability and relatively lower tier 1 capital as well as after sudden surges in deposits.

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Keywords: Bank specialization, asymmetric information, loan performance, bank performance, firm-level credit supply

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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 have 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 document loan portfolio specialization across industries among large U.S. banks and explore the determinants of such specialization and its potential consequences for credit supply and bank stability.

First, 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. We show this pattern using several measures of specialization. Most simply, specialization can be thought of as the degree to which a bank is "over-invested" in an industry relative to a "diversified" lending portfolio based solely on the relative size of industries. Accordingly, specialized banks direct a greater proportion of their C&I lending to a particular industry – at the expense of other industries – than would be expected under pure diversification. In Figure 1, we plot the average over-investment (in percentage points) of the 40 banks in our sample. Over-investment is computed as the deviation between the share of a bank's portfolio that should be invested (if the bank were diversified) and the actual investment

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

in that industry. Additionally, we look separately at a bank's favorite, second-favorite, and all other industries. As can be seen, the average bank directs 8.2% more of its total C&I lending to its single "favorite" industry (measured here at the two-digit NAICS level) than would be expected if it were diversified. Banks only have one or two preferred industries, which remain stable over time.

[Figure 1 about here]

Second, we find that this type of specialization is consistent with banks having superior knowledge in their specialized industry, which facilitates better ex-ante screening and ex-post monitoring of loans. Specifically, loans made by banks specialized in a borrower's industry are less likely to become non-accruing or be downgraded prior to maturity/renegotiation. By leveraging a bank's internal loan ratings – that are unobservable to the market–, we can show that this performance is the result of both the superior screening of loan applicants as well as superior post-origination monitoring. Our results are more pronounced in non-syndicated loans. After all, a specialized bank is most incentivized to use its superior information in instances where free-rider concerns are mitigated. In a first extension to our main analysis, we show that despite an aggregate decrease in bank lending to SMEs in recent years, specialized banks are more willing to lend to smaller, more opaque firms in their industry of specialization.

Third, by looking at periods of tighter tier 1 capital within a bank or a sudden and quasi-unsolicited increase in deposits – such as occurred during the COVID-19 outbreak – we find that banks do not reshuffle their loan portfolio proportionally: they are less likely to decrease lending to their industry of specialization when funds are tight and more likely to increase lending to it after unplanned fund inflows. Moreover, using COMPUSTAT data, we can show that this preference has very real effects on firm growth

with borrowers of specialized lenders benefiting. This finding highlights that banks are not fungible, given their specialization, and deposit reshuffling within the system can have firm-level consequences.

Banks attract and keep good borrowers in an industry in which they are specialized by offering competitive terms. As such, we find that specialization correlates with larger loans, made at lower rates, and with a longer maturity. This holds especially for firms with access to alternative sources of funding, suggesting that specialization by large banks may in fact be a partly necessary answer to increased loan competition.

Finally, a natural question that arises in the context of specialization vs. diversification, is whether concentrated banks suffer worse performance and greater aggregate risk. On the one hand, a diversified portfolio reduces a bank's exposure to local shocks, maximizing risk-sharing and minimizing the risk of runs (See Diamond and Dybvig (1983) and Allen and Gale (1998)). On the other hand, however, diversification increases the correlation across banks' portfolios and the probability of systemic crises.[3] During the period of our sample, which covers 2011q3-2021q1, we find that more specialized banks (i.e. banks with a greater focus on their top industry) earn more stable, though slightly lower, returns and charge off fewer loans on aggregate.[4]

The analyses in this paper are based on the FR Y-14 Q-H archive, which tracks all C&I loans over 1 million USD 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

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

[4]Loans originated by banks specialized in an industry even perform better during the economic disruptions that followed due to the spread of COVID-19.As such, banks may find higher specialization or greater concentration desirable from a stability standpoint. Though this may initially seem paradoxical, it follows logically from our results suggesting loans in a bank's "favored" industries perform better since banks specialize in industries in which they have an informational advantage.

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 to ensure that the patterns we identify are not the result of omitted variables. We account, for example, for the degree to which a bank has captured an industry. If a bank captures a majority lender-stake in a sector in an attempt to extract monopoly rents, we may accidentally measure 'specialization' where none holds. While specialization is correlated with industry capture, our results on specialization hold despite of – and not because of – a bank's role in an industry. We also account for the individual relationships that may exist between a borrower and a bank, which we may otherwise mistake for industry-level specialization. Finally, we saturate our specifications with a variety of industry-time, bank-time, or even firm-time fixed effects. Bank-time fixed effects allow for a comparison of loans within the same bank, made to borrowers in industries in which the bank is differently specialized. Industry-time fixed effects, on the other hand, allow for a comparison of loans made in the same industry, but by differently specialized banks. Finally, if we include firm-time fixed effects, our effect of interest is identified within a borrower with multiple loans from differently specialized banks.[5]

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 our sample as part of the stress testing process and therefore highly comparable across loans. 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

[5]This is somewhat akin to a Khwaja and Mian (2008)-style control, ultimately holding constant any firm-time effects. Given the fact that not all firms are borrowing from multiple lenders in a given period – as this would only apply to very large firms with high credit demand – we do not take this as our primary specification.

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. This paper is therefore 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 a 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

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

in lending, by screening and monitoring loans (Diamond (1984)). Consider also Loutskina and Strahan (2011) who show that concentrated lenders focus on information-intensive loans. In this context, increasing returns to information acquisition push banks towards holding specialized loan portfolios. Understanding how specialization impacts 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 (1990a) 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 implications for the regulation front. We, therefore, explore both dimensions in this paper.

The remainder of this paper is organized as follows. Section 2 presents theoretical motivations *for* and develops the primary hypotheses tested *in* this paper. Section 3 describes the data used and explores the methodology employed. Section 4 showcases specialization in the banks of our sample. In section 5 we explore the performance of loans made by specialized banks. Section 6 describes loan terms offered to borrowers. Finally, Section 7 discusses aggregate results at the industry and bank levels. Section 8 concludes.

2 Hypotheses Development

There are many complementary theories that seek to justify why banks exist (see Battacharya and Thakor (1993) and Gorton and Winton (2003) for a review on the early literature on the role of banks). On the one hand, banks allow agents to smooth their consumption by providing insurance against idiosyncratic consumption shocks (Diamond and Dybvig (1983) and Allen and Gale (1998)) and reduce the investors' exposures to risk by investing in a diversified portfolio. For example, by monitoring the loans they make, banks reduce the idiosyncratic risk in their loan portfolio more efficiently than individual depositors would (Diamond (1984))[7].

On the other hand, in the presence of asymmetric information between borrowers and banks, banks also play a crucial role as information producers, either by signaling the quality of loans to investors (Leland and Pyle (1977)) or by producing new information about potential investments or improving their screening of borrowers (Campbell and Kracaw (1980), Boyd and Prescott (1986)).

While risk-sharing considerations push banks to hold well diversified loan portfolios, increasing returns to information may lead them to concentrate their lending in areas in which they hold more expertise. The more a bank knows about a particular type of loan, the better the quality and performance of the loans of that type in its portfolio. If information acquisition is costly or there are information processing constraints, the bank will specialize its learning and its loan portfolio will be under-diversified.[8]

Long-term interactions between banks and borrowers can also give a bank an informational advantage over its competition from observing a borrower's history (Sharpe

[7] See also the discussion presented in Blickle et al. (2022)

[8] This logic is analogous to the one presented in vanNieuwerburgh and Veldkamp (2010) for under-diversified portfolios.

(1990b), Rajan (1992), and Petersen and Rajan (1995)). In this case, if banks have market power, they may be willing to offer low rates to borrowers to capture the informational rents from continuing to lend to these good borrowers in the future. This mechanism would push banks towards concentrating their portfolio at the cost of lower aggregate earnings. Moreover, if banks have asymmetric information about borrower quality, the less informed banks will curb their participation to protect themselves against the "Winner's Curse" (He et al. (2023)). This, in turn, may allow the informed bank to increase its market share without decreasing its rates– thereby making the rents from acquired information higher. We would expect that a bank's trade-off between market share and earnings could be influenced by competition for good borrowers and the bank's expertise.

Finally, it is worth highlighting that our assumptions thus far are based on a bank having sufficient access to funds to lend to borrowers in industries of its choice. A bank limited to making a single loan to a single borrower is unlikely to accrue information (beyond some borrower-specific knowledge). This leads us to the following conjectures:

Hypothesis 1: If banks are unconstrained, banks with informational advantages will showcase specialized loan portfolios.

If facilitating risk-sharing among depositors was the only objective of banks, all banks should hold the same portfolio - the industry-size weighted loan portfolio. Deviations from this portfolio showcase bank specialization and, if banks are unconstrained, reflect banks' informational advantages. If banks are constrained, however, specialization may be a mechanical outcome arising from fixed costs to lending in a particular industry or from the attempt to eliminate much of the idiosyncratic risk in an industry. If this was the case, there should be no systematic difference in the performance of loans made by specialized and non-specialized banks.

Hypothesis 2: Bank specialization driven by informational advantages should be correlated with better loan performance in an industry in which a bank specializes. Constraint-driven specialization should not be associated with better loan performance.

3 Data

Our primary data for this paper 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 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 2021:Q1 we thus observe 40 banks that report several million loan observations. We keep observations for which we observe the amount, maturity, and interest rate. We naturally remove observations with interest rates or maturities that are likely the result of coding errors (i.e. negative or beyond reasonable coding ranges). In our fully cleaned sample, we thus focus on about 391,000 term loans, with a total of 2,300,000 loan-quarter observations.

Unlike other commercially available databases, which cover a subset of the market or specialize in syndicated lending[9], 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

[9]Please review Blickle et al. (2020) for a discussion of the shortcomings of Dealscan data.

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 rated by the bank and reported to Federal Reserve examiners, as well as whether a loan has become non-performing or is in arrears. 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 (this is discussed in greater detail below).

[Table 1 about here]

The average size of a loan in our sample is 5.5 million, which is right-skewed toward a few very large loans. Our data is reported in thousands of USD and logged. As can be seen in Table 1 the average size of our logged loans is 8.6. The average interest rate for loans in our sample period is 3.4%. Around 28% of loans make use of no form of collateral. 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 or is more than 89 days in payment arrears. Only 5% of term loans ever become non-performing during their time in the sample.

The degree to which an industry has been captured by a single bank is around 9% in our sample – meaning the average bank accounts for 9% of C&I lending to a certain two-digit industry, as defined within the Y14 sample. 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 to denote a "relationship" between the bank and borrower without impacting results.

In this paper we further make use of SNC (syndicated national credit registry data) for additional tests and robustness analyses. As discussed in Blickle and Santos (2022), the SNC program, run by the Federal Deposit Insurance Corporation, the Federal Reserve, and the Office of the Comptroller of the Currency, tracks all outstanding syndicated credits that exceed $20 million and are held by three or more federally supervised institutions.[10] For each loan, the program reports the identity of the borrower, the credit type, its purpose, origination amount, origination date, maturity date, and amount drawn-down on credit lines as well as the stakes held by syndicate participants.

4 Measuring and Documenting Specialization

4.1 Measuring Specialization

Bank specialization in an industry can be measured in a number of different ways. The simplest measure uses the share of a bank's C&I portfolio invested in a single industry or sector. We define industry according to 2-digit NAICS codes and sectors according to 4-digit NAICS codes.[11] We thereby assume that a bank's specialized knowledge is developed from committing significant funds to one sector. However, we need to control

[10] In January of 2018 this cutoff was raised from $20 to $100 million. This reduced the volume of loans supervised by the SNC program. For this reason, we limit our sample period to 2018 when we use the SNC data.

[11] There are 20 industries based on 2-digit NAICS codes.

for industry size since some industries are naturally larger than others. On average, more funds are lent to manufacturing businesses – for instance – than to warehousing businesses in any given year. Hence, a perfectly diversified bank would invest in accordance to the relative total amount an industry/sector borrows in a given period.

We define specialization in two ways going forward. Our baseline measure is similar to the one used in Paravisini et al. (2020). We calculate the relative degree to which a lender is over-invested in a particular 2- or 4- digit industry/sector. Specifically, we calculate the share of bank b's C&I portfolio invested in a single industry/ sector s, relative to the ideal share that would be invested by a diversified bank. The 'ideal share' is based on the total lending directed towards the industry/sector s in a given period, relative to all CI lending, across all sectors in the period – see equation 1. We call this "relative" specialization. For example, assume a bank directs 10% of its portfolio into an industry in 2012q3. If this industry accounts for 5% of total C&I lending in 2012q3, the bank would be over-invested in that industry by a factor of 2.

$$\frac{\frac{LoanAmount_{b,s,t}}{\sum_s LoanAmount_{b,s,t}}}{\frac{LoanAmount_{s,t}}{\sum_s LoanAmount_{s,t}}} \tag{1}$$

A potential shortcoming of this measure is that it can introduce large right-tails. After all, a bank that invests 10% of its portfolio into a small industry that accounts for only 1% of all C&I lending, would be over-invested by a factor of 10. If, on the other hand, the industry accounted for 3% of C&I lending, the bank would be over-invested by a factor of 3.3. With the "relative" specialization measure, extreme tails are especially common when using 4-digit industries at a quarterly frequency. At this granularity, lending can fluctuate. The question is whether the extreme right tail provides meaningful information

to econometricians.

To address this issue, we use an alternative measure that calculates over-investment as the deviation of a bank's portfolio from the ideal portfolio – as presented in equation 2.

$$\frac{LoanAmount_{b,s,t}}{\sum_s LoanAmount_{b,s,t}} - \frac{LoanAmount_{s,t}}{\sum_s LoanAmount_{s,t}} \tag{2}$$

We refer to this as "excess" specialization, since it simply reflects the degree to which a bank is over-invested, without scaling the measure by an industry's size. This measure can take on negative values and is not bounded at 0. Moreover, tails are less likely to distort estimation attempts. Using this measure, a 5% excess over-investment is treated in the same way, regardless of whether the ideal diversified portfolio weights the industry in question with a 1% or 20% investment share. Since this can be seen as both a benefit and weakness in the measure, we show that our results hold with both measures at the 2 and 4-digit industry/sector classification.

4.2 Documenting Specialization

We begin our analysis by documenting that even the large stress-tested banks specialize. Figure 1 (discussed briefly above) shows the average bank's "excess" specialization in its "top" 2-digit industry (i.e. the industry in which it is most specialized), its second most preferred industry, and all other industries. We remove financial services – as some banks are heavily specialized in lending to other banks or insurance firms. If a bank is not invested in an industry at all, the industry is not reflected in the bank's portfolio, which explains why the average "excess" share in all other industries is non-negative.

From Figure 1, it is readily evident that the share of the average bank's portfolio in its

most favored industry is substantially larger than would be expected from a diversification standpoint. The average bank invests 8% more of its portfolio in its most favored industry than a fully diversified bank. Moreover, banks have – on average – one or two preferred industries, in which they are over-invested to a significant degree. In all other industries, they are either not invested or invested in accordance with diversification expectations.

[Figure 2 about here]

In Figure 2 we show the distribution of the degree to which a bank is over-invested in certain industries at the two digit level. In panel (a) we showcase excess specialization for a bank's top industry. In panel (b) we use all other industries. As can be seen from these figures, there exists significant heterogeneity in the degree to which a bank is specialized in its favorite industry. We explore some of this variation when analyzing the determinants of specialization below. On the other hand, the distribution of specialization in non-favored industries is somewhat right-tailed but generally normal.

[Table 2 about here]

In table 2 we show summary statistics for our various specialization measures. We make use of 2-digit NAICS industries and 4-digit NAICS sectors. Moreover, we show measures of specialization as measured by "relative" specialization as well as by "excess" specialization. As above, we split our data into a bank's most favored industry and all other industries. A bank is over-invested in its favored industry by a factor of 3, implying it is investing three times more in an industry than expected. Whereas it is not over-invested in all other industries, suggesting a significant disparity in preference. At the sector level, this is even more pronounced, with the relative over-investment rising to a factor of 5.7 for a bank's most preferred sector. Given the fact that some banks do not

invest in some industries at all, and the fact that a bank can have a strong preference for several sectors in a favored industry, the relative over-investment in all other sectors is still relatively small. For this reason, we exploit continuous measures of specialization below.

From the summary statistics presented in table 1, we can see that specialization is associated with differences in loan terms and loan performance. It appears that loans in favored industries are larger, with lower rates, have a longer maturity[12] and – perhaps most importantly – are less likely to become non-performing. This would imply that specialized banks may have an advantage in selecting or monitoring loans in industries in which they have specialized. We investigate this in detail below while attempting to hold constant a variety of other confounding influences.

5 Methodology

5.1 Specialization and Loan Performance

A natural question to be tested to further understand the drivers of specialization 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. To assess this in our data, firstly, we regress loan performance on the industry specialization of the bank that granted it. Our specifications take the following form:

[12]Banks appear to interact with the firms in favored industries less often. While this finding is somewhat counter-intuitive, it is driven in part by the fact that specialized banks lend to SMEs or young firms more frequently, which do not appear in the data as often. We explore this phenomenon below as well.

$$NonPerformance_{l,i,b,s,T} = \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 \mathbf{X}_{l,b} + \beta_3 Relationship_{i,b} + \xi_{b,t} + \sigma_{s,t} + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t} \quad (3)$$

This specification relates the performance of a loan l to firm i that is operating in industry/sector s by bank b at any time over its maturity T to the specialization of bank b in industry/sector s at time t.

Non-performance occurs if a loan ever becomes 90 days past due or is otherwise in arrears. The dependent variable is forward-looking, taking the value of 1 if the loan becomes non-performing at any point in the future. Our variable of interest is the degree to which a bank is specialized (i.e. over-invested) in an industry at a given point in time. Our premise is that the greater the specialization, the more knowledge gained and the greater the possible performance gains. We use the "relative" and "excess" specialization measures discussed above, at both the 2-digit and 4-digit levels. We include loan terms – such as size, rate, maturity, and whether the loan is collateralized – and a number of loan and bank controls in each regression.

Specifically, we also include 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. We acknowledge that our data begins after many banks have established relationships with firms. As such, we also include future bank-firm interactions as a rough proxy for the overall propensity of the bank to lend to the firm in question. We further include bank size (total assets), loan

type, and loan purpose fixed effects. The sample includes all observations and allows for re-negotiations (though our results are not impacted by this choice, as we have shown in robustness exercises).

Beyond identifying any informational advantage a bank may have in the industry in which it specializes, we are interested in whether any performance differential is the result of a bank's ability to monitor a loan post-origination or whether it is the result of a superior ability to pick loans ex ante. To help disentangle these two possibilities, we use a bank's internal ratings of a loan at origination. In specifications that account for initial ratings, superior subsequent loan performance would be the result of bank monitoring.[13]. After all, the loan's ex-ante quality at origination should be reflected in a combination of interest rate and internal rating. While the former can be somewhat impacted by competitive pressures, the latter is known only to the bank and may therefore be an accurate internal assessment. If we exclude the rating, any subsequent loan performance would be the result of ex-ante loan selection and ex-post monitoring.

Finally, we use bank-time or industry-time fixed effects in separate regressions. Bank-time fixed effects allow us to show differences in loan performance observed within a bank, by comparing loans made to industries in which the bank is differently specialized. With industry-time fixed effects, we are able to show differences in loan performance observed within an industry, by comparing loans made by banks that are differently specialized. In an extension, we use firm-time fixed effects. There we compare loans made to the same firm by two differently specialized banks. However, since the sample of firms that borrow from multiple banks in a period is small and non-random, this is seen as indicative evidence only. Banks with a high degree of specialization have a

[13] Heitz et al. (2023) find evidence of banks monitoring loans in the construction sector

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 in the loan market over the past years (consider: Fernholz and Koch (2016) or Laeven et al. (2016)). Therefore, the specialization observed could be unrelated to a bank's knowledge about an industry and driven by a bank's rent-seeking behavior. Through decreased competition and higher market power, 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)). 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 an additional variable in the baseline regressions discussed above.

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. As a consequence, even large banks can specialize without necessarily capturing an industry.

Lastly, since bank specialization in certain industries can grow from a regional concentration, where certain industries may have originally clustered, we also control for

regional specialization. Regional specialization is measured as the unadjusted share of a bank's portfolio that is invested in any single state.[14]

5.2 Specialization and Bank Performance

If bank specialization is driven by informational advantages, We would expect banks with a high degree of specialization to have a safer more stable loan portfolio overall. After all, 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:

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

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 aggregate charge-off rate. 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.

[14]We determine the location of investment with the headquarters of the borrower so that this measure can be seen as a rough approximation.

5.3 Specialization and Loan Characteristics

We next seek to understand how specialized banks may attract borrowers they deem valuable. To do so, we relate a bank's specialization in an industry to the loan characteristics it offers in the industry in question. In our baseline regressions, which takes the same form as the regressions discussed above in equation 3.

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.[15] We readily acknowledge that all the loan characteristics are simultaneously determined. Therefore, we use those loan characteristics that are not employed as the dependent variables as additional independent regressors. That is to say, 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.

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 by firm-year fixed effects in specifications that employ them. However, while adding firm-year fixed effects accounts for 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

[15] 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, which borrowers would wish to be compensated for. 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.

may not be fully representative. As such, we are generally careful when interpreting our results.

We run additional specifications to further explore the relationships in our data. Specifically, we interact the variable of interest, specialization, with a measure that tracks whether a borrower had access to alternate sources of funding. This is most easily, if noisily, gauged by whether a firm has borrowed from another lender within the year and represents whether a specialized bank is facing competition for the borrower in question. Firms with alternate sources of funding may be able to extract some of the benefits of their lender's specialization. Similarly, we interact specialization with a bank's tier 1 capital. A bank with low Tier 1 capital may be most desperate to obtain the borrowers of their choice.

5.4 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 that are 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. Strahan (2017) specifically points out that lager banks –like those in our sample – prefer lending based on "hard" information. This may have contributed to the slowdown in lending to small firms.

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 to these opaque borrowers. 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 (<50 mil USD). Alternatively, we can use EBIT, which is also reported for a subset of firms that is not nested within the subset of firms that report assets. We define a firm as being small if it has less than 25 mil USD in EBIT.

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 characteristics 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.

6 Results

6.1 Specialization and Loan Performance

Table 3 shows that a loan is less likely to become non-performing– over the time it is observed in our sample – if made by a bank more specialized in the borrower's industry. Looking at column (1), we can see that a loan in a bank's most preferred industry would be 1.2% less likely to become non-performing than a loan in any other industry[16]. Given that the average non-performance rate of loans in our sample is 5%, this effect is both statistically and economically meaningful. If loan ratings are standardized on a scale of 1 to 10, then we would observe similar performance differences between loans in the best rating group (i.e. group 1) and loans 6 rating buckets lower (i.e. rating group 7). As discussed in the section above, the regressions are saturated with a number of fixed effects and controls so that we can isolate the relationship of interest.

If we account for bank-internal loan ratings (column (2)), we can see that the effect is somewhat diminished. To some extent then, specialized banks pick firms they consider to be safe. However, a significant proportion of the effect could still be attributable to the bank's ability to monitor the loan post origination. Of course, an alternative explanation is that banks do not report fully accurate risk ratings for loans in specialized industries.[17] If they overestimate risks because these are based not on soft information but on hard metrics, we cannot disentangle monitoring from loan selection. We can attempt to assuage

[16]This is computed by taking the delta of mean specialization in a preferred industry (3.12) and mean specialization in all other industries (1.1) multiplied by the coefficient of 0.006.

[17]Consider discussions in Behn et al. (2022).

these concerns somewhat. In Appendix A.1 we make use of firm-year fixed effects. While the relationship of interest can only be estimated among firms taking multiple loans from different banks within a short period, we still find that our coefficient of interest is negative and significant. Importantly, we find that the relationship between loan performance and bank specialization is identical whether we include firm ratings or not. A firm-year fixed effect would capture a firm's true risk in a given year, irrespective of the ratings assigned by different lenders. As such, this is indicative evidence that the effect of specialization is not only a consequence of knowledgeable banks picking safer firms, but rather also due to these banks' monitoring ability.

Columns (3) and (4) of table 3 uses industry*year-quarter fixed effects instead of bank*year-quarter fixed effects. As such, the regression compares loans made by differently specialized banks to firms in the same industry. As can be seen, the effects of specialization are similar in this regression setup as in columns (1) and (2), implying our results hold across banks.

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 which in turn may be associated with the ability of the lead bank to extract quasi-monopoly rents. It is worth noting that specialization and industry capture have opposite effects on loan performance. Banks that have captured significant market share in industries may have done so at the expense of loan performance (or at least at the expense of sufficient due diligence). As such, we can argue that specialization is distinct from the attempt by banks to extract monopoly rents by dominating an industry. We also account for the relationship (past and future)

between a bank and a borrower. In this way, we can ensure that the effect is not specific to the knowledge gained through specific bank-borrower interactions. While the coefficients on relationships take the expected sign, they do not affect our baseline coefficient of interest.

[Table 3 and Figure 3 about here]

From Figure 3 we can see that the effect observed is not necessarily driven by a few outlier values for specialization. Here, we show binned values of relative specialization at the 2-digit industry (across all the bank-time observations in our sample) and the associated average chance that the loans become non-performing. The relationship we observe is smooth and linear, decreasing in higher levels of specialization. There is no structural break indicating that, in general, more specialization leads to better performance at a relatively steady rate.

[Table 4 about here]

In Table 4 we show only the coefficient of interest for 16 variations of the main regression. We use relative as well as excess specialization (see equations 1 and 2 above) at the 2-digit industry and 4-digit sector levels. We include bank*year-quarter fixed effects in columns (1) and (2) and industry*year-quarter fixed effects in columns (3) and (4). Columns (1) and (3) do not include loan ratings at first observation, columns (2) and (4) do. The first row shows the same coefficients already discussed in Table 3 above. All other rows show the alternate definitions of specialization.

As can be seen, the effect in question is independent of the definition of specialization that we employ. Going from any industry to the most preferred industry in excess

specialization at the 2-digit level is associated with an 1.5% reduction in the likelihood that a loan becomes non-performing. This is highly similar to the 1.2% discussed above (column (1) row (2)). The effects are statistically and economically significant at the four-digit level as well. However, the impact of relative specialization is somewhat smaller at this more granular level. Very small sectors can distort the relative measure at the 4-digit level. We observe extreme values of specialization (in excess of ten-fold over-investment). It seems implausible that the relationship between loan performance specialization holds linearly in the extreme tails. This concern is attenuated somewhat with excess specialization, where we again observe similar effect magnitudes to those discussed above.

We can also observe that the effect of specialization on loan performance is always more pronounced if we exclude loan-rating controls at first observation. This lends additional credence to the idea that monitoring is an important component of loan performance. The difference between including bank-time vs industry-time fixed effects is, again, trivial.

A concern may arise with the inclusion of renegotiated loans in our data. Renegotiations can use information gleaned by the bank about the borrower (not just the industry) over the course of the loan. We can identify newly originated loans in Y14 data. These are a subset of all loans we observe. We exclude loans originating prior to their appearance in our sample (which could be the result of a bank buying a stake in the loan at a later date). Results relating loan performance to bank specialization for this sample can be found in the Appendix Table A.2, which depict coefficients of interest for the regression discussed above but focused only on newly originated loans. Our dependent variable of loan performance is still forward looking, taking a value of 1 if the loan ever becomes

non-performing at any point in the future. All the results discussed above hold if we focus on this much narrower sample of loans.

6.2 Specialization and Information Acquisition

In order to highlight that the results observed above are truly driven by information acquisition that results from bank specialization, we perform a series of additional tests. First, we compare loans that remain on a bank's balance sheet with loans that the bank has syndicated as well as with loans in which the specialized bank has bought shares as a participating lender. Secondly, we make use of SNC data to analyze the interplay between bank size and specialization. As we hypothesized above, banks specialized due to size constraints should not necessarily experience the same benefits from specialization as larger banks that specialized out of choice.

In table 5, we use 2-digit relative specialization (as above). However, we interact our variable of interest with two additional variables: (i) whether the loan was not a syndicated loan, meaning it remains fully on the issuing bank's balance sheet and (ii) whether the bank in question is the syndicating agent of the loan.

We would expect that loans retained on the specialized bank's balance sheet to fully reflect the extent of a specialized bank's knowledge. After all, if a loan is to remain on the balance sheet, the bank is most likely to invest in ex-ante screening and ex-post monitoring, given the exposure. Moreover, free-rider concerns (whereby other banks benefit from a specialized bank's knowledge) may be mitigated. In a similar vein, if a bank is syndicating a loan as the lead agent it has the greatest amount of control over loan terms. As such, we would expect some improved performance, relative to the terms for which we are able to account.

[Table 5 about here]

As can be seen in Table 5, the chance of a loan becoming non-performing is lower, for a given level of specialization, if the loan is retained on the balance sheet. Retained loans are more likely to be smaller and intended for more risky SMEs. The greater risk is captured by the fact that, on average, retained loans are more risky[18]. The interaction with specialization, however, is strongly negative and significant. The utility of monitoring appears particularly high among loans that remain on the balance sheet, suggesting that the ability to observe/guide risky borrowers is valuable. Similarly, the effect of specialization is more pronounced if the bank is the syndicating lead agent. As expected, however, the effect is generally smaller in these cases than for loans retained fully on the balance sheet.

Importantly, the baseline effect remains negative and significant. Even loans in which the specialized bank is merely a participant experience relatively good performance. This is a consequence of specialized banks choosing to invest in loans that are – relative to their characteristics – safe. The value of monitoring is somewhat lower among these loans. The role of a participating bank is much smaller when it comes to loan monitoring. However, the risk assessment by a specialized and a non-specialized bank can differ. Given that we control for the bank's own loan rating, this difference is captured in columns (2) and (4).

[Figure 4 and Table 6 about here]

To determine whether the specialization that we observe is a product of banks choosing to invest in certain industries or of banks being too constrained to invest in optimally diversified portfolios, we use SNC data. While this data set contains less loan-level

[18]This could in part be a consequence of the fact that banks are less likely to sell risky loans out of reputation concerns. See for instance Blickle et al. (2020).

information, we are able to observe a greater number of banks – especially small banks. Small banks are more likely to be constrained, such that any specialization we observe may be the result of an inability to diversify. This specialization should be associated with less – or even no – valuable industry information that would facilitate better loan performance.

In Figure 4 we first split banks in the SNC into four groups based on their assets: (i) banks larger than 100 billion USD, banks between 5 and 100 billion USD, (iii) banks smaller than 5 billion USD, and finally all other lenders for which size data is not available. This last group contains mostly funds and foreign lenders. We graph the degree to which banks are over-invested (relative to the ideal portfolio) in their most preferred, their second most preferred, and all other industries (see equation 2 on "excess" specialization). As can be seen, small banks appear to be highly concentrated.[19] In fact, while specialization can be observed in all groups, it is somewhat decreasing in size.

In Table 6 we therefore split our sample into size quintiles that roughly follow the thresholds from Figure 4, with banks above 100 billion USD in assets broken into roughly two groups. We use loans at the time of origination and include only the first three groups (leaving out the undefined group and the smallest) of banks by size. We account for as many loan characteristics as are observable to us, including loan size, purpose, and type. However, we are unable to account for loan risk or interest rate. We focus on loans in which the bank in question was an arranger so as to ensure the bank had some degree of control in the origination process. Results are largely unaffected if we make use of both participant and arranger data (not reported for brevity).

[19]It should be noted that these averages are not weighted. Given that some small banks and funds invest in only one or two industries, the values are skewed toward a right tail. We do not include data on industries in which a bank is not invested. Values in each Panel will therefore sum to more than 1.

Loans made by large and specialized banks are less likely to become non-performing in the future. However, loans by smaller banks that are also specialized do not seem to enjoy the same improved performance. Specialization is associated with improved performance only in larger banks. Smaller banks are not "specialized" by choice as much as they are constrained by their size. "Specialization" for these banks is simply the result of one or two loans directed to a certain industry. These institutions are unable to leverage this concentration.

6.3 Specialization and Loan Characteristics

The question that naturally arises, given the results discussed above, is how specialized banks attract and retain high-quality borrowers. We therefore relate loan terms to a bank's specialization. Specifically, we analyze whether specialized lenders grant larger loans, at favorable rates, with longer maturity, and with different collateral. We are not arguing for a causal link and acknowledge that loan terms are co-determined. We include loan terms that are not dependent variables as explanatory covariates. Results are depicted in Table 7. We use bank*time fixed effects in Panel A. In Panel B, we use industry*time fixed effects and depict only the coefficients of interest for brevity.

[Table 7 about here]

From Table 7, column (1), we can see that specialization is positively correlated with loan size. Moving from an average industry to a specialized bank's favorite industry would be associated with a loan-size increase of 12%, 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 0.10%-pts. Specialization is also associated with increased loan maturity. A specialized bank would grant 1.5 quarters longer maturity, all else equal. Finally, loans made by specialized banks are less likely to be unsecured. We find similar patterns hold across banks within an industry. Here, however, the effects are slightly diminished in magnitude, with interest rate differentials becoming insignificantly negative.

In the Appendix A.3 we explore the relationship between specialization and collateral further. We distinguish among different forms of collateral used for a given loan, exploiting the high degree of detail in our data. Specialization in an industry is associated with a higher likelihood that the loan is secured with, fixed assets, or "other assets". The latter is a group that is not further broken down but that does not fit into any of the other categories. Both are arguably assets that are more easily priced and, if the need arises, liquidated by banks with specialized knowledge.[20] Specialization is associated with a lower likelihood that the loan is secured by marketable securities, which include cash, or a blanket lien – both of which would require less specialized knowledge to liquidate.

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 available to firms.

In Table 8 we interact our variable of interest with a dummy denoting whether the borrowing firm has borrowed/is borrowing from another Y14 bank in the same year. Firms that borrow from multiple lenders are typically large, rated, and established with

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

known track records. As such, these results should be seen as indicative. As can be seen, more specialized banks offer more attractive loan terms to those firms that have access to more than one lender in a given period. As such, larger borrowers with the option to extract some of the rent banks obtain from specializing. In fact, given that firms may be averse to borrowing from a bank that might pass information to a competitor (consider Asker and Ljungqvist (2010)) specialized banks may have to offer better loan terms to firms with better outside borrowing options.

6.4 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. Appendix Figure A.1 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.

In Appendix Figure A.1, 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 analyze the likelihood of a specialized bank originating a (i) small loan of less than 3 mil. USD in columns (1) and (2) (ii) loan to a small borrower with less than 50 mil USD in assets in columns (3) and (4) and (iii) loan to a small borrower with less than 25 mil USD in EBIT in columns (5) and (6). We use alternative definitions to

make sure our results are not driven by the selection of our sample, since we only have firm size or profit data for a subset of firms in our data. Our controls include the standard loan characteristics discussed above, as well as, industry, year*quarter, and rating fixed effects. In columns (1), (3) and (5) we make use of bank fixed effects while in columns (2), (4), and (6) we make use of firm fixed effects. Firm fixed effects absorb any firm-specific and time-invariant characteristics. Given our focus on particular firms, the inclusion of firm fixed effects is arguably necessary in these specifications.

[Table 9 about here]

As can be seen, a more specialized bank is more likely to grant a small loan or lend to a small firm. The effect size is considerable; going from an average to a bank's specialized industry would lead to an almost 10%-pt increase in the likelihood of a small loan being granted (column (1)).

Importantly, the analyses include a measure of industry capture in all columns. 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, once again suggesting that capture (and associated rent extraction) and the leveraging of specialized knowledge run in opposite directions.

7 Aggregate Results

7.1 Loan vs Industry Performance

An important question, at the aggregate level, concerns the performance of loans originated/held by specialized banks relative to the average performance of loans in the industry at large. We wish to determine to what extent – if any – specialized banks are able to buck negative industry trends. It is possible, after all, that specialized banks make loans at fortuitous times. These specialized banks may be unable to avoid aggregate industry downturns any more than other banks.

[Table 10 about here]

In Table 10, column (1), one can see that the average performance of loans in a given industry is strongly correlated with the average rate of non-performing loans in that industry. This relationship holds if we include time fixed effects as well as loan characteristics, some of which (such as the rate) might account for loan risk.

From column (2) it is apparent that this relationship does not hold if we interact the average non-performing rate of loans in a given industry with a dummy denoting whether the loan in question was originated by a bank that considers the industry it's "favorite" – i.e. the industry in which it is most specialized. In column (3) we additionally include bank-time fixed effects to show that the effect is independent of any bank-specific characteristics during the given quarter. Naturally, we cannot include industry-time fixed effects, as these would subsume our coefficient of interest – i.e. the average industry-wide rate of non-performing loans. Finally, in column (4), we interact our variable of interest with our standard measure of industry-level "relative" specialization (used above). The results remain the same.

In each case, the specialization of the originating bank breaks the correlation between loan-specific performance and the industry's wider performance. Specialization is associated with better loan performance, even in times of aggregate industry downturns. Specialized banks make loans to safer borrowers, which they are able to identify and attract through attractive rates, and monitor these borrowers successfully over the period of the loan, especially during crises.

7.2 Drivers of Specialization

Given that loans originated by specialized banks perform better but charge a lower rate, questions arise as to (i) the drivers of bank specialization and (ii) the aggregate performance of more specialized banks. A fully specialized bank may see the lowest possible rate of non-performing loans. However, such a bank may also see a relatively lower net income. This trade-off may become more attractive to a bank during certain times.

We look first at the determinants of specialization. We relate the degree to which a bank is concentrated to a variety of lagged bank characteristics. Concentration, in this context, is computed as the bank's HHI – i.e. the squared share of a portfolio invested in each industry. The larger the HHI, the more concentrated the bank. A bank fully specialized in a single industry would exhibit the highest HHI. For convenience, we focus on the measure that is consistently statistically and economically meaningful: the tier 1 capital ratio.

[Table 11 about here]

Table 11 relates a bank's lagged (by one quarter) tier 1 capital ratio to its concentration.

We first include only time fixed effects in column (1). Banks with higher tier 1 ratios are associated with lower degrees of concentration. In column (2) we include bank-year fixed effects. This specification now measures the relationship between tier 1 capital and concentration within a given bank during a single year. In this regression, tier 1 capital ratios are detrended by a bank's average ratio so that the specification accounts for a bank's proclivity to operate with high or lower levels of tier 1 capital in general. Nevertheless, we find that higher levels of tier 1 capital for a given bank are associated with lower levels of concentration[21]. In column (3) we additionally include other measures that may be important. Neither a bank's charge-off ratio nor its net income appear to be significantly related to its concentration. Only assets are negatively and significantly correlated, implying that an increase in bank size is associated with a decrease in concentration.

Taken together, these results are suggestive evidence for two ideas: (i) banks diversify in times of relatively higher tier 1 capital and concentrate on their industry of choice in times when tier 1 capital is lower and (ii) banks diversify when experiencing a sudden influx in funds. A focus on stability, which may be associated with better loan performance and lower charge-off rates observed in a bank's most preferred industry, may be more valuable as tier 1 ratios fall. However, banks that experience a growth in assets within a given year may not be able to direct all of these into their industry of choice. Optimal loan selection may take time and there may not exist an inexhaustible supply of borrowers in a bank's preferred industry at any given point.

[Table 12 about here]

We further find that banks focus on their preferred industry following a shock to deposits. In Table 12 we show that a sudden rise in deposits – measured as a more than one

[21]This association holds if we use contemporaneous as well as lagged Tier 1, not reported for brevity.

standard deviation increase in deposits in a given quarter – is associated with an increase in relative specialization. This only holds, however, for a bank's preferred industry. There is no such response to a drop in deposits. Instead we see that a bank shields its preferred industry from negative deposit shocks. Similarly, log changes in deposits are associated with an increased concentration in a bank's preferred industry. Recognizing that a bank may attract deposits in times of lucrative investment opportunities in their preferred industry, we run the same analysis while focusing on the COVID period[22]. Our results remain unaffected by this limitation. This is an important finding, as the deposit growth during COVID was almost certainly unsolicited.

While we cannot argue that firm-bank relationships are exogenous, we can still analyze the degree to which deposit growth during COVID impacted a bank's borrowers. After all, if banks lend more to their preferred industry following a deposit shock, this should facilitate easier firm growth and possibly better firm performance for the thus affected firms. Using a large sample of hand-matched COMPUSTAT to Y14 data, we show that this is indeed true in the Appendix section B. These findings are important as they show that banks are not necessarily fungible given their specialization. An unsolicited reshuffling of deposits can have firm-level effects.

7.3 Specialized Bank Performance

The performance of specialized banks follows expected patterns. In Appendix Table A.4, we relate a bank's charge-off rate (i.e. the share of loans a bank is charging off, relative to its total CI lending) and a bank's net income ratio to the degree it is specialized in it's most preferred industry (columns (1) and (3)) as well as to its HHI (computed as above).

[22]See Kundu et al. (2022) for a review of deposit shock literature.

An increase in its specialization or HHI is both associated with greater stability. Loan charge-offs fall.[23] However, a bank's net income also falls in response to higher levels of specialization.

Overall, a bank may be willing to trade some returns for stability when facing a decrease in its capital ratio. In fact, a more specialized bank is more likely to offer generous loan terms if its tier 1 ratio is low. In Appendix Table A.5 we can see that especially loan rates, and loan maturity respond to Tier 1 ratio. This is likely the cost of concentrating on a favorite industry during times when a bank views stability as critical.

8 Conclusion

In this paper, we show that even large stress-tested banks specialize in certain industries. We find that this type of specialization correlates with improved loan performance and beneficial loan terms for the borrowers even when controlling for borrower fixed effects and loan risk at origination. This evidence suggests that specialized banks can discern borrower quality due to superior industry-specific knowledge in their specialized industry.

The type of loan portfolio specialization we document has important implications for bank stability and credit supply. At the bank level, we show that specialization leads to more stable bank performance. At the industry level, we find that industries with more specialized banks also experience fewer loan down-grades and write-offs on average, while loans by specialized banks are more likely to buck industry-wide increases in the share of non-performing loans. Moreover, during surges in deposits, borrowers of

[23]The standard deviation of net income also falls in response to greater levels of specialization/concentration. Not reported for brevity.

specialized lenders receive more funding than borrowers from other lenders, allowing them to grow more rapidly and profitably.

Our results speak to the role of banks as designated intermediaries. We highlight that banks – even large banks – are not necessarily perfectly fungible in lending. During periods in which deposits are reshuffled in the banking system – such as during the COVID outbreak or possibly following the failure of SVB – borrowers of specialized banks may be differently affected than their competitors. This is a key insight for future research into banking as well as for policymakers.

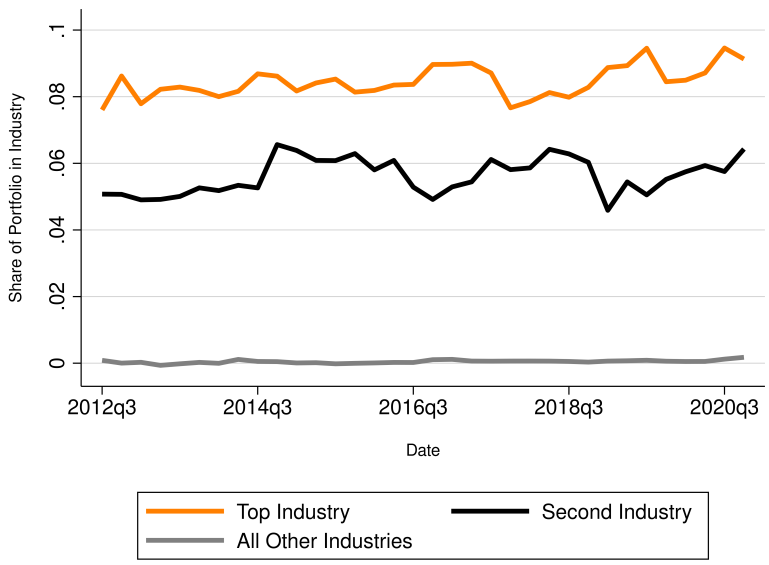
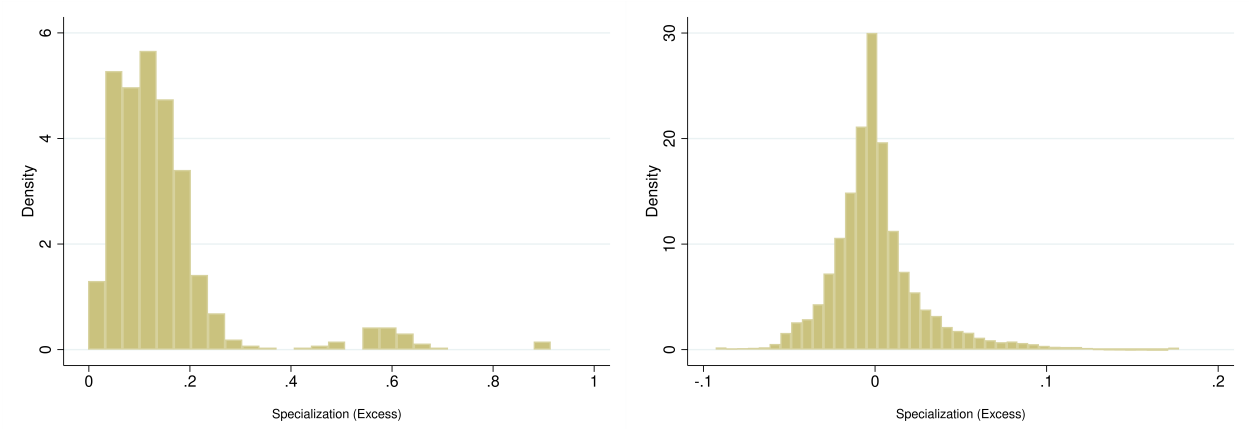


Figure 1: ***"Excess" Specialization*** *This figure shows the degree to which banks in our data are "over-invested" in their "favourite", second favourite, and all other industries. A perfectly diversified bank is one that is invested in accordance with industry size, with larger industries (relative to all C&I lending) receiving proportionately more loans. Excess specialization is* $\frac{LoanAmount_{b,s,t}}{\sum_s LoanAmount_{b,s,t}} - \frac{LoanAmount_{s,t}}{\sum_s LoanAmount_{s,t}}$ *(see equation 2 for details). We have split bank lending into three groups based on the degree to which said banks are over-invested. We make use of a bank's favourite (top) industry, its second favourite industry and all other industries. Figure ignores industries in which a bank has no investments and therefore excludes a theoretical left tail.*



(a) *Favourite Industry.* **(b)** *All Other Industries.*

Figure 2: *This figure plots the distribution of "excess" specialization for the banks in our data. Excess specialization is measured as the degree to which a bank is over-invested in an industry. A perfectly diversified bank is one that is invested in accordance with industry size, so that excess is* $\frac{LoanAmount_{b,s,t}}{\sum_s LoanAmount_{b,s,t}} - \frac{LoanAmount_{s,t}}{\sum_s LoanAmount_{s,t}}$ *(see equation 2 for details). We split our sample into a bank's favoured industry (panel (a) and all other industries (panel (b)).*

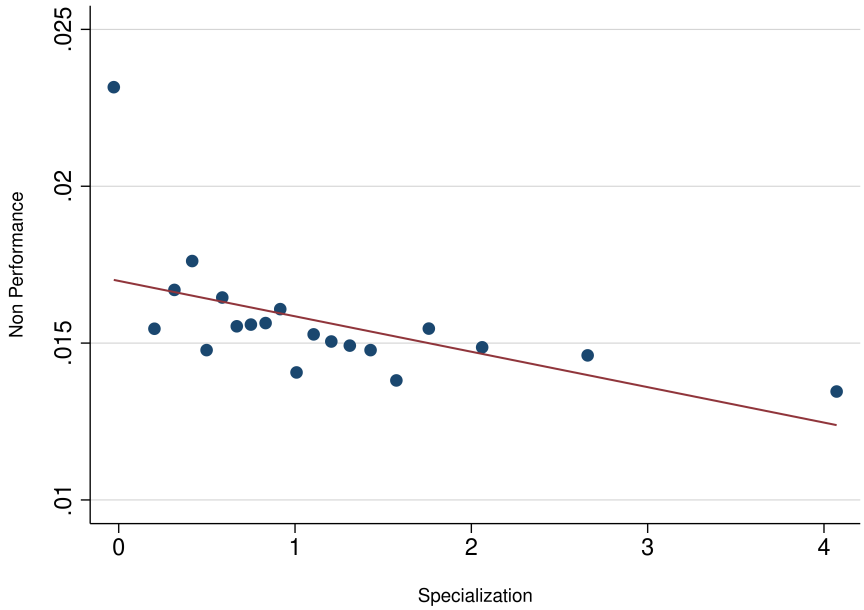


Figure 3: ***Performance and Specialization*** *This figure plots the binned relationship between relative specialization (i.e.* $\frac{LoanAmount_{b,s,t}}{\sum_s LoanAmount_{b,s,t}} / \frac{LoanAmount_{s,t}}{\sum_s LoanAmount_{s,t}}$ *as defined in equation 1) of banks in our sample and loan performance. A non-performing loan is either flagged as non-accruing by the reporting bank or is more than 89 days in payment arrears. We account for industry-year fixed effects in the relationship.*

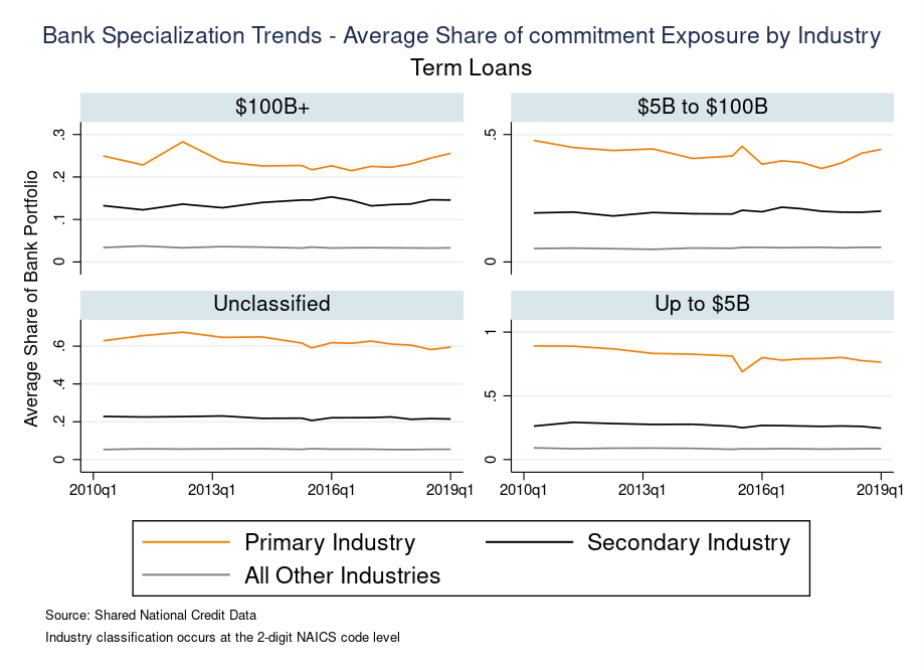


Figure 4: ***Bank Size and Specialization*** *This figure makes use of SNC (syndicated national credit registry) data. It details the relationship between a bank's "excess" specialization in its favourite, second favourite and all other industries and a bank's size. Excess specialization is measured as the degree to which a bank is over-invested in an industry. A perfectly diversified bank is one that is invested in accordance with industry size, so that excess is* $\frac{LoanAmount_{b,s,t}}{\sum_s LoanAmount_{b,s,t}} - \frac{LoanAmount_{s,t}}{\sum_s LoanAmount_{s,t}}$ *(see equation 2 for details). We split our sample based on total bank assets. "Unclassified" are either foreign banks or funds of varying sizes. Figure ignores industries in which a bank has no investments and therefore excludes a theoretical left tail.*

Table 1: *Summary Statistics of Key Variables*

	N	Mean	SD	Top-Industry	Other-Industry	Diff
Log Amount	391,680	8.60	1.39	8.61	8.52	0.09***
Interest Rate	391,680	3.39	1.50	3.29	3.40	-0.11***
Maturity Remaining	391,680	18.51	16.95	19.84	18.40	1.4***
Unsecured	391,680	0.28	0.45	0.33	0.27	0.06***
Loan Becomes Non-Performing	391,680	0.049	0.21	0.032	0.052	-0.02***
Industry Capture	391,680	0.09	0.098	0.086	0.073	0.013***
Bank-Firm Interactions	391,680	8.83	28.8	5.93	9.06	-3.12**

Note: This table shows summary statistics for loans in our sample. We count each bank-loan combination only once, on the date when it is first observed in our data (this may be a different date from the loan's first origination date). Log size is based on the natural logarithm of the committed exposure, scaled by 1000 USD. The interest rate is the un-adjusted cost of the loan, measured in percent. Maturity is measured in quarters remaining. Unsecured is a dummy that takes the value of 1 if the loan is not secured with any type of collateral. "Non performing" is also a dummy that takes the value of 1 if the loan falls in arrears or is otherwise in default. Industry capture measures the degree to which a given bank accounts for all lending to the two-digit industry of the borrower – it is measured as a share of all lending to that industry in the Y14 data. Finally bank-firm interactions are a count of the number of times a given borrower and lender ever interacted in the Y14 data. The mean-values of each variable data are split by whether a loan is made in a lender's favourite industry or not.

Table 2: *Summary Statistics of Specialization*

		Top Industry				**All Other Industries**			
	Specialization Type	Mean	SD	25-pct	75-pct	Mean	SD	25-pct	75-pct
Two Digit	"Relative" Specialization	3.13	1.27	1.91	4.75	1.10	0.91	0.47	1.41
	"Excess" Specialization	0.09	0.05	0.07	0.17	0.00	0.03	-0.01	0.01
Four Digit	"Relative" Specialization	5.71	1.54	5.48	6.58	3.72	2.22	5.48	6.58
	"Excess" Specialization	0.06	0.02	0.06	0.07	-0.00	0.01	-0.01	0.01

Note: This table shows summary statistics for various specialization measures at the 2-digit industry and 4-digit sector level. Specialization is defined as the degree to which a bank is over-invested in an industry, relative to a perfectly diversified portfolio. A diversified portfolio is one based solely on the size of an industry relative to all C&I lending. We show both "relative" (i.e. $\frac{LoanAmount_{b,s,t}}{\sum_s LoanAmount_{b,s,t}} / \frac{LoanAmount_{s,t}}{\sum_s LoanAmount_{s,t}}$) as well as "excess" (i.e. $\frac{LoanAmount_{b,s,t}}{\sum_s LoanAmount_{b,s,t}} - \frac{LoanAmount_{s,t}}{\sum_s LoanAmount_{s,t}}$) specialization. We split data by whether an industry/sector is a bank's most preferred "top" industry (as measured by the respective specialization measure) or not.

Table 3: ***Specialization and Performance***

	(1)	(2)	(3)	(4)
	Loan ever becomes non-performing			
"Relative" Specialization (2 digit)	-0.006***	-0.003***	-0.006***	-0.004***
	[0.001]	[0.000]	[0.001]	[0.000]
Unsecured	-0.007***	0.005***	-0.006***	-0.005***
	[0.002]	[0.001]	[0.001]	[0.002]
Interest rate	0.017***	0.006***	0.016***	0.006***
	[0.000]	[0.000]	[0.000]	[0.000]
Industry capture	0.074***	0.066***	0.034***	0.043***
	[0.008]	[0.006]	[0.007]	[0.006]
Number of past interactions (relationship)	-0.001	-0.000***	-0.000	0.000***
	[0.001]	[0.000]	[0.000]	[0.000]
Future Interactions	-0.001***	-0.001***	-0.000***	-0.001***
	[0.000]	[0.000]	[0.000]	[0.000]
Specialization in a State	-0.020*	-0.003	-0.011	-0.002
	[0.01]	[0.01]	[0.032]	[0.009]
Log loan amount	0.002***	-0.001***	0.001***	-0.001**
	[0.000]	[0.000]	[0.000]	[0.000]
Key Fixed Effects:	Bank*Year-Quarter		Industry*Year-Quarter	
Rating FE:	No	Yes	No	Yes
Bank and Loan Controls	Yes	Yes	Yes	Yes
Mean of dependent variable	0.049	0.049	0.049	0.049
R^2	0.2	0.22	0.21	0.28
N	2,324,663	2,324,663	2,324,663	2,324,663

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

$$Y_{l,i,b,s,T} = \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 \mathbf{X}_{l,b} + \beta_3 Relationship_{i,b} + \xi_{b,t} + \sigma_{s,t} + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t}$$

It regresses whether loan l to firm i in quarter t by bank b in sector/industry s ever becomes non-performing in future periods on the lending bank b's specialization in industry s. Y is "Non performing", a dummy that takes the value of 1 if the loan falls in arrears or is otherwise in default. Specialization is defined as the degree to which a bank is over-invested in an industry, relative to a perfectly diversified portfolio. A diversified portfolio is one based solely on the size of an industry relative to all C&I lending. We make use of "relative" (i.e. $\frac{LoanAmount_{b,s,t}}{\sum_s LoanAmount_{b,s,t}} / \frac{LoanAmount_{s,t}}{\sum_s LoanAmount_{s,t}}$) specialization at the two-digit industry level. Columns (1) and (2) make use of bank*time fixed effects while columns (3) and (4) make use of industry*time fixed effects. Columns (1) and (3) do not include bank-internal risk scores at loan origination, columns (2) and (4) do. Other controls/fixed effects include loan purpose and type as well as bank size. Relationship measures include past and future bank-borrower interactions as well as the specialization of bank b in borrower i's state. Our sample includes only term loans and allows for re-negotiations. Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table 4: ***Loan Performance – All Possible Specialization Measures***

	(1)	(2)	(3)	(4)
	Loan ever becomes non-performing			
"Relative" 2-Digit Industry	-0.006***	-0.003***	-0.006***	-0.004***
	[0.001]	[0.000]	[0.000]	[0.000]
"Excess" 2-Digit Industry	-0.185***	-0.090***	-0.141***	-0.091***
	[0.010]	[0.009]	[0.010]	[0.010]
"Relative" 4-Digit Industry	-0.001***	-0.001***	-0.001***	-0.001
	[0.000]	[0.000]	[0.000]	[0.001]
"Excess" 4-Digit Industry	-0.240***	-0.045***	-0.168***	-0.027
	[0.017]	[0.016]	[0.024]	[0.025]
Key FE:	**Bank*Year-Quarter**		**Industry*Year-Quarter**	
Loan Rating at First Obs.	**No**	**Yes**	**No**	**Yes**
Other Loan and Bank Controls:	Yes	Yes	Yes	Yes
Loan Purpose and Type FE:	Yes	Yes	Yes	Yes
N	2,324,663	2,324,663	2,324,663	2,324,663

Note: Each coefficient in this table is the result of a stand-alone regression. We vary our measure of specialization for equation:

$$Y_{l,i,b,s,T} = \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 \mathbf{X}_{l,b} + \beta_3 Relationship_{i,b} + \xi_{b,t} + \sigma_{s,t} + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t}$$

It regresses whether loan l to firm i in quarter t by bank b in sector/industry s ever becomes non-performing in future periods on the lending bank b's specialization in industry s. "Non performing" is a dummy that takes the value of 1 if the loan falls in arrears or is otherwise in default. Specialization is defined as the degree to which a bank is over-invested in an industry, relative to a perfectly diversified portfolio. A diversified portfolio is one based solely on the size of an industry relative to all C&I lending. We make use of both "relative" (i.e. $\frac{LoanAmount_{b,s,t}}{\sum_s LoanAmount_{b,s,t}} / \frac{LoanAmount_{s,t}}{\sum_s LoanAmount_{s,t}}$) as well as "excess" (i.e. $\frac{LoanAmount_{b,s,t}}{\sum_s LoanAmount_{b,s,t}} - \frac{LoanAmount_{s,t}}{\sum_s LoanAmount_{s,t}}$) specialization at the 2-digit and 4-digit level. Columns (1) and (2) make use of bank*time fixed effects while columns (3) and (4) make use of industry*time fixed effects. Columns (1) and (3) do not include bank-internal risk weightings at loan origination, columns (2) and (4) do. Other fixed effects include loan purpose and type as well as bank size. Relationship measures include past and future bank-borrower interactions as well as the specialization of bank b in borrower i's state. Regressions further include industry capture, loan size, whether a loan is secured by collateral, and the interest rate. Our sample includes only term loans and allows for re-negotiations. Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table 5: ***Specialization, Syndication, and Loan Performance***

	(1)	(2)	(3)	(4)
	Loan ever becomes non-performing			
"Relative" Specialization (2 digit)	-0.005***	-0.001*	-0.003***	-0.000
	[0.001]	[0.001]	[0.001]	[0.001]
Interaction: Specialization * Synd. Agent	-0.004***	-0.002*	-0.002	-0.001
	[0.001]	[0.001]	[0.002]	[0.001]
Syndication Agent	0.024***	0.004	0.017***	0.002
	[0.003]	[0.003]	[0.003]	[0.003]
Interaction: Loan on BS * Specialization	-0.001	-0.002**	-0.002**	-0.004***
	[0.001]	[0.001]	[0.001]	[0.001]
Loan on Balance Sheet	0.008***	0.014***	0.006**	0.014***
	[0.002]	[0.002]	[0.002]	[0.002]
Key Fixed Effects	**Bank*Year-Quarter**		**Industry*Year-Quarter**	
Rating Fixed Effects	**No**	**Yes**	**No**	**Yes**
Other Loan and Bank Controls:	Yes	Yes	Yes	Yes
Loan Purpose and Type FE:	Yes	Yes	Yes	Yes
Mean of dependent variable	0.049	0.049	0.049	0.049
R^2	0.015	0.23	0.0092	0.22
N	2,324,663	2,324,663	2,324,663	2,324,663

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

$$Y_{l,i,b,s,T} = \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 Specialization * Syndictaion_{b,s,t} + \beta_3 \mathbf{X}_{l,b} + \beta_4 Relationship_{i,b} + \xi_{b,t} + \sigma_{s,t} + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t}$$

It regresses whether loan l to firm i in quarter t by bank b in sector/industry s ever becomes non-performing in future periods on the lending bank b's specialization in industry s. "Non performing" is a dummy that takes the value of 1 if the loan falls in arrears or is otherwise in default. Specialization is defined as the degree to which a bank is over-invested in an industry, relative to a perfectly diversified portfolio. A diversified portfolio is one based solely on the size of an industry relative to all C&I lending. We make use of "relative" (i.e. $\frac{LoanAmount_{b,s,t}}{\sum_s LoanAmount_{b,s,t}} / \frac{LoanAmount_{s,t}}{\sum_s LoanAmount_{s,t}}$) specialization at the two-digit industry level. We are further interested in interactions with the variable of interest which include whether the bank in question is the syndicating agent or whether the loan remains on the bank's balance sheet in its entirety. Columns (1) and (2) make use of bank*time fixed effects while columns (3) and (4) make use of industry*time fixed effects. Columns (1) and (3) do not include bank-internal risk weightings at loan origination, columns (2) and (4) do. Other fixed effects include loan purpose and type as well as bank size. Relationship measures include past and future bank-borrower interactions as well as the specialization of bank b in borrower i's state. Regressions further include industry capture, loan size, whether a loan is secured by collateral, and the interest rate. Our sample includes only term loans and allows for re-negotiations. 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 Bank Size***

	(1)	(2)	(3)
	Loan ever non-performing		
	Largest Quintile	Second Quintile	Third Quintile
Specialization of the Agent	-0.028***	-0.006	-0.032
	[0.008]	[0.031]	[0.031]
Bank-Time Fixed Effects	Yes	Yes	Yes
Loan and Bank Controls	Yes	Yes	Yes
R^2	0.06	0.06	0.06
N	69,061	69,181	69,167

Note: This table is based on SNC (syndicated national credit registry) data. We split our sample into 5 groups, based on the size of the syndicating bank, and display the coefficient of interest of the top three size-quintiles for regression:

$$Y_{l,i,b,s,t} = \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 \mathbf{X}_{l,b} + \xi_{b,t} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t}$$

Our coefficient of interest is bank b's specialization in industry /sector s (in the SNC data) at time t. We make use of "relative" (i.e. $\frac{LoanAmount_{b,s,t}}{\sum_s LoanAmount_{b,s,t}} / \frac{LoanAmount_{s,t}}{\sum_s LoanAmount_{s,t}}$) specialization at the two-digit industry level. Regressions include bank*time as well as loan size and the number of syndicate participants as controls. 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 Loan Characteristics*

	(1) Log loan amount	(2) Interest rate	(3) Maturity remaining	(4) Unsecured
		(Panel A)		
"Relative" Specialization (2 digit)	0.061***	-0.050***	0.765***	-0.010***
	[0.005]	[0.006]	[0.072]	[0.001]
Unsecured	0.562***	-0.114***	-3.614***	
	[0.023]	[0.029]	[0.173]	
Interest rate	-0.144***		0.579***	-0.007***
	[0.003]		[0.042]	[0.002]
Industry capture	0.059	-0.101	-5.162***	0.137***
	[0.045]	[0.129]	[1.069]	[0.019]
Number of past interactions (relationship)	-0.001***	-0.000*	-0.009***	0.000***
	[0.000]	[0.000]	[0.001]	[0.000]
Future Interactions	0.001***	-0.002***	-0.014***	0.002***
	[0.000]	[0.000]	[0.003]	[0.000]
Specialization in a State	-0.582***	-0.103**	4.832***	-0.052***
	[0.039]	[0.046]	[0.324]	[0.009]
Log loan amount		-0.228***	0.148***	0.051***
		[0.006]	[0.051]	[0.002]
Key Fixed Effects:		Bank*Year-Quarter		
		(Panel B)		
"Relative" Specialization (2 digit)	0.087***	-0.003	0.114***	-0.005***
	[0.004]	[0.007]	[0.042]	[0.002]
Key Fixed Effects:		Industry*Year-Quarter		
Bank and Loan Controls	Yes	Yes	Yes	Yes
Mean of dependent variable	8.6	3.5	18	.14
R^2	0.2	0.22	0.13	0.28
N	2,324,663	2,324,663	2,089,171	2,324,663

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

$$Y_{l,i,b,s,T} = \beta_0 + \beta_1 Specialization_{b,s,t} + \beta_2 \mathbf{X}_{l,b} + \beta_3 Relationship_{i,b} + \xi_{b,t} + \sigma_{s,t} + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t}$$

Here, Y stands for various measures of loan characteristics, such as the size, interest rate, maturity, and whether the loan is secured by collateral. The equation relates characteristics of loan l to firm i in quarter t originated by bank b in sector/industry s to bank b's specialization in industry s. Specialization is defined as the degree to which a bank is over-invested in an industry, relative to a perfectly diversified portfolio. A diversified portfolio is one based solely on the size of an industry relative to all C&I lending. We make use of "relative" (i.e. $\frac{LoanAmount_{b,s,t}}{\sum_s LoanAmount_{b,s,t}} / \frac{LoanAmount_{s,t}}{\sum_s LoanAmount_{s,t}}$) specialization at the two-digit industry level. All columns include bank-internal risk scores at loan origination. Other fixed effects include loan purpose and type as well as bank size and the degree to which said bank has captured an industry. Relationship measures include past and future bank-borrower interactions as well as the specialization of bank b in borrower i's state. Panel A showcases the variable of interest as well as several controls, while making use of bank-time fixed effects. Panel B shows only the variable of interest and makes use of industry-time fixed effects. Our sample includes only term loans and allows for re-negotiations. Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table 8: ***Specialization and Loan Characteristics in times of Competition***

	(1) Log loan amount	(2) Interest rate	(3) Maturity remaining	(4) Unsecured
"Relative" Specialization (2 digit)	0.038***	-0.011**	0.617***	-0.005***
	[0.005]	[0.006]	[0.072]	[0.001]
Interaction: Specialization * "Other Lenders"	0.041***	-0.055***	0.654***	-0.025***
	[0.009]	[0.008]	[0.071]	[0.003]
Borrower interacts with other lenders	0.648***	-0.205***	-1.393***	0.056***
	[0.023]	[0.019]	[0.118]	[0.008]
Key Fixed Effects:		Bank*Year-Quarter		
Bank and Loan Controls	Yes	Yes	Yes	Yes
Mean of dependent variable	8.6	3.5	18	0.14
R^2	0.24	0.22	0.13	0.28
N	2,324,663	2,324,663	2,089,171	2,324,663

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

$$Y_{l,i,b,s,T} = \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 Specializationb, s, t * OtherBorrowing_i + \beta_3 \mathbf{X}_{l,b} + \beta_4 Relationship_{i,b} + \xi_{b,t} + \sigma_{s,t} + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t}$$

Here, Y stands for various measures of loan characteristics, such as the size, interest rate, maturity, and whether the loan is secured by collateral. The equation relates characteristics of loan l to firm i in quarter t by bank b in sector/industry s to bank b's specialization in industry s. Specialization is defined as the degree to which a bank is over-invested in an industry, relative to a perfectly diversified portfolio. A diversified portfolio is one based solely on the size of an industry relative to all C&I lending. We make use of "relative" (i.e. $\frac{LoanAmount_{b,s,t}}{\sum_s LoanAmount_{b,s,t}} / \frac{LoanAmount_{s,t}}{\sum_s LoanAmount_{s,t}}$) specialization at the two-digit industry level. We are further interested in interactions of the variable of interest with whether the borrower in question has borrowed from other lenders within the year. We make use of bank*time as primary fixed effects and include bank-internal risk weightings at loan origination. Other fixed effects include loan purpose and type as well as bank size. Relationship measures include past and future bank-borrower interactions as well as the specialization of bank b in borrower i's state. Regressions further include industry capture, loan size, whether a loan is secured by collateral, and the interest rate. Our sample includes only term loans and allows for re-negotiations. Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

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

	(1)	(2)	(3)	(4)	(5)	(6)
	Small Loan		Small Firm (assets)		Small Firm (EBIT)	
Specialization	0.051***	0.025*	0.005	0.118***	-0.013	0.102***
	[0.009]	[0.015]	[0.009]	[0.010]	[0.011]	[0.013]
Total Assets	-0.000***	0.000***	0.000***	-0.000***	0.000***	-0.000*
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Interest rate	-0.000	-0.002**	0.017***	-0.005***	0.010***	-0.001
	[0.000]	[0.001]	[0.000]	[0.001]	[0.001]	[0.001]
Industry Capture	0.001	-0.002	0.003	-0.038***	-0.016**	-0.096***
	[0.006]	[0.008]	[0.006]	[0.005]	[0.007]	[0.007]
Log loan amount	-0.161***	-0.151***	-0.060***	-0.015***	-0.076***	-0.016***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Relationship (ever)	0.000	-0.000	-0.000***	0.000***	-0.001***	0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Fixed Effects	Bank	Firm	Bank	Firm	Bank	Firm
Purpose, Time, Industry, Rating FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.3	0.73	0.19	0.86	0.24	0.84
N	272,825	272,825	272,825	272,825	272,825	272,825

Note: This table relates a bank's specialization in an industry to the propensity that it will make small loans or loans to SMEs. In columns (1) and (2) small loans are defined as loans worth less than 3 mil USD. In columns (3) and (4) an SME/small firm is defined as one with assets of less than 50 mil USD. In columns (5) and (6) an SME/small firm is defined as having an EBIT of less than 25 mil USD. Each dependent variable takes the value of 1 if the loan fulfills the requirement of the definition and 0 if not. Columns (1), (3), and (5) make use of bank fixed effects and columns (2), (4) and (6) make use of firm fixed effects. Each regression includes, loam purpose, type, and a bank's internal rating at first observation fixed effects. Further controls include bank size, loan interest rate, a bank's industry capture, loan size, and the number of times the borrower and lender have ever interacted in the data (past and forward looking). Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table 10: *Aggregate Results: Loan Performance*

	(1)	(2)	(3)	(4)
	Non-Performing Loans			
Avg. non-perf loans in industry	1.382***	1.381***	1.370***	1.327***
	[0.005]	[0.005]	[0.005]	[0.007]
Interaction:				
Avg. non-perf loans in industry * favourite industry		-0.696***	-0.676***	
		[0.143]	[0.138]	
Favourite industry		-0.008**	-0.009***	
		[0.003]	[0.003]	
Interaction:				
Avg. non-perf loans in industry * Specialization				-0.164***
				[0.003]
Specialization				-0.001***
				[0.000]
Fixed Effects:	Quarter-Year		Bank*Quarter-Year	
R^2	0.61	0.63	0.75	0.7
N	2,324,663	2,324,663	2,324,663	2,324,663

Note: This table relates the average performance of loans in an industry to the performance of an individual loan. Loan performance is measured as a binary variable "non-performing", which takes the value of 1 if the loan falls into arrears or is otherwise in default. Columns (2) and (3) include an interaction with whether the loan was issued by in the lender's most preferred ("favourite") 2-digit industry. Column (4) includes an interaction with the lender's degree of specialization in the industry. Other controls include loan rate and size. Standard errors are heteroskedasticity robust and *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table 11: *Aggregate Results: Bank Specialization*

	(1)	(2)	(3)
	Aggregate Bank HHI		
T1-Ratio$_{t-1}$	-2.859*	-7.349***	-6.694**
	[1.927]	[2.609]	[2.610]
Charge-off Ratio			2.001
			[1.323]
Net-Income Ratio			-1.512
			[1.127]
Bank Assets			-10.389***
			[3.859]
Key Fixed Effects	Year-Quarter	Bank * Year	
R^2	0.019	0.67	0.68
N	1,148	1,148	1,148

Note: This table relates a bank's lagged (by one quarter) Tier 1 capital ratio to a bank's aggregate HHI. Our sample is a collapsed bank-time panel based on Y14 and Y9C data. Bank HHI is calculated as the summed squared-shares of the percentages of its portfolio a given bank has invested in each industry. Higher HHIs imply higher degrees of concentration and therefore specialization. We include time (column (1)) and bank*time (columns (2) and (3)) fixed effects and controls including "carge-offs", net-income ratios, as well as a bank's risk weighted assets in column (3). Standard errors are clustered at the bank level while *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table 12: *Specialized Lending after Deposit Shock*

	(1)	(2)	(3)	(4)
	Relative Specialization		Change Relative Specialization	
Deposit Drop	-0.016		-0.003	
	[0.023]		[0.007]	
Deposit Increase	-0.017		-0.005	
	[0.021]		[0.008]	
Favourite Industry$_{t-1}$	1.925***	0.169***	0.052***	0.004***
	[0.037]	[0.001]	[0.012]	[0.000]
Dep. Drop * Fav. Ind.$_{t-1}$	0.128		-0.014	
	[0.125]		[0.041]	
Dep. Inc * Fav. Ind$_{t-1}$	0.232**		0.077**	
	[0.100		[0.002]	
Change Dep.		-0.004		0.001
		[0.005]		[0.434]
Change Dep. * Fav. Ind$_{t-1}$		0.156***		0.030***
		[0.024]		[0.009]
Industry, Bank, and Time FE	Yes	Yes	Yes	Yes
R^2	0.31	0.92	0.44	0.97
N	22,714	22,714	22,714	22,714

Note: This table makes use of bank-industry-time data. It relates shock's to bank deposit (or changes in bank deposit) to specialization in a given industry. Shock's to deposit (columns (1) and (3)) are measured as drops or jumps in deposits that exceed a one standard deviation deposit change for a given bank. We separate out positive and negative shocks. We interact deposit shocks (or changes in deposits) with whether an industry is a bank's most preferred. Standard errors are clustered at the bank level while *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

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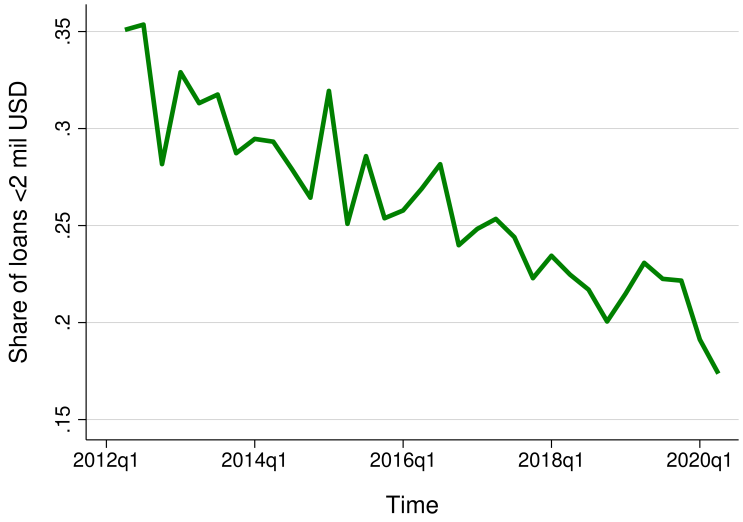
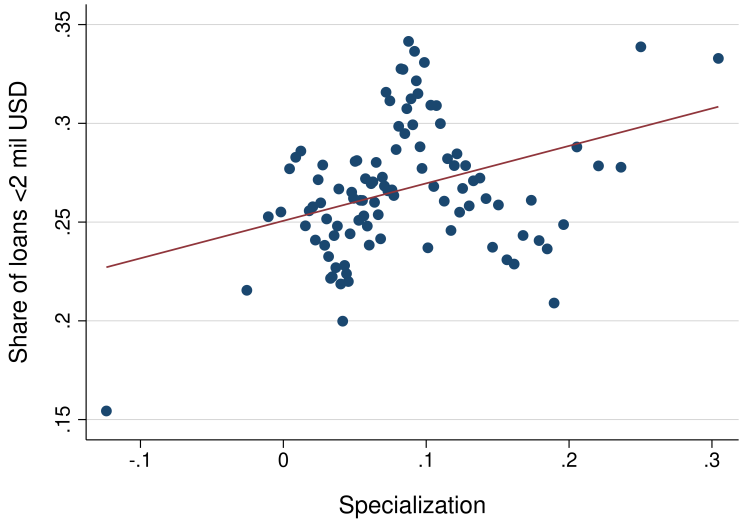
Internet Appendix for "Specialization in Banking"

A Supplementary Tables and Figures



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



(b) *Correlation between Specialization and SME Lending*

Figure A.1: ***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 3 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 A.1: *Specialization and Performance – Firm Fixed Effects*

	(1)	(2)	(3)	(4)
	Loan ever becomes non-performing			
Specialization (2 digit)	-0.002**	-0.002***	-0.049***	-0.048***
	[0.001]	[0.000]	[0.009]	[0.009]
Unsecured	-0.003*	-0.003**	-0.003**	-0.003**
	[0.001]	[0.001]	[0.001]	[0.001]
Interest rate	0.007***	0.007***	0.007***	0.007***
	[0.001]	[0.001]	[0.001]	[0.000]
Industry capture	0.002	0.002	0.001	0.001
	[0.003]	[0.003]	[0.003]	[0.003]
Number of past interactions (relationship)	-0.001	-0.000***	-0.000***	-0.000***
	[0.001]	[0.000]	[0.000]	[0.000]
Future Interactions	-0.000***	-0.001***	-0.001***	-0.001***
	[0.000]	[0.000]	[0.000]	[0.000]
Specialization in a State	-0.001*	-0.001*	-0.001*	-0.001*
	[0.001]	[0.001]	[0.001]	[0.001]
Log loan amount	0.002***	-0.001***	0.000	0.000
	[0.000]	[0.000]	[0.000]	[0.000]
Key Fixed Effects:	Firm ID * Year			
Specialization Measure:	Relative		Excess	
Rating FE:	No	Yes	No	Yes
Bank and Loan Controls	Yes	Yes	Yes	Yes
Mean of dependent variable	0.049	0.049	0.049	0.049
R^2	.72	.79	.72	.79
N	2,324,663	2,324,663	2,324,663	2,324,663

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

$$Y_{l,i,b,s,T} = \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 Specialization * Syndictaion_{b,s,t} + \beta_3 \mathbf{X}_{l,b} + \beta_4 Relationship_{i,b} + \xi_{b,t} + \sigma_{s,t} + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t}$$

It regresses whether loan l to firm i in quarter t by bank b in sector/industry s ever becomes non-performing in future periods on the lending bank b's specialization in industry s. "Non performing" is a dummy that takes the value of 1 if the loan falls in arrears or is otherwise in default. Specialization is defined as the degree to which a bank is over-invested in an industry, relative to a perfectly diversified portfolio. A diversified portfolio is one based solely on the size of an industry relative to all C&I lending. We make use of "relative" (i.e. $\frac{LoanAmount_{b,s,t}}{\sum_s LoanAmount_{b,s,t}} / \frac{LoanAmount_{s,t}}{\sum_s LoanAmount_{s,t}}$) (in columns (1) and (2)) as well as "excess" (i.e. $\frac{LoanAmount_{b,s,t}}{\sum_s LoanAmount_{b,s,t}} - \frac{LoanAmount_{s,t}}{\sum_s LoanAmount_{s,t}}$) in columns (3) and (4))specialization at the two-digit industry level. All columns make use of firm*year fixed effects. Other fixed effects include loan purpose and type as well as bank size. Relationship measures include past and future bank-borrower interactions as well as the specialization of bank b in borrower i's state. Regressions further include industry capture, loan size, whether a loan is secured by collateral, and the interest rate. Our sample includes only term loans and allows for re-negotiations. Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table A.2: ***Specialization and Performance – New Origination Only***

	(1)	(2)	(3)	(4)
	Loan ever becomes non-performing			
Specialization (2 digit)	-0.003***	-0.002***	-0.003***	-0.003***
	[0.001]	[0.000]	[0.001]	[0.001]
Key Fixed Effects:	Bank*Year-Quarter		Industry*Year-Quarter	
Rating FE:	No	Yes	No	Yes
Bank and Loan Controls	Yes	Yes	Yes	Yes
Mean of dependent variable	0.049	0.049	0.049	0.049
R^2	.72	.79	.72	.79
N	2,324,663	2,324,663	2,324,663	2,324,663

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

$$Y_{l,i,b,s,T} = \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 \mathbf{X}_{l,b} + \beta_3 Relationship_{i,b} + \xi_{b,t} + \sigma_{s,t} + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t}$$

It regresses whether loan l to firm i in quarter t by bank b in sector/industry s ever becomes non-performing in future periods on the lending bank b's specialization in industry s. "Non performing" is a dummy that takes the value of 1 if the loan falls in arrears or is otherwise in default. Specialization is defined as the degree to which a bank is over-invested in an industry, relative to a perfectly diversified portfolio. A diversified portfolio is one based solely on the size of an industry relative to all C&I lending. We make use of "relative" (i.e. $\frac{LoanAmount_{b,s,t}}{\sum_s LoanAmount_{b,s,t}} / \frac{LoanAmount_{s,t}}{\sum_s LoanAmount_{s,t}}$) specialization at the two-digit industry level. Columns (1) and (2) make use of bank*time fixed effects while columns (3) and (4) make use of industry*time fixed effects. Columns (1) and (3) do not include bank-internal risk weightings at loan origination, columns (2) and (4) do. Other fixed effects include loan purpose and type as well as bank size. Relationship measures include past and future bank-borrower interactions as well as the specialization of bank b in borrower i's state. Our sample includes only term loans. We further limit our sample to only those loans we can identify as being newly originated in the quarter in question. We exclude all subsequent observations of the same loan including any re-negotiations. Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table A.3: ***Specialization and Collateral***

	(1) Secured by fixed assets	(2) Secured by real estate	(3) Secured by marketable securities	(4) Secured by AR	(5) Secured by other	(6) Unsecured
Specialization	0.005*	-0.019***	-0.001	0.001	0.042***	-0.010***
	[0.002]	[0.003]	[0.001]	[0.001]	[0.004]	[0.001]
Bank*Year-Quarter	Yes	Yes	Yes	Yes	Yes	Yes
Bank and Loan Controls	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.38	0.59	0.12	0.28	0.17	0.28
N	2,314,144	2,314,144	2,314,144	2,314,144	2,314,144	2,314,144

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

$$Y_{l,i,b,s,T} = \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 \mathbf{X}_{l,b} + \beta_3 Relationship_{i,b} + \xi_{b,t} + \sigma_{s,t} + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t}$$

It regresses the collateral type used by loan l to firm i in quarter t by bank b in sector/industry s ever becomes non-performing in future periods on the lending bank b's specialization in industry s. Collateral type is a dummy that takes the value of 1 if the examiner identifies the type of collateral used as falling under one of the listed categories. Specialization is defined as the degree to which a bank is over-invested in an industry, relative to a perfectly diversified portfolio. A diversified portfolio is one based solely on the size of an industry relative to all C&I lending. We make use of "relative" (i.e. $\frac{LoanAmount_{b,s,t}}{\sum_s LoanAmount_{b,s,t}} / \frac{LoanAmount_{s,t}}{\sum_s LoanAmount_{s,t}}$) specialization at the two-digit industry level. Columns (1) and (2) make use of bank*time fixed effects while columns (3) and (4) make use of industry*time fixed effects. Columns (1) and (3) do not include bank-internal risk weightings at loan origination, columns (2) and (4) do. Other fixed effects include loan purpose and type as well as bank size. Relationship measures include past and future bank-borrower interactions as well as the specialization of bank b in borrower i's state. Our sample includes only term loans. We further limit our sample to only those loans we can identify as being newly originated in the quarter in question. We exclude all subsequent observations of the same loan including any re-negotiations. Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table A.4: *Aggregate Results: Bank Performance*

	(1)	(2)	(3)	(4)
	Charge Off Ratio		Net Income Ratio	
Specialization (scaled)	-0.699***		-0.602***	
	[0.001]		[0.030]	
Bank HHI		-0.377***		-0.410***
		[0.000]		[0.000]
Fixed Effects		Year*Quarter		
R^2	0.4	0.29	0.46	0.38
N	932	932	932	932

Note: This table relates the aggregate charge-offs (columns (1) and (2)) and the net income (columns (3) and (4)) of a bank to the degree it has specialized. In columns (1) and (3) specialization is measured as the percentage share it has invested in its most favored industry. In columns (2) and (4) specialization is measured as the summed squared-shares of the percentages of its portfolio a given bank has invested in each industry. Controls include a bank's size and risk weighted assets. We make use of time (quarter*year) fixed effects throughout. Standard errors are heteroskedasticity robust and *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table A.5: ***Specialization, Loan Characteristics and Tier1***

	(1) Log loan amount	(2) Interest rate	(3) Maturity remaining	(4) Unsecured
Specialization* Tier1-Capital	-0.018	0.006**	-0.073***	0.005***
	[0.026]	[0.003]	[0.026]	[0.001]
"Relative" Specialization (2 digit)	0.007***	-0.135***	1.346***	-0.063***
	[0.002]	[0.033]	[0.337]	[0.007]
Key Fixed Effects:		Bank*Year-Quarter		
Bank and Loan Controls	Yes	Yes	Yes	Yes
Mean of dependent variable	8.6	3.5	18	0.14
R^2	0.24	0.22	0.13	0.28
N	2,324,663	2,324,663	2,089,171	2,324,663

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

$$Y_{l,i,b,s,T} = \beta_0 + \beta_l Specialization_{b,s,t} + \beta_2 Specializationb, s, t * Tier1_{b,t} + \beta_3 \mathbf{X}_{l,b} + \beta_4 Relationship_{i,b} + \xi_{b,t} + \sigma_{s,t} + \phi_{loanriskrating} + \omega_{loanpurpose} + \epsilon_{l,i,b,s,t}$$

Here, Y stands for various measures of loan characteristics, such as the size, interest rate, maturity, and whether the loan is secured by collateral. The equation relates characteristics of loan l to firm i in quarter t by bank b in sector/industry s to bank b's specialization in industry s. Specialization is defined as the degree to which a bank is over-invested in an industry, relative to a perfectly diversified portfolio. A diversified portfolio is one based solely on the size of an industry relative to all C&I lending. We make use of "relative" (i.e. $\frac{LoanAmount_{b,s,t}}{\sum_s LoanAmount_{b,s,t}} / \frac{LoanAmount_{s,t}}{\sum_s LoanAmount_{s,t}}$) specialization at the two-digit industry level. We are further interested in interactions of tier 1 capital of the bank in question with the specialization variable of interest. We make use of bank*time as primary fixed effects and include bank-internal risk weightings at loan origination. Other fixed effects include loan purpose and type as well as bank size. Relationship measures include past and future bank-borrower interactions as well as the specialization of bank b in borrower i's state. Regressions further include industry capture, loan size, whether a loan is secured by collateral, and the interest rate. Our sample includes only term loans and allows for re-negotiations. Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

B Real Effects: Firm Growth during COVID

As shown in the paper above, the COVID pandemic saw many large banks experience a sharp increase in deposits. These banks purchased securities and lent to firms – primarily in their preferred sector of specialization. This growth in firm-level funding was largely exogenous to banks and certainly exogenous to the firms that borrowed from these banks. The excess availability of credit for some firms may well have affected the ability of these firms to grow. To test this proposition, we therefore merge COMPUSTAT with Y14 data using a complicated hand-matching procedure based on the names of firms, or the ticker symbols where these are available. Our combined sample accounts for 60,000 individually verified firm-year observations between 2012 and 2022. We relate the growth in firms during the COVID 19 pandemic (fiscal years 2019, 2020, 2021 and 2022) to the degree of specialization of the firm's primary lender over this same time period[1]. We limit our sample to those firms that have borrowed from a Y14 lender within a five year period (2018 to 2022) at least once.

Mechanically, we are interested in determining the degree to which lender specialization affects year-on-year firm growth of its borrowers during a period of exogenous growth in deposits. Our primary variable of interest is the degree to which a firm's lender is specialized in its industry. For many firms, this measure is simply the degree to which its sole lender is specialized. For firms that borrow from multiple lenders during the period, we rank lenders by their specialization in the borrower's industry and use the most specialized lender. We count the number of lenders a firm engages with in a given period and control for this number separately. However, it should be noted that the intuition of our results, found in table A.6 does not change if we make use of the average specialization of all lenders.

As can be seen, the more specialized a firm's lender is – measured with our relative specialization measure –, the more likely it is that the firm grows its liabilities during COVID. A highly specialized lender would facilitate a 5% greater growth in borrowing, all else equal. This ability to borrow more than competitors during a key period facilitates a similarly sized growth in EBITDA. In columns (4) - (6) we account for lagged growth in EBITDA, to avoid accidentally capturing the fact that firms growing profitably borrow from specialized lenders.

Overall, our results are significant and sizeable, given that firms in our sample see an annualized liabilities growth-rate of 7% and an EBITDA growth-rate of 4% during the period in question. Our results are unaffected by whether we use our adjusted measure of specialization (not shown for brevity). Finally, given that we are much more likely to be able to merge large firms to Y14, due to the nature of COMPUSTAT data and the likelihood that larger borrower information is better recorded in Y14, our results are liable to be a lower-bound estimate. After all, small firms with less access to outside funding will be more reliant on their banking relationship, especially in times of turmoil. We show this by highlighting (in columns (3) and (6)) that smaller firms that lie bellow our median asset-value experience a more pronounced growth due to lender specialization.

Naturally, given that better firms may have stronger relationships with more specialized lenders, these results should be viewed with caution. However, these findings still speak to the real effects of an exogenous reshuffling of deposits in the banking sector. Not all banks are fungible, given that they specialize in different industries. This specialization has very real consequences for the firms that borrow from them. Given the recent flight of deposits from smaller to larger banks after the failure of SVB, this finding is important.

[1] We include 2019 in the sample as we measure year-on year growth rates

Table A.6: ***Firm Growth during COVID***

	(1)	(2)	(3)	(4)	(5)	(6)
	Change in Liabilities			Change in EBITDA		
Most Specialized Lender	0.013***	0.008**	0.016***	0.011**	0.020***	0.035***
	[0.003]	[0.003]	[0.006]	[0.005]	[0.006]	[0.010]
Assets_{t-1}	-0.000	-0.000	-0.000***	-0.000***	-0.000***	-0.000**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Count other lenders_{t-1}	-0.013***	-0.010***	-0.008***	0.004	-0.001	-0.005
	[0.001]	[0.001]	[0.003]	[0.003]	[0.003]	[0.005]
Liabilities to EBITDA_{t-1}	-0.001***	-0.001***	-0.002***	0.020***	0.019***	0.021***
	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]	[0.001]
Leverage_{t-1}	-0.116***	-0.127***	-0.114***	-0.167***	-0.155***	-0.134***
	[0.008]	[0.008]	[0.010]	[0.022]	[0.023]	[0.033]
Industry and Time FE	No	Yes	Yes	No	Yes	Yes
R^2	.036	.067	.096	.13	.19	.19
N	8844	8844	4506	7164	7164	3397

Note: This table relates a firm's year-on-year growth (in total liabilities or EBITDA) to the specialization of its *most specialized* lender (using our relative measure). We include a number of firm-specific characteristics such as lagged assets, lagged leverage (debt/assets), lagged, profitability (debt/EBITDA). We account for industry (2 digit) and year fixed effects in columns (2), (3), (5) and (6). Columns (3) and (6) are focused on smaller firms. Columns (4)-(6) include lagged changes in EBITDA. Standard errors are clustered at the firm-year level while *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.