Banks' Specialization and Private Information[*]

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Abstract

We document the geographical and sectoral specialization of banks' lending activities using comprehensive data on the universe of loans to corporate borrowers in Spain. Our analysis highlights how specific sources of specialization are more relevant for evaluating different types of borrowers. Specifically, loans to micro and small firms exhibit reduced probabilities of non-performance in geographical markets where banks specialize, whereas loans to medium and large firms experience lower non-performance in sectors in which banks specialize. Crucially, we provide the first evidence of a direct link between bank specialization and enhanced banks' private information by leveraging confidential data on banks' private risk assessments reported to regulators. We corroborate our findings by analyzing the relevance of relationship lending, a well-established proxy for firm-specific private information.

Keywords: Bank Lending; Bank Specialization; Financial Stability; Loan Performance; Private Information
JEL Codes: D82; E58; G21; G32; L10

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1   Introduction

A long-standing view in financial economics is that banks, by obtaining information, play a crucial role in screening and monitoring borrowers (Leland and Pyle, 1977; Diamond, 1984). Beyond non-transferable firm-specific information, lending to firms with shared characteristics can enable banks to learn and acquire information useful for evaluating similar firms. By disproportionately lending along certain dimensions, such as geographical markets and sectors, banks can specialize their lending activities (Loutskina and Strahan, 2011; Paravisini et al., 2023). This specialization can help banks develop local market- or sector-specific expertise and skills, enhancing their ability to perform more accurate corporate risk assessments. Given that firms differ in the relevance of various sources of information to assess their future performance, we argue that different types of specialization might be more relevant for different types of firms. In this paper, we provide evidence on the differential relevance of banks' local and sector specialization for the loan performance of firms of different sizes, with a particular emphasis on local specialization as a less explored dimension of bank specialization. Importantly, we also provide the first direct link between specialization and enhanced banks' private information.

Our initial findings underscore the relevance of various types of bank specialization for the loan performance of different types of firms. Specifically, we observe that loans granted to micro and small firms by banks specializing in their local markets exhibit better performance, an effect not observed for medium and large firms. Conversely, loans granted to medium and large firms by banks specializing in their sector present better performance, an effect not observed in micro and small firms. These results are in line with the varying nature of information needed to evaluate different types of firms. We then link this differential loan performance to banks' information by providing direct evidence on the role of specialization and banks' private information. By leveraging private regulatory information on banks' reported firms' probability of default (PD), we find that for a given micro or small firm, the predictive ability of locally specialized banks surpasses that of non-locally specialized banks. In contrast, for a given medium or large firm, sector-specialized banks exhibit greater predictive ability compared to non-sectoral specialized banks.

To perform our analyses, we use confidential data on the universe of Commercial and Industrial (C&I) loans granted in Spain by nearly 100 banks to over 700,000 active firms from the Spanish Credit Register (CIR). This dataset allows us to observe the comprehensive set of loans granted to firms of all sizes in a bank-dependent economy, including micro and small firms, which constitute 91% of total firms in Spain and are the backbone of several European economies. We begin by documenting how banks specialize across municipalities,

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with approximately 30% to 40% of their lending concentrated in their top municipality and around 10% to 15% in their second municipality.[1] Similarly, banks specialize in specific sectors, with approximately 30% to 40% of their lending concentrated in their top sector and around 20% in their second sector.[2] While sector specialization has been well-documented in prior research using U.S. data on loans larger than 1 million dollars (Blickle et al., 2023), potentially biased towards large firms, we provide novel insights to the literature on bank specialization by documenting the relevance of local specialization as well as by exploring how the relationship between both dimensions of specialization and loan performance depends on firm size.

We first present evidence on the relationship between the two dimensions of specialization, geographical markets and sectors, and loan performance. We find that new loans granted to micro and small firms, which face greater financing constraints (Gertler and Gilchrist, 1994; Chodorow-Reich, 2014), are associated with lower probabilities of ex-post non-performance in municipalities where banks specialize geographically. Conversely, new loans to medium and large firms exhibit lower probabilities of ex-post non-performance in sectors where banks specialize, consistent with the findings of Blickle et al. (2023). Specifically, our results estimate that a loan granted by a bank to a micro or small firm in its top municipality is 0.83 percentage points (p.p.) less likely to be non-performing ex-post compared to other loans, while a loan to a medium or large firm in its top sector is 0.64 p.p. less likely to be non-performing.[3] These estimates suggest that the nature of private information obtained through specialization in geographical markets and sectors may differ, enhancing banks' abilities to screen and monitor different types of borrowers depending on their size.

One key reason why private information obtained through local specialization may be more beneficial for banks in screening and monitoring smaller firms located in the same municipality is that these firms might be more susceptible to idiosyncratic local shocks or changes in the local competitive environment, given their plausible limited geographical diversification of activities, suppliers, and customers. Consequently, banks with local infor-

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[1]Our primary definition of geographical markets in Spain is a municipality, which is also used in studies analyzing the competitive implications of mergers and acquisitions by the competent Spanish authority, the Comisión Nacional de los Mercados y la Competencia (CNMC). Additionally, we consider provinces as an alternative local market definition and report in our robustness tests that our findings remain consistent.

[2]Our primary measure of local and sector specialization may raise concerns regarding the size of the municipality or sector. While our estimation strategy helps mitigate these concerns, we also compute bank excess specialization as the difference between a bank's share in a municipality or sector and the share a perfectly diversified bank would lend in that municipality or sector. We document in the Appendix that banks exhibit significant specialization in their top and second municipalities and sectors when using this particular measure.

[3]Due to the novelty of the findings regarding the relationship between banks' local specialization and the reduced non-performance of new loans granted to micro and small firms, we present a comprehensive set of robustness tests for this result in the Appendix.

mation advantages can better anticipate and evaluate the effects such type of shocks and changes may have on firms, which might be particularly relevant for the smaller ones. Additionally, since we use the firm's headquarter location—defined as its registered headquarters or where the management and direction of its activities are centralized—this municipality is more likely to be closely linked to the overall activity of micro and small firms. In contrast, sector specialization may be more beneficial for screening and monitoring larger firms within the same sector, as they might be more exposed to sector-wide shocks, such as fluctuations in raw material prices or sector-specific regulatory adjustments, and any local shock might be easier to diversify given their exposure to multiple other markets.

To support our arguments regarding the nature of local specialization advantages, we explore sector heterogeneity by classifying sectors into three categories: non-tradable, tradable, and other, following the methodology of Mian et al. (2020) in their international panel data. We find that the negative connection between local specialization and loan non-performance among micro and small firms is prominent in over half of the sectors, including trade and retail and manufacturing, which together account for more than 60% of new loans during the period under consideration. Local-specific private information may be particularly useful for evaluating borrowers closely tied to local factors, such as those in non-tradable sectors like trade and repair. Interestingly, this relationship is also evident in the manufacturing sector, which is traditionally considered tradable, as well as in other sectors not classified within the primary categories. Conversely, this negative relationship between local specialization and loan non-performance does not hold for medium and large firms in most sectors, suggesting that such private information held by banks is more relevant for evaluating micro and small borrowers, even in sectors not typically associated with local factors.[4]

These analyses are subject to two important concerns: specialized and non-specialized banks might lend to different types of firms, and the presence of bank-specific factors such as overall lending advantages across various geographical markets or sectors. We address these concerns by including municipality-sector-size-time fixed effects, following the approach of Degryse et al. (2019), to compare the performance of new loans granted by banks with different degrees of specialization to similar firms. This also allows us to control for the size of the municipality and sector. Additionally, we include bank-time fixed effects to compare the performance of new loans granted by the same bank across different geographical markets or sectors where the bank has varying degrees of specialization. To account for additional potential omitted variables, we control for local and sector bank market power

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[4]Notably, the only sector where a negative and statistically significant association between local specialization and loan non-performance is observed for medium and large firms is the other services sector, which had a relatively low number of new loans.

using market share, plausible firm-specific information advantages using the length of previous bank-borrower relationships, and loan characteristics including the interest rate charged, loan size, whether the loan is collateralized, maturity, and loan type. While we conduct extensive robustness tests throughout the paper, we acknowledge that our results cannot be interpreted as causal due to the lack of exogenous variation in specialization, a common issue in the lending specialization literature.

Next, we examine the connection between bank specialization and enhanced private information using confidential data on banks' private risk assessments reported to regulators.[5] While prior literature assumes that banks possess lending advantages related to private information where they specialize, we provide the first direct evidence of this claim. We utilize the internal estimates of borrowers' PD made by banks under the internal ratings-based (IRB) approach as a measure of banks' private information, following a novel methodology in the banking literature (Howes and Weitzner, 2023; Beyhaghi et al., 2024). Specifically, we focus on firms with outstanding loans from at least two banks assigning PDs within a given quarter. Given our previous results on the relevance of local specialization for micro and small firms, and sectoral specialization for medium and large firms, we evaluate the predictive accuracy of the PD assigned by the bank with the highest and lowest degree of local (sectoral) specialization. This evaluation is based on predicting one-year-ahead realized non-performance for the same micro or small (medium or large) firm, by employing the area under the curve (AUC) as a standard approach (e.g., Iyer et al. (2016)).[6]

We find that PDs assigned by locally specialized banks discriminate better between performing and non-performing micro or small firms compared to PDs assigned by non-specialized banks. The AUC for the PD of the locally specialized bank is 83.38%, compared to 82.47% for the non-specialized bank. Given a randomly chosen ex-post performing and non-performing firm, the probability that the non-performing firm has a higher PD than the performing one is 0.91 p.p. higher for the locally specialized bank.[7] This difference is not only statistically significant at conventional levels but also economically important. Even an improvement of 0.01 in AUC is considered to be noteworthy in the credit scoring industry, as underscored by Iyer et al. (2016). Additionally, we show that sector specialization,

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[5]Internal estimates of PDs are available from the fourth quarter of 2021. Throughout this sample period, four major Spanish banks employed internal models to assess corporate risk. As of the second quarter of 2023, these banks accounted for approximately 68.2% of total outstanding lending and 66.4% of lending to micro and small firms.

[6]See Howes and Weitzner (2023) for further details on the application of AUC in measuring the discriminatory ability of binary outcomes, and more specifically in the context of internally estimated PDs and future realized defaults.

[7]In the Appendix, we provide evidence that this result holds to a series of robustness tests, including considering local specialization in provinces instead of municipalities as the relevant local market.

computed using both sectors and 2-digit NACE codes, is linked to enhanced banks' private information when evaluating the credit risk of medium and large firms. Specifically, we estimate that, for a randomly selected pair of ex-post performing and non-performing firms, the probability that the sectorally specialized bank assigns a higher PD to the non-performing firm compared to the performing firm is 1.41 p.p. greater. Overall, these findings represent the first empirical evidence of improved banks' private information, using a direct measure of bank internal corporate risk assessment, linked to specialization.

Consistent with the notion that banks specializing in certain areas possess enhanced private information for screening and monitoring borrowers, we evaluate the credit supply effects associated with specialization. To identify the relationship between loan supply and specialization, we use banks' requests for borrower information from the Credit Registry, which can be interpreted as loan applications. We control for loan demand by applying a within-firm estimation strategy, following a standard approach in the banking literature (Khwaja and Mian, 2008; Jiménez et al., 2012) assuming that loan demand for a firm within a month is homogeneous across different banks. We compare the probability of a loan application made by the same firm within a month to more than two banks with differing degrees of specialization, while also accounting for relationship lending and time-variant bank-wide factors to control for overall bank lending advantages. We find that an application made by a micro or small firm located in the bank's top municipality is approximately 4.3 p.p. more likely to be granted compared to other applications. Additionally, while statistical significance is not achieved at conventional levels for our preferred specification, we estimate that an application made by a medium or large firm in the bank's top sector is approximately 3.2 p.p. more likely to be granted compared to other applications.[8]

The results so far highlight the enhanced private information possessed by banks that specialize their lending activities and its plausible relationship with improved loan performance. To further validate our findings, we replicate our analyses using relationship lending, proxied by the length of the relationship between banks and firms, as a well-known source of firm-specific private information for banks (Bharath et al., 2011; Claessens et al., 2024). Our analyses reveal that relationship lending is linked to reduced ex-post non-performance of granted C&I loans, with this association being stronger for smaller firms. Additionally, we find that banks with longer relationship lengths possess better private information, as their PDs have a superior predictive ability for one-year-ahead observed non-performance compared to banks with shorter relationship lengths, within the same micro or small firm. However, this result is smaller in economic terms and not statistically significant at conven-

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[8]In the Appendix, we show that the enhanced banks' loan supply linked to specialization does not seem to be reflected in higher interest rates on granted loans.

tional levels for medium and large firms.[9] Lastly, when examining loan applications made by a firm within a month to banks with different relationship lengths, we find that applications to banks with longer relationships have a higher probability of being granted, with this effect being stronger for micro and small firms. These results enhance the validity of our findings on bank specialization and allow us to compare the benefits of enhanced private information in predicting defaults, derived from both sources. While the advantages of building a relationship with a specific firm may be more pronounced, transferable private information obtained through lending specialization is highly relevant, as it enables banks to evaluate multiple borrowers effectively.

The findings provided in this paper have relevant implications for the growing academic literature on the consequences and benefits of bank lending specialization. They enhance our understanding of how various dimensions of bank lending specialization impact credit risk based on firm size. Notably, the less explored dimension of local specialization is particularly relevant for smaller firms that likely face greater financing constraints. Crucially, this paper provides the first empirical evidence linking specialization to enhanced private information, utilizing confidential banks' internal credit risk assessments reported to regulators. Banks can leverage this private information to improve their screening and monitoring capabilities across multiple firms with shared characteristics, such as operating in the same geographical market. Consequently, these findings enable policymakers to gain deeper insights into the benefits of bank portfolio concentration across various dimensions, particularly in terms of loan performance, as banks can exploit their enhanced private information during credit risk assessments.

1.1 Literature Review

Our article relates to three main strands of the literature. The first is the work on how banks specialize their lending activities in different dimensions and the lending implications associated with doing so (Degryse and Ongena, 2007; Blickle et al., 2023; Paravisini et al., 2023). Banks specialize geographically and sectorally, but also in certain firm types, export markets, and collateral types (Blickle, 2022; Gopal, 2021; Duquerroy et al., 2022; Di and Pattison, 2023; Bonfim et al., 2023). Specialized banks seem to possess the capacity to offer more favorable loan conditions, including less restrictive covenants and lower spreads, and tend to invest more in information collection (Loutskina and Strahan, 2011; Berger et al., 2017b; Giometti and Pietrosanti, 2022). Moreover, specialization might also create spillovers into different lending markets, affect firm innovation, and reduce zombie lending (Chu et al.,

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[9]A similar result is observed when using a firm's credit exposure to a bank as an alternative proxy for relationship lending, in line with Jiménez et al. (2022).

2021; Degryse et al., 2024; De Jonghe et al., 2024).[10]

If bank specialization is associated with enhanced expertise, technological development, or skills in evaluating projects within a particular geographical market or sector, as prior research has assumed (Paravisini et al., 2023; Blickle et al., 2023), banks may obtain a market- or sector-specific advantage where they specialize. We contribute to this literature by providing the first direct empirical evidence that specialization is related to banks' private information. Additionally, we show that the underlying private information related to local and sector specialization seems to have varying impacts on reducing C&I loan non-performance and increasing loan supply, depending on firm size.

Our paper also relates to the empirical literature on the special role of banks (Leland and Pyle, 1977; Diamond, 1984; Fama, 1985) and the production of private information. Banks produce information about borrowers at origination through the screening process (e.g., Agarwal and Hauswald (2010), Keys et al. (2010), Keys et al. (2012), Lisowsky et al. (2017), Hertzberg et al. (2018), Bedayo et al. (2020)) and over the life of the lending relationship due to their monitoring role (e.g., Mester et al. (2007), Cerqueiro et al. (2016), Gustafson et al. (2021), and Heitz et al. (2022)). Importantly, banks using the Internal Ratings-Based (IRB) approach employ their own models to estimate internal risk measures such as the PD (Behn et al., 2016; Dell'Ariccia et al., 2017; Berg and Koziol, 2017; Montes et al., 2018; Adelino et al., 2019; Beyhaghi et al., 2020).

These internal models require prior approval from supervisors. While prior research analyzing bank internal risk measures has reported some biases in these estimates (Begley et al., 2017; Plosser and Santos, 2018; Behn et al., 2022)), they are reported to regulators and have been used in recent research as direct measures of banks' private information (Howes and Weitzner, 2023; Beyhaghi et al., 2024).[11] To the best of our knowledge, we are the first to directly use banks' private information in the context of specialization to provide empirical evidence on the information advantages conferred by bank specialization. While Blickle et al. (2024) recently introduced a theoretical framework that concentrates on the private information banks gather from borrowers to analyze bank lending specialization and borrower

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[10]For the implications of bank local and sector specialization and other market structure characteristics for the transmission of monetary policy or supply shocks to the economy, see Favara and Giannetti (2017), Giannetti and Saidi (2019), De Jonghe et al. (2020), Giannetti and Jang (2021), Iyer et al. (2022), Izadi and Saadi (2023), Dursun-de Neef (2023), Casado and Martínez Miera (2024) and Ruzzier (2024), among others. For a discussion on the advantages and disadvantages of bank specialization and diversification, with a focus on the ongoing debate regarding whether diversification strengthens or undermines bank stability, see Acharya et al. (2006), Goetz et al. (2013), Goetz et al. (2016), Aguirregabiria et al. (2016), Berger et al. (2017a), Chu et al. (2020), Doerr and Schaz (2021), Levine et al. (2021), and Gelman et al. (2023), among others.

[11]Qian et al. (2015), Nakamura and Roszbach (2018), and Becker et al. (2020) also utilize the internal risk estimates of banks, focusing on data from one or two specific banks.

screening, no empirical evidence using a direct measure of banks' private information linked to the specialization benefits has been reported before.

Our paper also contributes to the literature on small versus large firms. Asymmetric information is presumable more pronounced for small firms, which rely more heavily on deposits and are generally less transparent. This makes them more susceptible to information frictions and more likely to experience credit supply constraints (Gertler and Gilchrist, 1994; Petersen and Rajan, 1994, 2002; Chodorow-Reich, 2014; Duygan-Bump et al., 2015; Chodorow-Reich et al., 2022). We add to these works by providing evidence that the relationship between local or sector specialization and banks' private information, loan performance, and loan supply varies by firm size. Geographical-specific information obtained through bank specialization appears to be particularly relevant for screening and monitoring micro and small firms, which face stronger financing constraints. In contrast, sector-specific information seems to be more important for medium and large firms.

Exacerbated information frictions observed in small business lending can also be alleviated by relationship lending (Berger and Udell, 1995; Ongena and Smith, 2001; Degryse and Ongena, 2005; Bolton et al., 2016; López-Espinosa et al., 2017; Puri et al., 2017). Puri et al. (2017) and Agarwal et al. (2018) provide evidence that relationship lending improves access to credit and reduces loan default probability. Additionally, Bharath et al. (2011) show that the benefits of relationship lending, particularly in terms of interest loan rates, are more relevant for small firms compared to large firms. We control for the effect of relationship lending in most of our analyses. Furthermore, our study contributes by providing evidence that relationship lending is associated with reduced loan performance, enhanced banks' private information, and increased loan supply, with these effects being more pronounced for smaller firms. This empirical evidence, consistent with increased banks' private information related to relationship lending using banks' internal risk estimates, aligns with the novel findings in Claessens et al. (2024) using U.S. data, and provides further validity for our results on bank specialization.

The remainder of the paper is organized as follows. Section 2 describes the data, presents our measure of specialization, and documents how banks specialize geographically across local markets. Section 3 discusses our empirical specification and presents the results on loan performance. In Section 4, we provide evidence on the link between banks' private information and local specialization. Section 5 presents results on loan supply. Section 6 replicates prior findings using relationship lending to validate our results on local specialization. Finally, Section 7 concludes.

2 Data

2.1 Data Sources & Summary Statistics

We primarily use confidential data from the Spanish Credit Register of the Banco de España (CIR). This dataset contains loan-level information granted by the universe of banks and firms operating in Spain. One of the main strengths of this data is its comprehensiveness, as it is not restricted to a subsample of banks or firms. This allows us to observe the lending behavior of institutions (banks and firms) of varying sizes. Our focus is on loans granted by domestic commercial banks, savings banks, and credit cooperatives, which account for approximately 95% of total outstanding lending as of the second quarter of 2024, to non-financial corporations.[12]

The dataset includes information on the performing status of each loan, loan amount, interest rate charged, loan type, maturity, and whether the loan is collateralized. Our analysis primarily covers the period from the second quarter of 2018 to the third quarter of 2024, given the availability of the loan-level information and the interest rate charged on the loan, which is one of the main control variable used in the analysis. During this sample period, there are 98 active banks and 767,492 active non-financial firms.

Spain is a bank-dependent economy as highlighted by Jiménez et al. (2012) and Jiménez et al. (2014), among others, where micro and small firms constitute its backbone. As of the second quarter of 2024, micro and small firms represent 91% of the total number of firms (accounting for 39% of total outstanding lending), while medium and large firms make up 6% and 3% of the total number of firms (accounting for 17% and 44% of total outstanding lending), respectively.[13] Consistent with data from the Directorio Integrado del Banco de España (DIBE), micro and small firms correspond to 95% of active non-financial firms and 42% of total employment.

Table 1 presents summary statistics for new loans granted to both micro and small firms, as well as to medium and large firms. The unit of observation is at the loan level

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[12]We exclude loans granted by non-depository institutions and foreign depository institutions, loans with multiple direct risk holders, and loans to firms in the financial and insurance sectors. Although mergers and acquisitions are not very relevant during our main sample period, we adjust for them by substituting the acquired entity with the acquirer at the beginning of the sample period.

[13]Firm size in the Spanish Credit Register is defined following the European Commission Recommendation (2003/361/EC) (Commission et al., 2003): Micro non-financial corporations have fewer than 10 employees and an annual turnover and/or annual total balance sheet not exceeding 2 million euros; small non-financial corporations, if not micro, have fewer than 50 employees and an annual turnover and/or total annual balance sheet not exceeding 10 million euros; medium non-financial corporations, if not small, have fewer than 250 employees and an annual turnover not exceeding 50 million euros and/or total annual balance sheet not exceeding 43 million euros; and large non-financial corporations are those that do not fall into the previous categories.

at origination. The average loan amount for new loans granted to micro and small firms is 49,000 euros, compared to 143,000 euros for medium and large firms. Both types of firms have a similar percentage of new loans secured by collateral (3%). However, micro and small firms have higher loan rates (4.1% versus 3.8%) and higher average maturity (6 quarters versus 3 quarters) compared to medium and large firms.

We define the variable loan non-performance (NP) as a binary indicator that takes the value of 1 if the loan defaults in the future, which is defined as being overdue by 90 days or more. This status is tracked from the loan's origination until either its maturity or the end of our sample period, which concludes in the third quarter of 2024. We observe that new loans granted to micro and small firms face higher ex-post realized default (1.7% versus 0.5%) relative to those granted to medium and large firms. We compute the variable *RelLength* as the number of quarters where the bank-firm relationship has a positive amount of total outstanding lending starting from the first quarter of the year 2000. We observe that micro and small firms, when originating a new loan with a given bank, have an average relationship length of about 32 quarters, compared with 47 quarters for medium and large firms.

2.2   Measuring Specialization

Our primary measure of local specialization is calculated as the share of outstanding C&I lending granted by a given bank b in a municipality m in a quarter t, divided by the total outstanding C&I lending granted by bank b in a quarter t. This variable is defined in equation 1:

$$LocalSpec_{bmt} = \frac{A_{bmt}}{A_{bt}} \tag{1}$$

We also construct sector specialization following equation 1, using sectors instead of municipalities. This is calculated as the share of outstanding C&I lending granted by a given bank b in a sector i in a quarter t, divided by the total outstanding C&I lending granted by bank b in a quarter t. Our primary definition of sectors includes 21 different sectors (e.g., agriculture, forestry and fishing, mining and quarrying, trade and repair, and manufacturing).

These straightforward measures of specialization are utilized in most of our analyses. Our estimation strategy addresses significant issues related to these variables, such as the potential influence of the size of the municipality or sector. Nevertheless, Table 4 shows that our finding on the relationship between the less-explored dimension of specialization, local specialization, and loan performance remains robust across various measures of the specialization variable.

Some alternative measures are constructed in the spirit of prior research on bank lending specialization (Blickle et al., 2023; Paravisini et al., 2023). Excess specialization is calculated as the difference between the share of a bank in a municipality and the share a perfectly diversified bank would lend in the municipality, computing such share using the total outstanding C&I lending granted by all banks in the municipality over total lending across all municipalities in Spain. Specialization can also be computed using only outstanding lending granted to micro and small firms. Relative specialization is calculated as the ratio between the share of a bank in a municipality and the share a perfectly diversified bank would lend in the municipality, winsorized at the 1% level. Finally, specialization is also computed using the number instead of the amount of outstanding loans, excluding the specific firm from the specialization measure to avoid influence by relevant firms, using quartiles of the specialization variable per municipality to allow for nonlinearities, using a dummy variable for the top quartile per municipality to capture potential nonlinearities between banks highly specialized in a municipality versus the rest, and using a dummy variable for banks over the median degree of specialization within a municipality. Additionally, we use an alternative definition of a local market using provinces, a broader definition, instead of municipalities.

Lastly, we construct local (sector) market shares as the share of outstanding C&I lending granted by a given bank b in a municipality m (sector i) in a quarter t, divided by the total outstanding C&I lending granted by all banks in a given municipality m (sector i) and quarter t.

2.3 Documenting Specialization

We start by documenting that Spanish banks specialize geographically. Figure 1 shows the average unweighted and weighted degree of local specialization in the most important municipality (top municipality), the second most important municipality (second municipality), and all other municipalities. We observe that Spanish banks are highly specialized in their most important municipalities, having on average around 30% to 40% of their portfolio in their top municipality and around 10% to 15% in their second municipality, depending on whether the measure is volume-weighted. Additionally, the average shares of local specialization in the top, second, and other municipalities remain relatively constant throughout the sample period.[14]

We also document how banks specialize in specific sectors. Figure 2 shows the average unweighted and weighted degree of sector specialization in the most important sector (top sector), the second most important sector (second sector), and all other sectors. Specifically,

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[14]Figure 2 in the Appendix also documents that Spanish banks specialize their C&I lending activities in specific sectors.

banks have approximately 30% to 40% of their lending portfolio in their top sector and around 20% in their second sector, depending on whether the measure is volume-weighted. Similar to local specialization, the average shares in the top, second, and other sectors remain relatively constant throughout the sample period.

Table 2 presents the average, standard deviation, and various percentiles of the local and sector specialization variables for the top municipality and sector, as well as for all other municipalities and sectors. On average, banks allocate 39.6% (36.9%) of their total outstanding C&I lending to their top municipality (sector), compared to just 0.1% (4.6%) in the other municipalities (sectors) where they have at least one outstanding loan. These averages are used to interpret the results in Section 3.

There might be some municipalities and sectors with a larger extent of economic activity where banks may grant larger amounts of loans. While our estimation strategy accounts for this, Figures A1 and A2 in the Appendix confirm that banks are highly specialized in their top and second municipalities and sectors compared to all other municipalities and sectors, when using excess specialization that accounts for the relative importance of the municipality and sectors.

Figure 3 provides a more general view of the average local specialization of banks during the second quarter of 2024. This figure illustrates the average degree of local specialization for all Spanish banks across municipalities in Spain. During this quarter, Spanish banks had outstanding lending in approximately 5,700 out of a total of 8,132 municipalities. This comparison can help determine whether the four groups of banks discussed earlier are over- or under-specialized in specific municipalities in Spain relative to the national average.[15]

Lastly, Figure 4 provides general overview of the average sector specialization of Spanish banks during the second quarter of 2024 across different sectors. This can be compared to the specific degrees of sector specialization of the four groups of banks discussed earlier, to determine whether these groups are over- or under-specialized in specific sectors relative to the average in Spain.[16]

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[15]Our findings underscore the importance of local specialization for the non-performance status of loans to micro and small firms. Figure A3 in the Appendix illustrates the average degree of local specialization during the second quarter of 2024 across all municipalities in Spain, focusing exclusively on outstanding loans granted to micro and small firms.

[16]Our findings highlight the relevance of sector specialization for the loan performance of medium and large firms. Figure A4 in the Appendix illustrates the average degree of sector specialization during the second quarter of 2024 across sectors, focusing only on outstanding loans granted to medium and large firms.

3 Specialization and Loan Performance

In this section, we explore the relationship between bank specialization and loan performance. We begin by documenting how the relationship between local and sector specialization and loan default probability varies with firm size. Specifically, local specialization is linked to reduced loan non-performance probabilities for micro and small firms, while sector specialization exhibits a similar relationship for medium and large firms. This novel evidence suggests that the nature of private information obtained through specialization is differentially beneficial for screening and monitoring various types of borrowers. While the relationship between sector specialization and loan performance has been previously studied, our findings on the relationship between local specialization and non-performing probabilities for micro and small firms are novel. We further provide evidence on this relationship, showing that it remains robust across various specifications. Additionally, we explore the heterogeneity across sectors to reinforce the notion that this specific source of specialization is more relevant for smaller firms.

3.1 Baseline Empirical Specification

Banks may gain local market- or sector-specific private information through specialization, enhancing their expertise and skills in these geographical areas or sectors. This enhanced private information might help banks in their screening and monitoring roles, leading to better loan performance compared to banks with less specialization. Recent evidence in Blickle et al. (2023) supports this view, showing that sector specialization is related to reduced ex-post non-performance using a sample of large loans, with a threshold over 1 million dollars, and the 40 largest stress-tested banks in the U.S. as a laboratory. We leverage comprehensive data from a bank-dependent economy, where small firms are the backbone, to explore how local and sector specialization affects loan performance depending on firm size.

To investigate this relationship, we compare the non-performing probability of new loans granted by banks to firms of different sizes located in municipalities and belonging to sectors where they specialize, relative to those in other municipalities and sectors. Our baseline empirical specification is as follows:

$$
\begin{aligned}
NP_{lbfmiT} =& \omega_{bt} + \alpha_{mist} + \beta_1 LocalSpec_{bm,t-1} + \beta_3 SectorSpec_{bi,t-1} + \\
& \Gamma Controls_{lbfmit} + \epsilon_{lbfmit},
\end{aligned}
\tag{2}
$$

where NP_{lbfimT} is the ex-post non-performance status of a new loan l granted by bank b to firm f located in municipality m that belongs to sector i until the loan's maturity or the third quarter of 2024 T. $LocalSpec_{bm,t-1}$ is the degree of local specialization of bank b in municipality m in the prior quarter $t-1$, $SectorSpec_{bi,t-1}$ is the degree of sector specialization of bank b in sector i in the prior quarter $t-1$, and $Controls_{lbfmit}$ includes a set of bank-municipality, bank-sector, bank-firm, and loan level controls. ω_{bt} and α_{mist} are bank-time and municipality-sector-size-time fixed effects, respectively.

A key concern is that highly specialized banks might lend to different types of firms compared to less specialized banks. To address this, we use municipality-sector-size-time fixed effects (α_{mist}) and focus on new loans to firms in the same municipality, sector, and size during the same quarter, following the approach in Degryse et al. (2019). This allows us to compare loan performance among similar firms served by banks with varying degrees of specialization.[17] Additionally, the inclusion of this set of fixed effects also control for the size of the municipality and the size of the sector, allowing our analyses to be capturing the differential effect of local and sector specialization across banks.

We incorporate bank-time fixed effects (ω_{bt}) to account for relevant time-variant bank heterogeneity, such as overall lending advantages or bank-wide shocks that might influence the reporting of non-performing loans. Additionally, our baseline specification includes a comprehensive set of controls ($Controls_{lbfmit}$), which encompass local and sector bank market shares, the duration of previous bank-borrower relationships (measured in quarters since the year 2000), and various loan characteristics, including size, whether the loan is collateralized, interest rate, and maturity. We exclude observations with likely coding errors in loan interest rates or maturities, such as negative values or those beyond reasonable ranges. Finally, we control for loan type, differentiating between cash flow loans, asset-based loans, credit lines, trade finance, leasing, and other loans, similarly to the approach of Ivashina et al. (2022).[18] In our main sample, which includes the full set of fixed effects, we analyze over 9 million new loans, with more than 5.7 million of these granted to micro and small firms.

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[17]We do not rely on a within-firm comparison (Khwaja and Mian, 2008) because such a comparison would capture the dynamics of which types of loans firms default on first, rather than focusing on defaults related to banks' private information in screening and monitoring borrowers. While this type of analysis could be interesting, it falls outside the scope of this article. Additionally, a within-firm comparison in this setup would require firms to originate at least two different loans in the same quarter with different banks. This requirement would limit the analysis to firms originating multiple loans in a given quarter, thereby excluding firms that borrow from only one bank. Given that our primary advantage and focus lie in leveraging information from small firms, using a within-firm comparison would potentially bias the analysis towards larger firms.

[18]We exclude overdrafts from our analysis because they represent a very specific type of loan that is often associated with disproportionately high interest rates.

While we are able to account for time-variant bank heterogeneity, firm types, and a large set of controls, we acknowledge that causality cannot be definitively established when interpreting our results. Nonetheless, our results provide robust evidence of the beneficial relationship between bank specialization and loan performance, particularly for smaller firms in specialized local markets.

3.2 Baseline Results

Table 3 presents the results for the baseline specification shown in equation 2, segmented by firm size.[19] Column (1) focuses on the full sample of firms and shows that new loans originated by banks with geographic specialization in a municipality are less likely to become non-performing ex-post. Based on the data in Table 2, we estimate that a loan granted by a bank to a firm located in its top municipality is approximately 0.4 p.p. less likely to be non-performing ex-post compared to other loans, after controlling for bank-time and municipality-sector-size-time factors.[20] Thus, we compare loans originated by a bank to firms in its top municipality relative to both loans from the same bank and period in any other municipality and loans to firms in the same municipality, sector, size, and period but originated by banks for which the municipality is not the top one. Given that the average ex-post non-performing probability for new loans originated and observed during our sample period is around 1.24%, loans in the top municipality are 32.26% less likely to become non-performing, highlighting the economic relevance of this effect. However, sector specialization does not show a statistically significant relationship with the ex-post non-performance of loans when considering all firms.

Columns (2) and (3) examine the relationship between local and sector specialization and loan ex-post non-performance for two subsamples of firms based on their size: micro and small firms, and medium and large firms. The results indicate that that new loans originated by banks to micro and small firms in the municipalities where they are specialized are associated with a decreased probability of ex-post non-performance. Conversely, new loans to medium and large firms in their specialized sectors exhibit lower ex-post non-performance.

Specifically, a loan granted by a bank to a micro or small firm in its top municipality is 0.83 p.p. less likely to be non-performing ex-post, while a loan to a medium or large firm in its top sector is 0.64 p.p. less likely to be non-performing compared to other loans. Given that the average ex-post non-performance rate for new loans in our sample is 1.7% for micro

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[19]In Table A1 of the Appendix, we present the results, including the control variables.

[20]This estimate is calculated by multiplying the coefficient (-0.0103) by the difference between the average local specialization in the top municipality (0.396) and the average in other municipalities (0.001): $-0.0103 * (0.396 - 0.001) = 0.004 = 0.4 p.p.$

and small firms and 0.5% for medium and large firms, loans originated in the top municipality are 47.06% less likely to become non-performing, and loans in the top sector are 125% less likely to become non-performing. These findings underscore the economic significance of the relationship between local (sector) specialization and ex-post non-performance for micro and small (medium and large) firms.

To provide further insights into the relationship between local and sector specialization and loan ex-post non-performance, columns (4) to (7) examine this relationship across four subsamples of firms based on their size. The results indicate that the relationship between ex-post non-performance and local (sector) specialization is most pronounced for micro (large) firms. Specifically, a loan granted by a bank to a micro firm in its top municipality is 0.84 p.p. less likely to be non-performing ex-post, while a loan to a large firm in its top sector is 1.21 p.p. less likely to be non-performing compared to other loans.

To visually illustrate these findings, Figure 5 presents the interpreted coefficients for loans originated in the top municipality or sector relative to other loans, along with the associated 95% confidence intervals. This visual representation highlights the extent and significance of the reduced loan non-performance linked to local and sector specialization across different firm sizes.

Given that bank specialization is linked to enhanced private information where they operate strongly (as we will show in Section 4), banks can leverage this private information to develop local and sector-specific expertise and skills in evaluating borrowers. However, the nature of the private information obtained through specialization may vary. Local or sector-specific information might be more beneficial for screening and monitoring certain types of borrowers based on their size.

Firms, regardless of size, are subject to at least two types of shocks: those affecting their geographical area and those impacting their sector. Due to differences in geographical diversification of activities, suppliers, and customers, smaller firms may be more susceptible to changes in the local competitive environment or idiosyncratic local shocks. These shocks can affect the firms themselves or their suppliers and customers within the same municipality. Consequently, banks specializing in specific municipalities can gather valuable local-specific information, such as credit demand trends or early default signals across all firms within the same area. This information can be particularly useful for evaluating projects from micro and small firms, aligning with our empirical findings.

Furthermore, since we consider the registered headquarters or the location where the management and direction of activities are centralized as the firm's headquarters, this municipality is likely to be closely linked to the overall activity of micro and small firms. In Section 3.4, we explore the relationship between local specialization and loan non-performance

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of micro and small firms across different sectors. This analysis provides further evidence and specific illustrative examples to enhance the interpretation of our results.

Conversely, sector-specific information obtained by banks, such as changes in raw material prices, sector-level regulatory adjustments, or shifts in household preferences related to products shared by the sector, might be more relevant for assessing projects from medium and large firms. Additionally, these firms may find it easier to diversify any local shocks due to their exposure to multiple other markets. This is also consistent with our empirical results, highlighting the differential utility of local and sector-specific information based on firm size.

3.3   Robustness

Since local specialization remains a relatively unexplored facet of banks' specialization, we provide in Table 4 the results from a comprehensive set of robustness tests examining the relationship between local specialization and loan non-performance for micro and small firms.

Panel A explores the consistency of our results across different specifications of the specialization variable and the exclusion of sector specialization, sector market share, and local market shares as controls. First, we demonstrate that our findings remain robust when using various specifications of the specialization variable, addressing concerns that the specific construction of this variable might drive the results. Specifically, we compute the specialization variable as excess in column (1), relative in column (2), using only loans granted to micro and small firms in column (3), by the number of loans instead of the lending amount in column (4), and excluding loans granted to the specific firm in column (5).[21]

Second, our results hold when excluding sector specialization and sector market shares in column (6), and when excluding sector specialization, sector market share, and local market share in column (7). This alleviates the concern that the observed relationship between loan non-performance and local specialization is contingent on the inclusion of these controls.

Third, we examine the robustness of our results to nonlinearities in the relationship between local specialization and loan non-performance by computing the local specialization variable as quartile dummies in column (8), as an indicator for the top quartile in column (9), and as an indicator for values greater than the median in column (10).

Panel B presents robustness tests for various dependent variables, sample periods, the use of drawn amounts, and an alternative specification of local markets. First, the results are consistent when computing loan non-performance over one year in column (1) and when

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[21]Some of these robustness tests are inspired by prior research on bank specialization (e.g., Blickle et al. (2023) and Paravisini et al. (2023), among others).

including doubtful loans as non-performing in column (2), addressing concerns related to the construction of the dependent variable.

Second, the results are robust when using only drawn amounts in column (3). This ensures that our findings are not only influenced by undrawn credit lines, which might behave differently. Third, restricting the sample to loans without public credit guarantees during the COVID-19 crisis does not alter the results, indicating that these findings are not driven by government interventions during this period.

Fourth, the results remain consistent when considering all outstanding loans in a given quarter, rather than only new loans, as shown in column (5). Fifth, the results are similar when focusing on banks that report PDs from their IRB models in column (6), for bank-firm relationships where the IRB PD is available from the fourth quarter of 2021 in column (7), and when including the initial PD as a control in column (8). Although the significance in column (7) is lower, these findings support the persistence of the relationship between local specialization and loan non-performance when focusing on banks with IRB models. This is particularly relevant as we will further explore these reported PDs in Section 4 to provide direct evidence of banks' private information advantages related to specialization.

Sixth, restricting the sample to new loans originated before the first quarter of 2021 does not alter the results, as shown in column (9). This allows us to analyze the ex-post non-performance of new loans over at least two years, alleviating concerns about the observation period. Lastly, our results remain robust when considering provinces as an additional local market instead of municipalities and when controlling for sector specialization and sector market shares using 2-digit NACE codes in column (10). This demonstrates that our findings are not specific to the definitions of local and sector markets used.

Table A2 in the Appendix also shows that the relationship between local specialization and loan non-performance for micro and small firms holds across different specifications of the fixed effects included. Column (1) presents the results with bank-time, sector-time, and municipality-time fixed effects. Column (2) includes bank-time and sector-municipality-time fixed effects. Column (3), our preferred and most saturated empirical specification, explores the relationship with bank-time and municipality-sector-size-time fixed effects. Overall, the relationship between local specialization and loan non-performance remains economically and statistically significant across these specifications.

3.4 Sector Heterogeneity

To strengthen the interpretation of our findings on the reduced probabilities of loan non-performance for micro and small firms linked to local specialization, we investigate differences

in this relationship across different sectors. To identify sectors more likely affected by local factors—where local-specific private information from banks might be particularly useful—we classify sectors into three categories: non-tradable, tradable, and other. This classification follows the framework used by Mian et al. (2020) in their international panel data set.[22]

Figure 6 presents the results for micro and small firms in sectors with at least 500 new loans originated during our sample period.[23] Among these sectors, eleven exhibit a negative relationship between local specialization and ex-post loan non-performance, with six achieving statistical significance at the 5% level and 1 at the 10% level.[24] Six out of nine non-tradable sectors exhibit a negative relationship, suggesting that banks are better able to use local-specific private information when evaluating borrowers in sectors where local factors are more relevant. However, statistical significance is only achieved for the water and sewerage, and trade and repair sectors.

Importantly, the trade and repair and the manufacturing sectors, which account for over 60% of new loans to micro and small firms during our sample period, exhibit a negative and statistically significant relationship at the 1% level between local specialization and loan non-performance. As the trade and repair sector is classified as non-tradable, it is likely more influenced by local activity. Therefore, it is reasonable that local-specific private information acquired by banks specializing in a specific geographical area is highly valuable for evaluating micro and small firms in this sector.

To further illustrate this result, consider the following example where a bank specializing in the municipality of Alcobendas and the trade and repair sector. There are two firms headquartered in this municipality within this sector: a micro firm, which is an innovative company selling electric motorcycles, and a large firm, which is a prominent national company selling both cars and motorcycles, with a focus on electric variants and sales points across the country. By concentrating its lending activities in Alcobendas, the bank can gather local-specific information that is particularly valuable for evaluating loans to the small retail firm. This includes insights into local economic conditions, commuting patterns, public bicycle service implementation, and local car pollution restrictions. Conversely, by specializing in the trade and repair sector, the bank can acquire sector-specific information relevant for assessing loans to the national company, including advancements in battery pollution efficiency, fluctuations in lithium-ion battery prices, and supply chain disruptions.

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[22]This classification aligns with existing research suggesting that non-tradable sectors rely more heavily on local demand, while tradable sectors depend more on national or global demand (Mian and Sufi, 2014; Adelino et al., 2017; Müller and Verner, 2024; Li et al., 2024).

[23]Table A3 in the Appendix includes results for the full set of sectors, including extraterrestrial organizations and household activities.

[24]No sectors show statistically significant positive relationships between local specialization and loan non-performance for micro and small firms at conventional levels.

The negative relationship for micro and small manufacturing firms is strong, even though the manufacturing sector is classified as tradable and may not have been previously seen as directly linked to local factors. However, this relationship does not hold for medium and large firms, as reported in Table A4 in the Appendix. This aligns with the idea that local-specific private information held by banks in geographical markets where they specialize is useful for evaluating micro and small, but not medium and large, borrowers. This differential relationship between micro and small versus medium and large firms is consistent across most sectors, including retail and trade, as well as sectors not classified in either category. These findings support the notion that local-specific private information acquired by banks is useful for screening and monitoring smaller firms, even in sectors traditionally considered less influenced by local factors and classified as tradable or other.

To rationalize this, consider a bank specializing in the municipality of Yecla and the manufacturing sector. In this municipality and sector, there are two firms: a micro firm manufacturing furniture and a large multinational company manufacturing furniture. By focusing its lending activities in Yecla, the bank can gather local-specific information particularly valuable for evaluating loans to the small manufacturing firm. This includes insights into changes in demand related to house construction, supply and prices, natural disasters affecting local production, increased competition from other local manufacturers or imported goods, and local economic downturns that can reduce consumer spending on non-essential items like furniture. Conversely, by specializing in the manufacturing sector, the bank can acquire sector-specific information more relevant for assessing loans to the multinational company, including technological advancements and innovations, fluctuations in raw material prices, supply chain interruptions, and changes in global economic conditions such as trade policies, tariffs, and international market dynamics. This differentiation in the utility of local versus sector-specific information aligns with our empirical results, explaining how specialization benefits banks in managing loans for firms of different sizes.

4   Specialization and Informational Advantages

The results above indicate that banks' local specialization is strongly associated with lower loan non-performance probabilities for micro and small firms, while sector specialization is similarly associated with lower non-performance probabilities for medium and large firms. Prior literature has highlighted the potential link between various dimensions of banks' lending specialization and enhanced private information (Paravisini et al., 2023; Blickle et al., 2023). However, direct evidence on this connection remains unexplored. To assess whether specialization is directly related to increased banks' private information where banks spe-

cialize, we utilize the reported PDs under the IRB approach as a measure of banks' private information, following recent works in the literature (Howes and Weitzner, 2023; Beyhaghi et al., 2024). Consistent with our previous results, we then test whether PDs assigned by locally specialized banks outperform those assigned by non-specialized banks in assessing the credit risk of micro and small firms, and whether PDs assigned by sectorally specialized banks outperform those assigned by non-sectorally specialized banks.

To explore whether specialization directly relates to better private information, we focus on performing firms with positive outstanding lending from at least two different banks, each assigning its own internal PD to the firm within a given quarter.[25] We assess the goodness of fit of both PDs reported by the bank with the highest and the bank with the lowest degree of local (sector) specialization to the same micro or small (medium or large) firm by comparing both predicted PDs with the one-year ahead realized default using the receiver operating characteristic (ROC) curve.

ROC analysis is useful for evaluating the performance of statistical models that classify outcomes into one of two categories, such as non-performance in this case. Therefore, we compute the ROC curves by plotting the sensitivity (i.e., true positive rate) against 1-specificity (i.e., the false positive rate) at various threshold settings.[26] By using every possible value of the PD as thresholds, firms are classified based on their PDs. If a firm's PD exceeds a given threshold, it is classified as defaulted. Conversely, firms with PDs below the threshold are classified as non-defaulted. Then, the true positive ratio and the false positive ratio are computed and plotted, forming the ROC curve, from which the AUC can be interpreted as a measure of how well the PD discriminates ex-post realized default.

After computing and plotting the ROC curves for the PDs from both specialized and non-specialized banks, we calculate the two respective AUCs. The AUC ranges from zero to one,

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[25]We specifically focus on firms without non-performing loans in any given quarter, as these would uniformly have an assigned PD of 100%. We also limit our analysis to the period from the fourth quarter of 2021 to the second quarter of 2023. This timeframe allows us to observe the one-year-ahead realized defaults in all periods where internally estimated PDs are available. During this sample period, four Spanish banks assigned internal PDs to non-financial firms, accounting for approximately 68.2% of total outstanding lending to firms of all sizes and 66.4% of total outstanding lending for micro and small firms, as of the second quarter of 2023. Figure A5 shows the distributions of both PD and the natural logarithm of PD. Figure A6 provides evidence supporting the usefulness of reported PDs in predicting future realized default by showing the positive relationship between PDs and ex-post observed default. To do so, we divide PDs into quartiles, show the average PD below each quartile, and illustrate their relationship to one-year ex-post realized default. We show a positive relationship between PDs and realized defaults.

[26]The true positive rate equals true positives divided by true positives plus false negatives. The false positive rate equals false positives divided by false positives plus true negatives. True positives are the bank-firm observations predicted as non-performing that we observe ex-post default. False negatives are the bank-firm observations predicted as performing that we observe ex-post default. False positives are the bank-firm observations predicted as non-performing that we do not observe ex-post default. True negatives are the bank-firm observations predicted as non-performing that we do not observe ex-post default.

with higher values indicating superior predictive ability for non-performance. For comparison, an AUC of 0.5 typically suggests that the prediction is no better than random chance. In this analysis, we focus on the difference between the AUCs derived from the reported PDs of specialized versus non-specialized banks. Consistent with our previous findings, we compare the AUCs generated by the reported PDs of locally specialized versus non-specialized banks for micro and small firms, and the AUCs generated by the reported PDs of sectorally specialized versus non-specialized banks for medium and large firms. Statistical significance for the difference in the prediction of PDs is determined using the DeLong test (DeLong et al., 1988) as in Iyer et al. (2016) and Howes and Weitzner (2023), among others.

Figure 7 provides evidence that banks possess better private information about micro and small firms located in municipalities where they specialize. Specifically, the AUC for the locally specialized bank is 83.38%, compared to 82.47% for the non-specialized bank. This indicates that, given a randomly chosen ex-post performing and non-performing firm, the probability that the non-performing firm has a higher PD than the performing one is 0.91 p.p. higher for the specialized bank compared to the non-specialized bank. Therefore, while the estimated PDs from both banks contain substantial information about the one-year ex-post realized default probabilities of firms, this result suggests that the specialized bank has a higher probability of distinguishing non-performance.[27] The difference between the two AUCs is statistically significant at the 1% level and is also economically meaningful. In the credit scoring industry, even an improvement of 0.01 in AUC is considered remarkable, as highlighted by Iyer et al. (2016).

Figure 8 provides evidence that banks possess better private information about medium and large firms within sectors where they specialize. We estimate that the AUC for sectorally specialized bank is 86.9%, compared to 85.49% for non-specialized bank. These results further indicate that while both PDs contain substantial information for evaluating ex-post default probabilities of medium and large firms, given a randomly chosen ex-post performing and non-performing firm, the probability that the non-performing firm has a higher PD than the performing one is 1.41 p.p. higher for the specialized bank compared to the non-specialized bank. Therefore, sectorally specialized banks exhibit higher probability of distinguishing ex-post realized non-performance. This difference between the AUCs is statistically significant at the 10% level.[28]

As local specialization is a less explored dimension of banks' lending specialization, Table

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[27]Columns (1) and (2) of Table A5 in the Appendix presents the results shown in the previous figure in a table format, facilitating easier comparison with a set of robustness tests presented in columns (3) to (10) in the same table.

[28]Figure A7 in the Appendix supports the robustness of banks' private information in sector specialization for medium and large firms when using 2-digit NACE codes instead of sectors.

A5 consistently supports that the presence of enhanced banks' private information in local specialization for evaluating micro and small firms is robust across various specifications. Specifically, when we consider provinces as the relevant market for bank local specialization, construct the local specialization variable using only loans to micro and small firms, include doubtful loans in the computation of the one-year realized default, and incorporate bank-firm controls for both the specialized and non-specialized banks. These controls local market share, sector specialization, sector market share, percentage of outstanding loan amount that is guaranteed, average interest rate, average maturity, log of total outstanding amount, and the length of the relationship.

5   Specialization and Loan Supply

The results so far support the idea that local and sector specialization are directly related to better private information for micro and small firms and medium and large firms, respectively. This enhanced private information may be a potential source of the decreased loan non-performance probabilities associated with bank specialization for these different types of firms. If, as our previous results have shown, banks' lending specialization is linked to enhanced private information, it might also influence loan supply. In this section, we explore the relationship between these two sources of specialization and loan supply.

To investigate this relationship, we examine loan application data. Crucially, in addition to originated loans, we can observe loan applications from the Spanish Credit Registry, allowing us to better control for loan demand. Our estimation strategy compares loan applications made by the same micro or small (medium or large) firm in a given month to banks with varying degrees of local (sector) specialization. We assume that if at least one application is granted and another is not, the firm was requesting the same loan.[29] This strategy allows us to effectively estimate a supply effect related to local and sector specialization, assuming that changes in firm demand are homogeneous across banks (Khwaja and Mian, 2008; Jiménez et al., 2012).[30]

Consistent with our previous findings on the importance of local specialization for evalu-

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[29]We observe all information requests to the Credit Registry made by banks on borrowers. Following Jiménez et al. (2012) and Jiménez et al. (2014), among others, we interpret these requests as loan applications because banks can only request information from the Credit Registry if borrowers are asking for a loan. Additionally, as we cannot perfectly match loan applications to loan origination, we consider an application made in a given month to a given bank to be granted if a new loan for that bank-firm relationship exists from that month to three months later. Conversely, if there is an application for a bank-firm relationship and no new loan during the same period, we consider the application not granted.

[30]We acknowledge that this assumption might not hold in certain specialization dimensions, such as bank lending specialization in borrowers' export destinations, as shown by Paravisini et al. (2023) using data from Peru.

ating micro and small firms and sector specialization for medium and large firms, we estimate the empirical specification for the supply effect on micro and small firms as follows:

$$LoanGranted_{abfmit} = \omega_{bt} + \theta_{ft} + \beta_1 LocalSpec_{bm,t-1} +$$
$$\Psi Controls_{bft} + \epsilon_{abfmit}, \tag{3}$$

where $LoanGranted_{abfmit}$ equals one if the loan application made by firm f at time t is approved by bank b in month t to $t+3$, and zero otherwise. $LocalSpec_{bm,t-1}$ is the degree of local specialization of bank b in municipality m in the prior quarter $t-1$, and $Controls_{bft}$ includes the degree of sector specialization of bank b in sector i in the prior quarter $t-1$ and the duration in quarters from the year 2000 of previous relationships between bank b and firm f in the prior quarter $t-1$. ω_{bt} and θ_{ft} are bank-time and firm-time fixed effects, respectively.[31] Similarly, for the results on loan supply to medium and large firms, we focus on sector specialization while controlling for local specialization.

The inclusion of firm-time fixed effects (θ_{ft}) allows us to disentangle supply and demand for loans. With this inclusion, we are effectively comparing loan applications made by the same firm in a given month to banks with different degrees of local or sector specialization, where at least one of the applications is granted from that month to three months later and another is not. Additionally, we control for factors that may influence the construction of the specialization variables, such as the size of the municipality where the firm is located and the size of the sector the firm belongs to. Bank-time fixed effects (ω_{bt}) control for time-variant bank heterogeneity, such as bank-wide factors related to lending advantages in all municipalities or sectors, as explained in Section 3.

Table 5 presents the results on granted applications for micro and small firms. Column (1) shows that firms applying for a loan in a given month to banks with varying degrees of local specialization have a higher probability of being granted a loan by the bank with a higher degree of specialization, even when controlling for the degree of sector specialization. We estimate that an application made by a firm located in the top municipality of the bank is approximately 8.1 p.p. more likely to be granted compared to other applications. This result is statistically significant at the 1% level.

Column (2) adds a control for the length of the relationship between firms and banks at the time of the loan application and shows that the result holds. Column (3) includes bank-time fixed effects, and column (4) is our preferred specification, where we control for sector specialization, relationship length, and bank-time fixed effects. While the result is reduced

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[31]For simplicity, we employ linear probability models as extant research analyzing granted applications (Jiménez et al., 2012).

in economic terms when controlling for bank-wide factors, we estimate that an application made by a firm to the locally specialized bank is approximately 4.3 p.p. more likely to be granted compared to other applications, and it remains statistically significant at the 1% level.

Table 6 provides evidence of an increased probability of a loan application being granted by banks with a higher degree of sector specialization when focusing on medium and large firms. However, this evidence is weaker in statistical terms. Column (1) estimates that an application made by a firm to a sectoral specialized bank is approximately 4 p.p. more likely to be granted compared to other applications, while also controlling for local specialization. This result is statistically significant at the 5% level. Column (2) controls for relationship lending, and while the result is reduced in economic magnitude, it remains significant at the 10% level. Column (3) includes bank-time fixed effects, and the result lacks statistical significance at conventional levels. Finally, column (4) presents our preferred specification, including both bank-time fixed effects and the control for the length of the relationship. We estimate that a an application made by a firm to a sectorally specialized bank is approximately 3.2 p.p. more likely to be granted compared to other applications. However, this result does not achieve statistical significance.

As we have previously argued, local specialization is a less-explored dimension of banks' specialization. Therefore, we present further evidence in Table A6 in the Appendix that the loan supply effect for micro and small firms related to local specialization is robust across different specifications. Specifically, the most saturated specification, which includes bank-time fixed effects and controls for sector specialization and prior relationship length, holds when considering provinces as the relevant local market of specialization, computing the specialization variable using only micro and small firms, and considering applications granted if a new loan is observed for that bank-firm pair four or five months after the application.

Finally, Tables A7 and A8 in the Appendix compare the interest rates charged on new loans granted to micro and small firms based on the degree of bank local specialization, and the interest rates charged on new loans to medium and large firms based on the degree of bank sector specialization. Although the evidence is not statistically significant at conventional levels, it indicates a negative correlation between loan rates on newly originated loans for micro and small firms and local specialization, as well as for medium and large firms and sector specialization. This suggests that banks do not charge higher interest rates on new loans in areas or sectors where they specialize, aligning with the notion that specialization allows banks to offer slightly lower rates. This finding, combined with the results in Tables 5 and 6, suggests that banks' increased lending supply to micro and small firms in municipal-

ities where they specialize, and to medium and large firms in sectors where they specialize, is not associated with higher interest rates. This is consistent with the enhanced private information banks hold when specializing their lending activities in specific local markets or sectors.

6 Validation of Findings using Relationship Lending

In this section we aim to enhance the validity of our estimation strategy and results on specialization by replicating the analysis using relationship lending instead of specialization. This analysis also contributes to a better understanding of the link between relationship lending, a bank-firm characteristic extensively analyzed in the literature as a potential source of information for banks, and banks' private information. Existing literature indicates that relationship lending, whether through longer lending relationships or other types of products such as transaction accounts, reduces loan interest rates and defaults (Bharath et al., 2011; Puri et al., 2017). Additionally, novel research shows that through longer relationships, banks are able to extract enhanced private information about their borrowers (Claessens et al., 2024). Following our previous analyses, we first examine the relation between relationship lending and loan non-performance across different firm sizes. We then focus on banks' internal risk assessments to explore whether relationship lending enables banks to obtain superior private information. Finally, we explore whether relationship lending influences loan supply.

We estimate equation 2 and present the results in Table 7, which shows the relation between relationship lending and loan non-performance for different firm sizes. Column (1) provides estimates for all firms, indicating that the length of the relationship between firms and banks is associated with a lower probability of ex-post non-performance for new loans. Specifically, a loan granted by a bank to a firm with the longest relationship length is approximately 1.12 p.p. less likely to become non-performing compared to other loans, after controlling for bank-time and municipality-sector-size-time factors.[32]

Columns (2) and (3) show results for new loans granted to micro and small firms and to medium and large firms, respectively. While relationship lending is negatively associated with loan ex-post non-performance, this relationship is stronger for smaller firms, consistent with smaller firms being more subject to informational frictions. A loan granted by a bank to a micro or small (medium or large) firm with the longest relationship length is approximately

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[32]We compute relationship lending from the year 2000 and interpret this estimate using the difference in quarters between the average relationship length for the firm with the longest relationship for a given bank (82) and the average relationship length of other firms (25).

1.43 (0.36) p.p. less likely to become non-performing compared to other loans. Columns (4) to (7) present results for firms of each sample size, with the strongest effect observed in new loans to micro firms, where a loan granted by a bank to a micro firm with the longest relationship length is approximately 2.16 p.p. less likely to become non-performing compared to other loans. Figure 9 visually illustrates the interpreted coefficients and 95% confidence intervals for new loans granted to firms of different sizes.[33]

Figure 10 computes and plots the ROC curves for the PDs from both the bank with the longest and the bank with the shortest relationship length for a given micro or small firm or a given medium or large firm, replicating the approach used in Section 4. The results indicate that banks with longer lending relationships with a given firm possess better private information, as evidenced by a higher probability of correctly distinguishing between performing and non-performing firms. This result is stronger in economic terms and statistical significance for micro and small firms compared to medium and large firms, consistent with smaller firms being subject to more informational frictions. When evaluating micro and small firms, the AUC for the bank with the longest relationship is 84.1%, compared to 82.03% for the bank with the shortest relationship. The difference of 2.07 p.p. is statistically significant at the 1% level. However, when evaluating medium and large firms, the AUC for the bank with the longest relationship is 86.78%, compared to 86.09% for the bank with the shortest relationship. In this case, the difference of 0.69 p.p. is smaller in magnitude and not statistically significant at conventional levels.[34]

Table 8 examines the link between relationship lending and loan supply by estimating equation 3 for micro and small firms and for medium and large firms. Columns (1) and (3) show that loan applications made by a firm in a given month are more likely to be granted by banks with which the firm has a longer lending relationship both for micro and small firms and for medium and large firms. Columns (2) and (4) present the results for our preferred specification controlling for bank-wide factors. We estimate that an application made by a micro or small firm to the bank with the longest relationship length is approximately 37 p.p. more likely to be granted compared to other applications, while an application made by a medium or large firm is approximately 33 p.p. more likely to be granted compared to other applications. These results are statistically significant at the 1% level, being the economic magnitude slightly larger for micro and small firms. These findings are consistent with relationship lending being associated with enhanced loan supply.[35]

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[33]Table A9 in the Appendix shows that the link between relationship lending and future loan non-performance for new loans granted to micro and small firms holds across different specifications of fixed effects.

[34]Figure A8 in the Appendix shows that this result holds when using the credit exposure a firm has with a bank as an alternative measure of relationship lending (Jiménez et al., 2022).

[35]Table A10 in the Appendix provides evidence that banks charge lower interest rates on new loans granted

Overall, these results indicate that banks enhance their non-transferable private information about specific borrowers through relationship lending, which is associated with decreased loan non-performance and increased loan supply, particularly for smaller firms. This finding aligns with prior literature on the importance of relationship lending and validates our analyses of specialization in Sections 3, 4, and 5.

7   Conclusion

In this paper, we examine the relevance of local and sector specialization on ex-post loan non-performance, documenting their different relevance depending on firms' size. Crucially we also establish the first direct evidence of enhanced banks' local or sector-specific private information linked to specialization. Using comprehensive data on all new loans granted by banks to firms in Spain from the second quarter of 2018 to the third quarter of 2024, we document how banks specialize geographically in specific municipalities and sectorally in certain sectors. Specifically, we show that local specialization correlates with reduced future loan non-performance for micro and small firms, whereas sector specialization is more pertinent for medium and large firms. While we are cautious about establishing causality, our results are estimated controlling for firm types, local market and sector sizes, bank-wide factors such as overall bank informational advantages across all markets and sectors, and firm-specific information gathered through relationship lending.

Our findings have important implications for the literature on bank lending specialization and for studies emphasizing the differences between small and large firms. Banks can acquire enhanced local-specific private information by developing expertise and skills through specializing their lending activities in specific geographical markets. This informational advantage is particularly relevant for screening and monitoring smaller borrowers, who are more prone to information frictions and, due to the lower geographical diversification of their activities, suppliers, and customers, might also be more susceptible to idiosyncratic local shocks. Conversely, by specializing in specific sectors, banks might develop sector-specific private information that is particularly relevant for evaluating larger borrowers. These borrowers may be better able to diversify any local shocks due to their exposure to multiple local markets but might be more susceptible to sector-wide shocks.

We use the reported PDs under the IRB approach as a measure of banks' private information about corporate borrowers' risk assessments (Howes and Weitzner, 2023; Claessens et al., 2024) to provide direct evidence of the link between enhanced private information

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to firms with longer relationship lengths, with its economic magnitude being again slightly larger for micro and small firms.

and specialization. Consistent with our findings on the relevance of local specialization for micro and small firms, and sectoral specialization for medium and large firms, we show that internally estimated PDs from locally (sectoral) specialized banks are more informative and better differentiate between performing and non-performing micro and small (medium and large) firms. This insight is crucial for understanding the production of private information by banks, and to our knowledge, this is the first empirical study providing such evidence linked to specialization.

The paper also has implications for the lending supply of banks based on their degree of specialization. By analyzing bank requests for borrower information recorded in the Spanish Credit Registry, interpreted as loan applications, we investigate loan supply while controlling for loan demand using a within-firm comparison. We find that loan applications by micro and small firms are more likely to be granted by banks with a higher degree of local specialization in the markets where these firms are located. Similarly, loan applications by medium and large firms have a higher probability of being granted by banks highly specialized in the firm's sector. Overall, our findings are valuable for policymakers aiming to comprehend the benefits of bank lending specialization and to understand banks' diversification decisions.

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Figure 1: Local Specialization
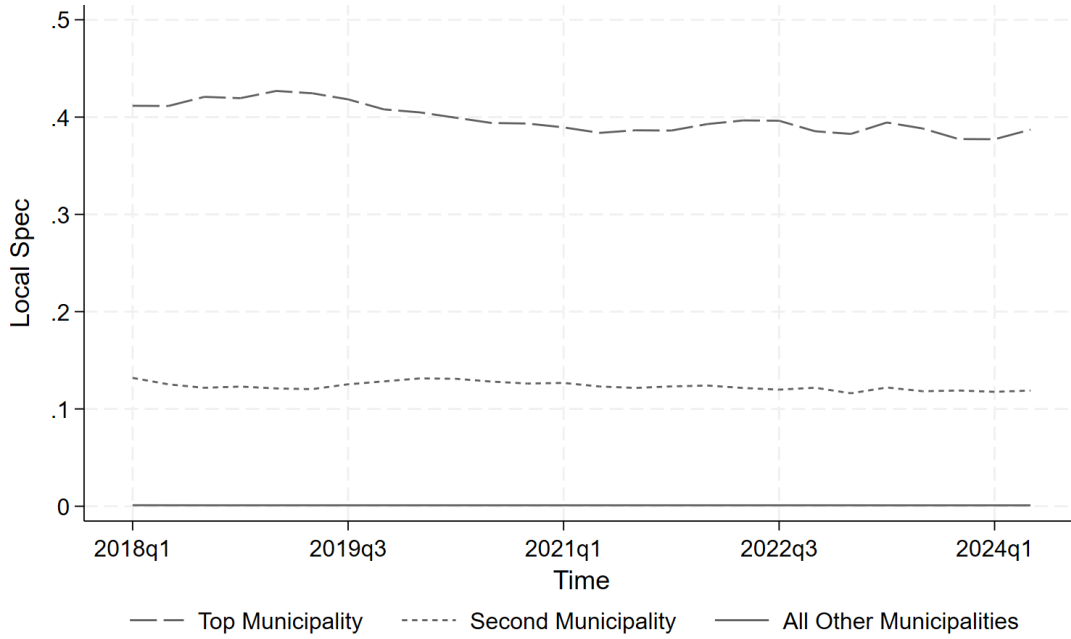
(a) Local Specialization (Volume Unweighted)
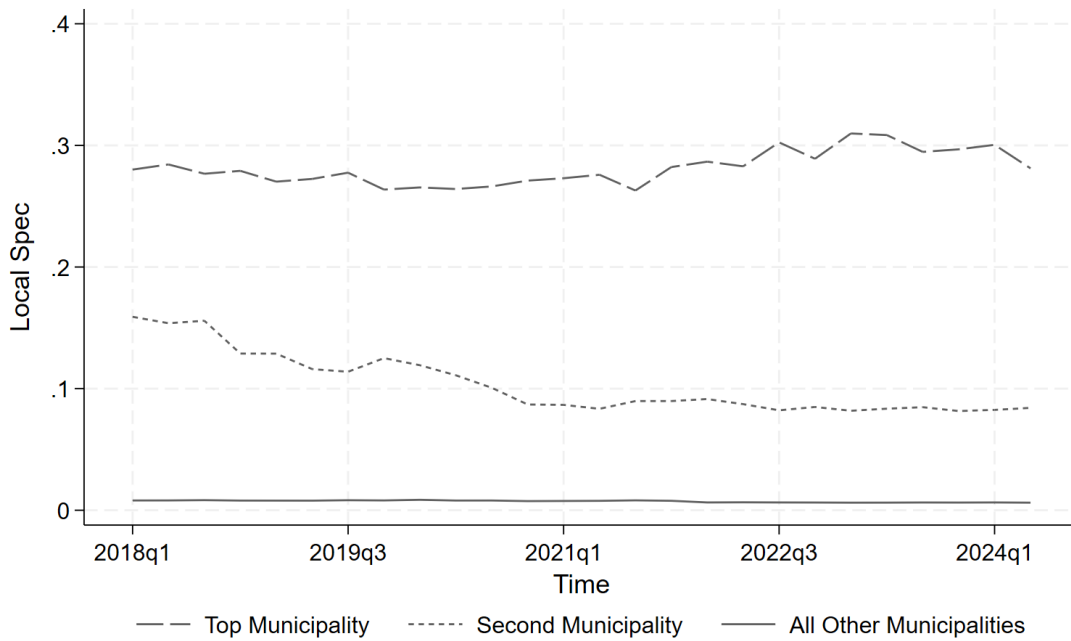
(b) Local Specialization (Volume Weighted)

Notes. This figure plots the degree of local specialization of banks in their top, second, and all other municipalities. Panel (a) presents the unweighted average local specialization. Panel (b) presents the weighted average local specialization using lending amounts as weights. The underlying data is from the Spanish Credit Registry.

Figure 2: Sector Specialization
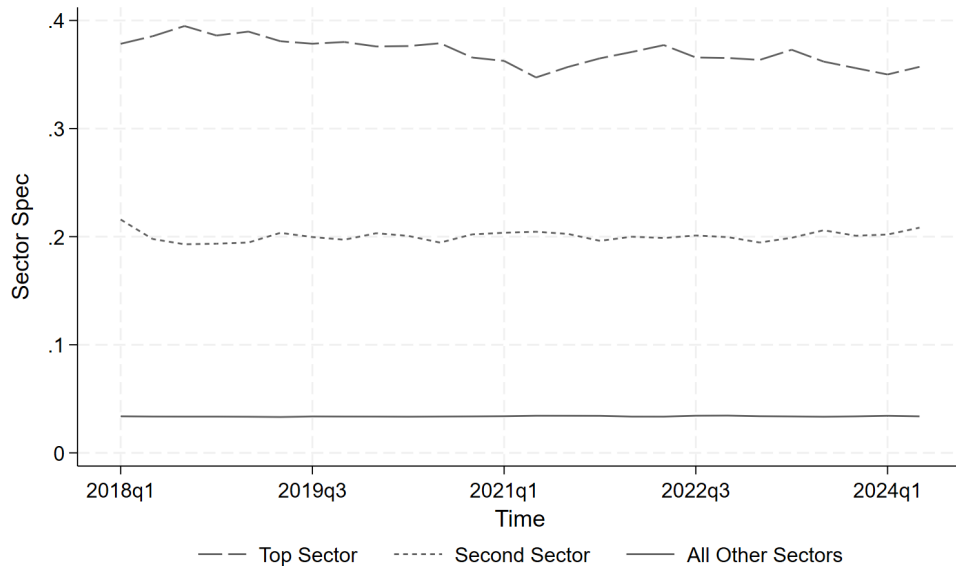
(a) Sector Specialization (Volume Unweighted)
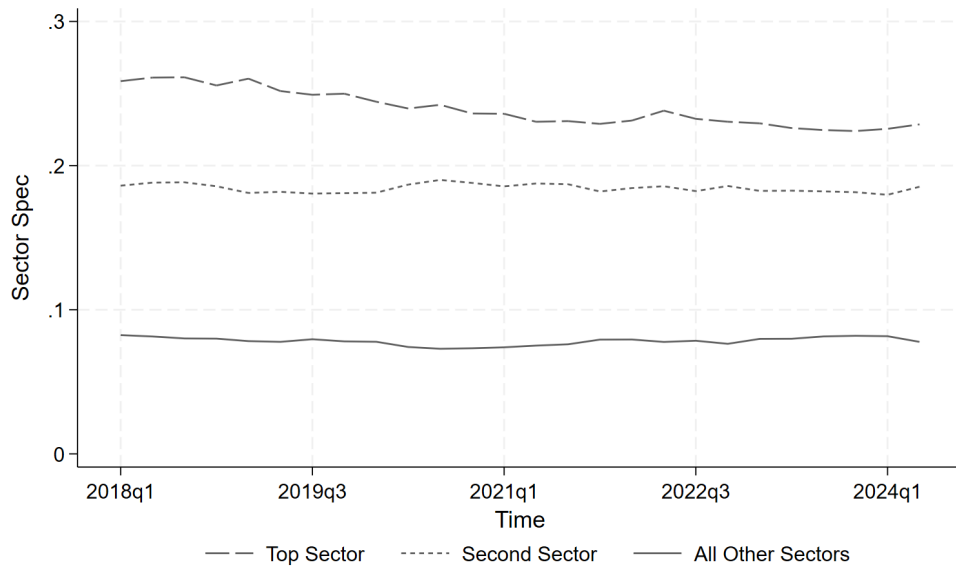
(b) Sector Specialization (Volume Weighted)

Notes. This figure plots the degree of sector specialization of banks in their top, second, and all other sectors. Panel (a) presents the unweighted average sector specialization. Panel (b) presents the weighted average sector specialization using lending amounts as weights. The underlying data is from the Spanish Credit Registry. The sample is from the third quarter of 2018 to the second quarter of 2024.

Figure 3: Average Local Specialization in Spain
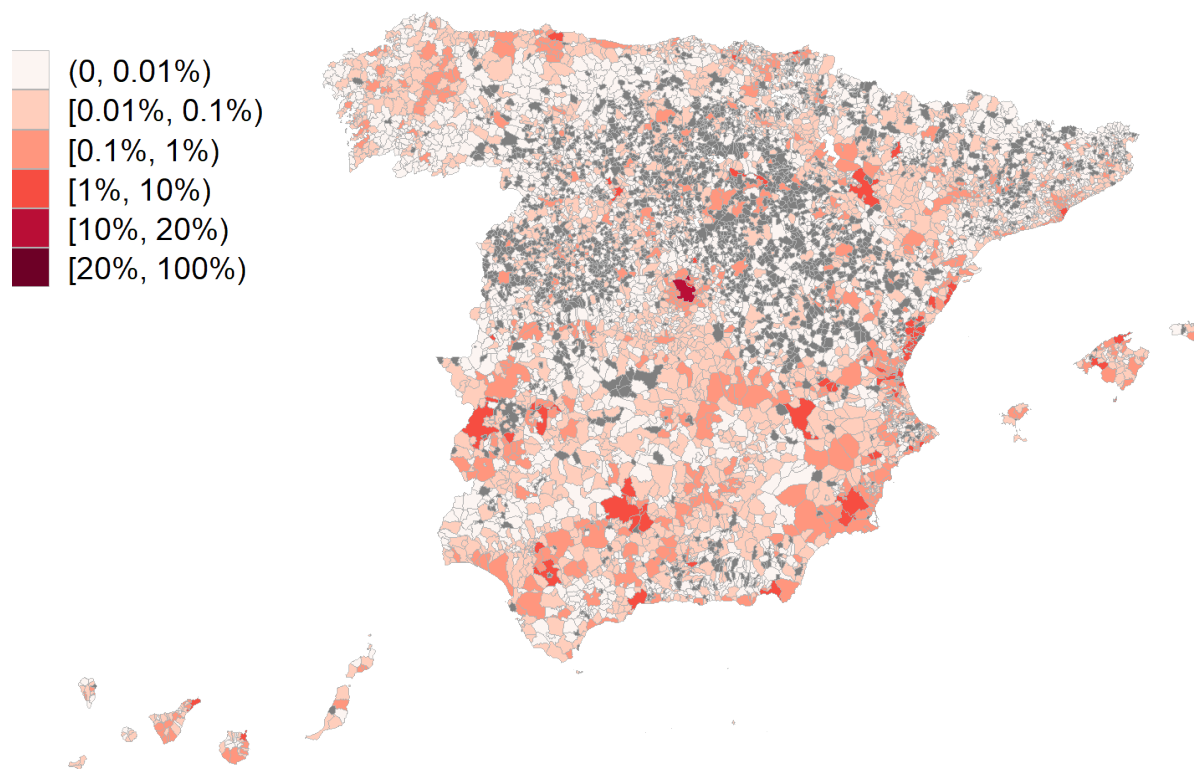
Notes. This map displays the average local specialization of banks across Spanish municipalities, presented as a percentage (%). Municipalities colored in grey indicate areas without headquartered firms having outstanding loans. The underlying data is from the Spanish Credit Registry. The sample is from the second quarter of 2024.

Figure 4: Average Sector Specialization
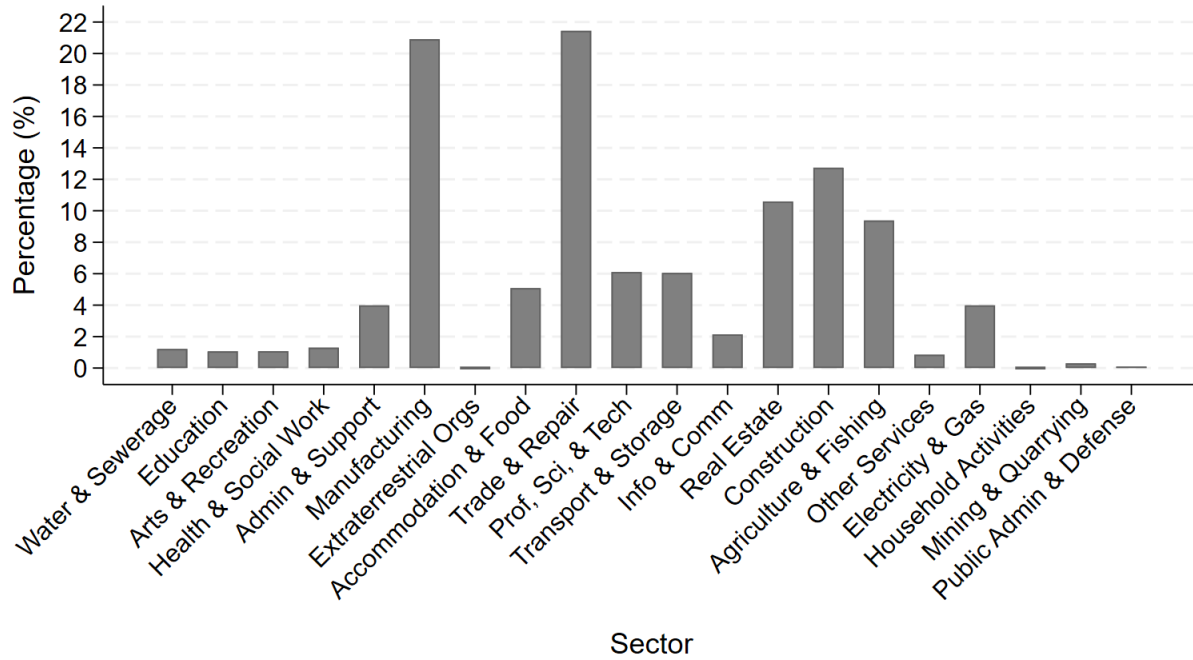
Notes. This figure displays the average sector specialization of banks across sectors, presented as a percentage (%). The underlying data is from the Spanish Credit Registry. The sample is from the second quarter of 2024.

Figure 5: Specialization, Loan Performance, and Firm Size: Interpreted Coefficients
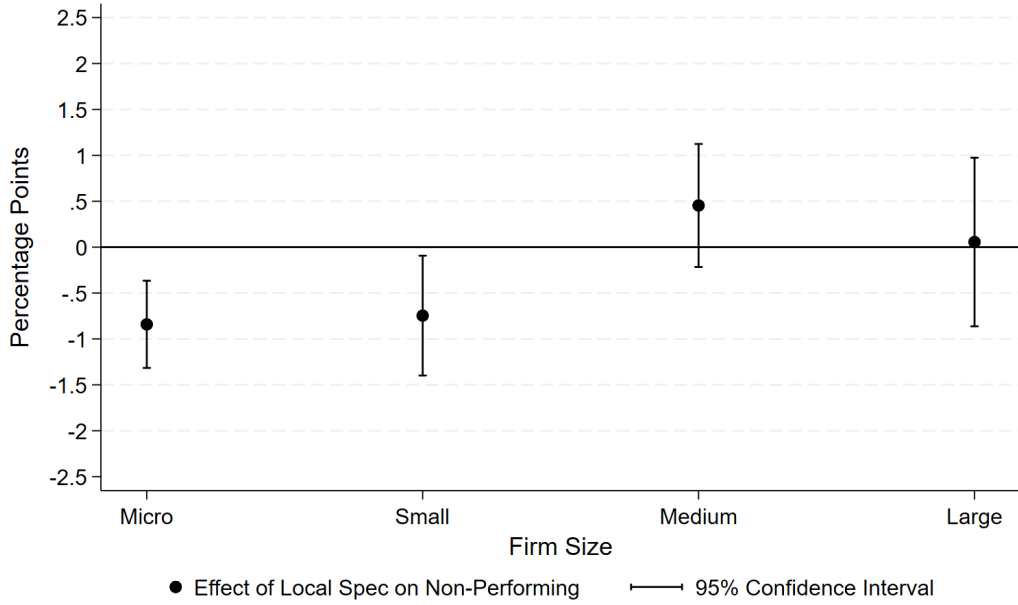
(a) Local Specialization
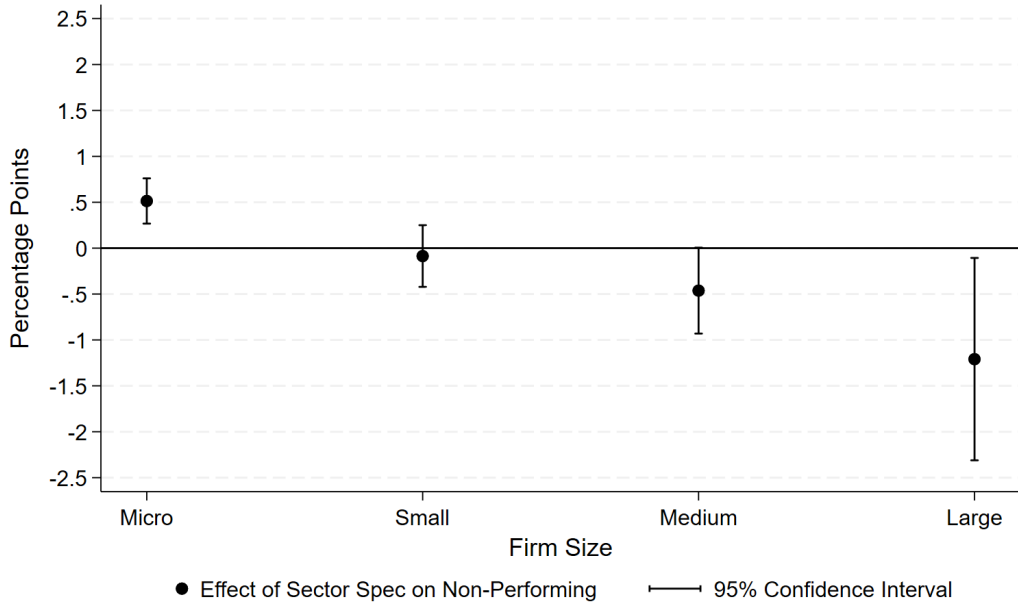
(b) Sector Specialization

Notes. This figure shows the relationship between banks' local and sector specialization and loan non-performance for loans granted to firms in the banks' top municipality or sector compared to other municipalities or sectors, depending on firm size. Panel (a) presents the results for local specialization. Panel (b) presents the results for sector specialization. The estimates and statistical significance (95% confidence intervals) are assessed by multiplying the estimated coefficients presented in Table 3 by the difference between the average local specialization in the top municipality or sector and the average in other municipalities or sectors presented in Table 2. The underlying data is from the Spanish Credit Registry. The sample is from the third quarter of 2018 to the second quarter of 2024.

Figure 6: Local Specialization, Loan Performance, and Micro-Small Firms: Across Sectors
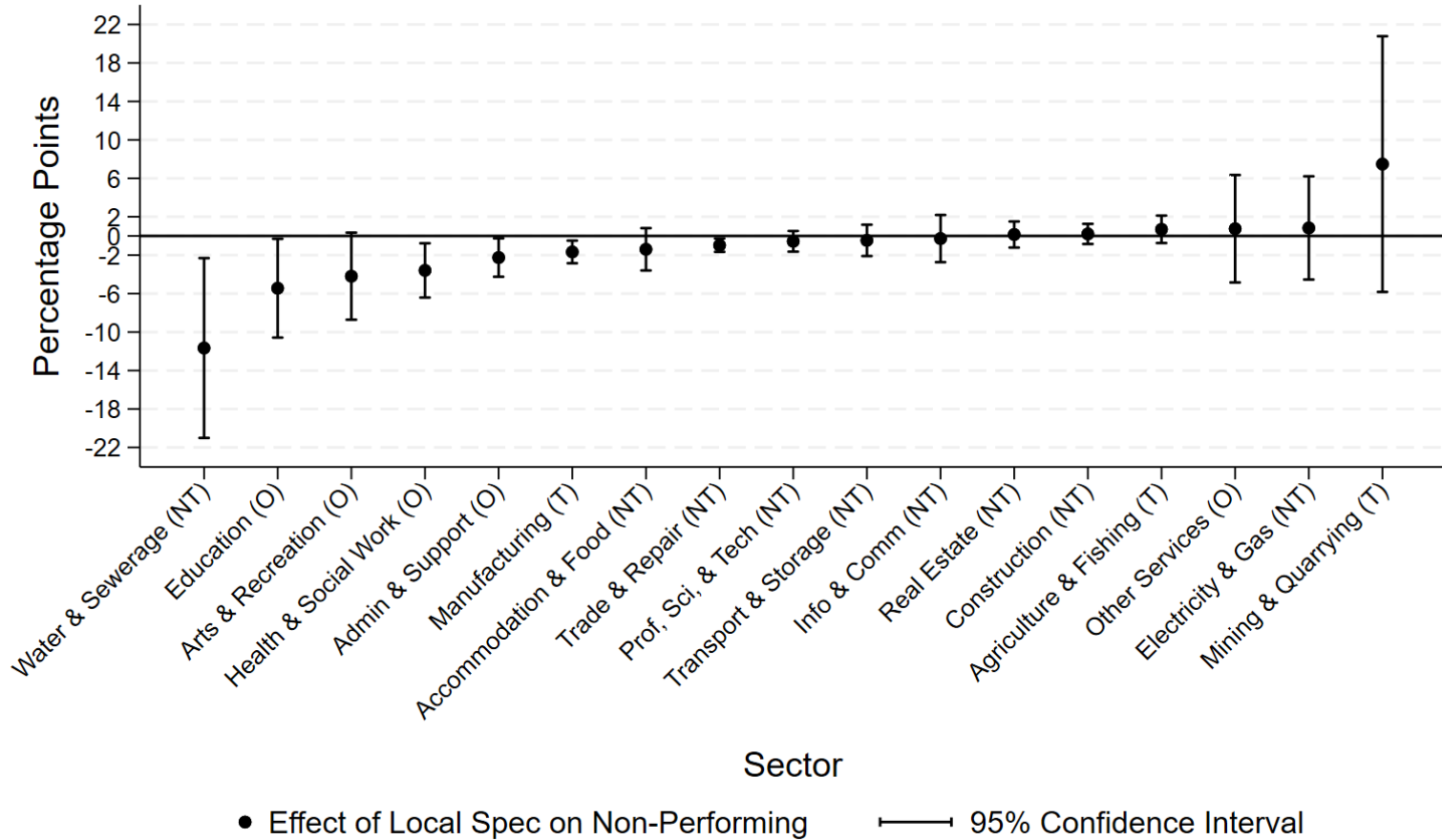
Notes. This figure shows the relationship between banks' local specialization and loan non-performance for loans granted to micro and small firms in the banks' top municipality compared to other municipalities, across different sectors. The estimates and statistical significance (95% confidence intervals) are assessed by multiplying the estimated coefficients presented in Table A3 in the Appendix by the difference between the average local specialization in the top municipality and the average in other municipalities presented in Table 3. We classify sectors into three categories: non-tradable (NT), tradable (T), and other (O), following the methodology of Mian et al. (2020) in their international panel data. The underlying data is from the Spanish Credit Registry. The sample is from the third quarter of 2018 to the second quarter of 2024.

Figure 7: Local Specialization, Private Information, and Micro-Small Firms
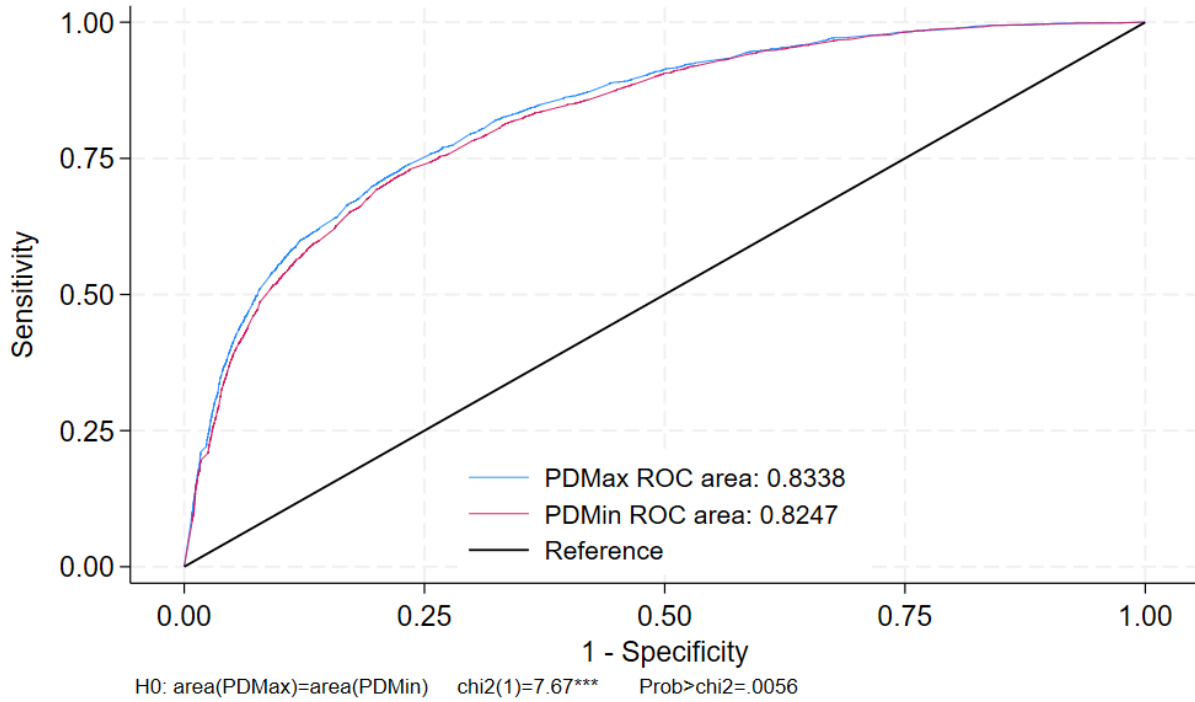
Notes. This figure shows the predictive accuracy of the internally estimated PD by banks with the highest and lowest local specialization for predicting realized default in micro and small firms, using the area under the receiver operating curve (AUC). The x-axis plots sensitivity (true positive rate). The y-axis plots 1-specificity (false positive rate). The blue and red ROC curves represent the PD from banks with the highest and lowest local specialization, respectively. The AUCs measure how well each PD discriminates ex-post realized default. A statistical test estimates if the difference between the AUCs is significant at conventional levels. The straight black line, with an AUC of 0.5, suggests a prediction no better than random. The data are from the Spanish Credit Registry. The sample is from the fourth quarter of 2021 to the second quarter of 2024. *** indicates significance at the 0.01 level.

Figure 8: Sector Specialization, Private Information, and Medium-Large Firms
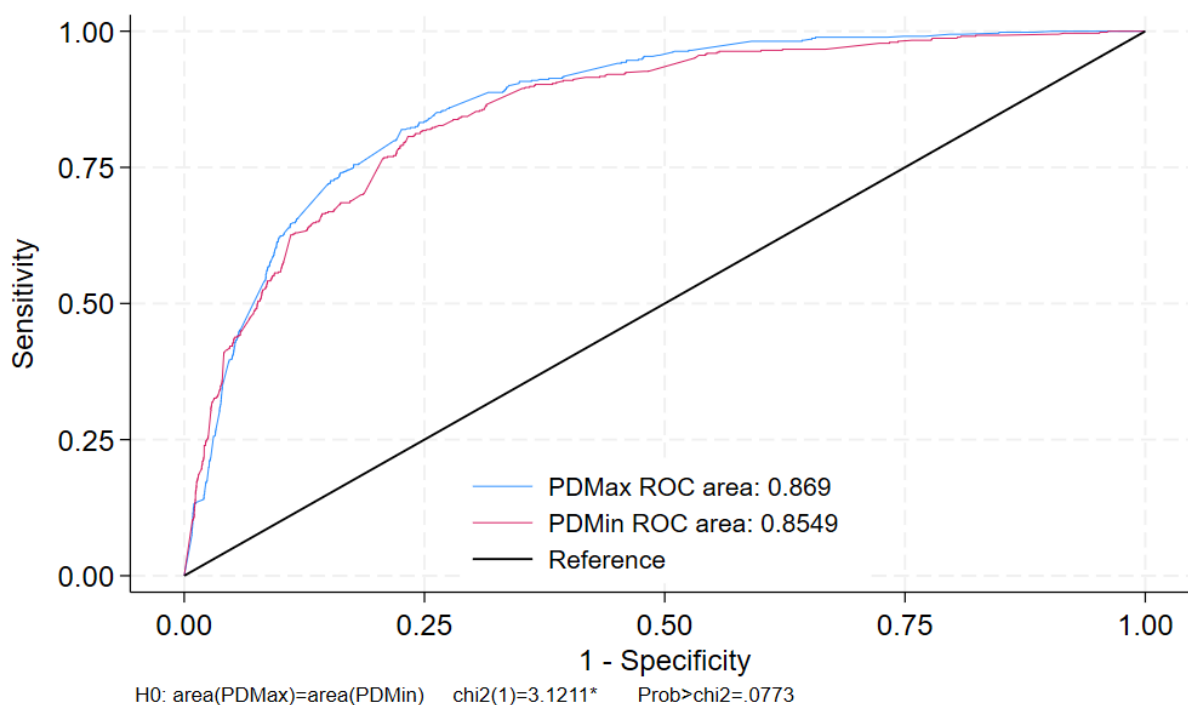
H0: area(PDMax)=area(PDMin)   chi2(1)=3.1211*   Prob>chi2=.0773

Notes. This figure shows the predictive accuracy of the internally estimated PD by banks with the highest and lowest sector specialization for predicting realized default in medium and large firms, using the area under the receiver operating curve (AUC). The x-axis plots sensitivity (true positive rate). The y-axis plots 1-specificity (false positive rate). The blue and red ROC curves represent the PD from banks with the highest and lowest sector specialization, respectively. The AUCs measure how well each PD discriminates ex-post realized default. A statistical test estimates if the difference between the AUCs is significant at conventional levels. The straight black line, with an AUC of 0.5, suggests a prediction no better than random. The data are from the Spanish Credit Registry. The sample is from the fourth quarter of 2021 to the second quarter of 2024. * indicates significance at the 0.1 level.

Figure 9: Relationship Lending, Loan Performance, and Firm Size: Interpreted Coefficients
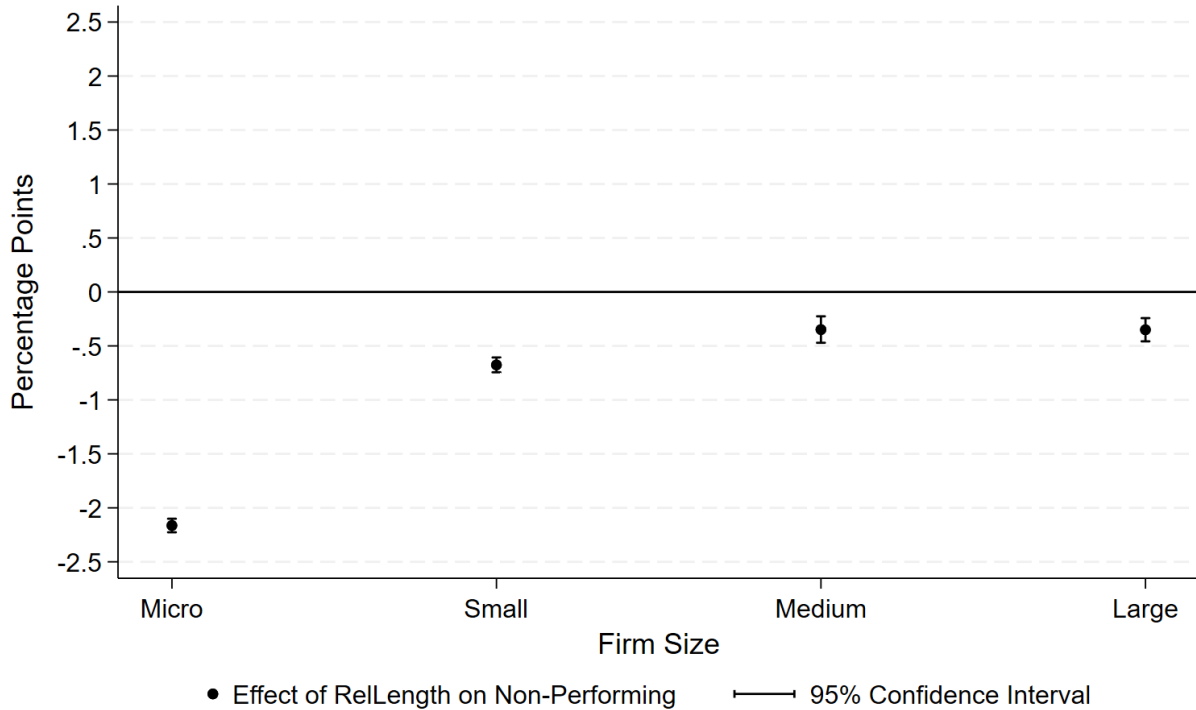
Notes. This figure shows the association between relationship lending and loan non-performance for loans granted to firms with the longest relationship length for a given bank compared to the average relationship length of other firms, depending on firm size. The estimates and statistical significance (95% confidence intervals) are assessed by multiplying the estimated coefficients presented in Table 7 by the difference between the average relationship length for the firm with the longest relationship (82) and the average for other firms (25). The underlying data is from the Spanish Credit Registry. The sample is from the third quarter of 2018 to the second quarter of 2024.

Figure 10: Relationship Lending and Private Information
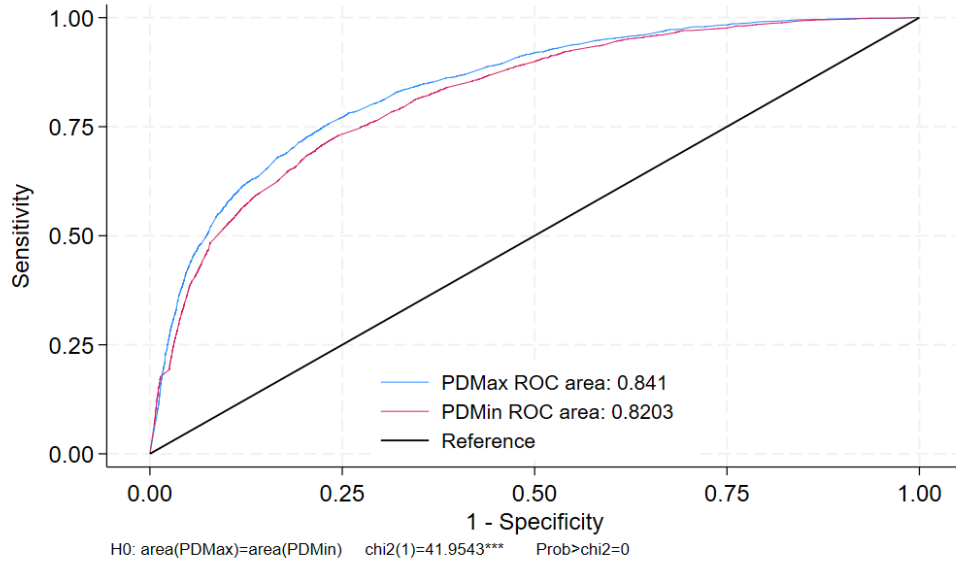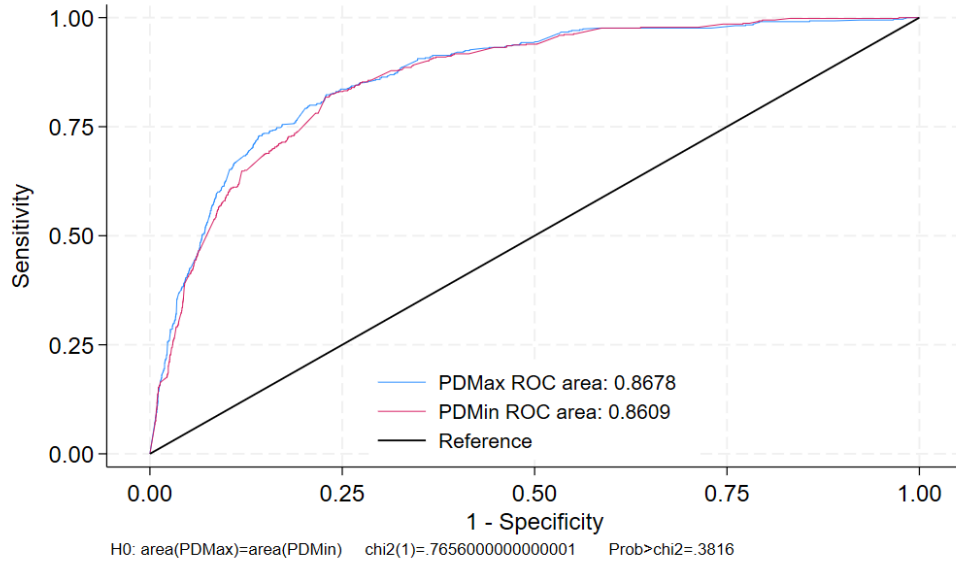
(a) Micro-Small Firms


(b) Medium-Large Firms

Notes. This figure shows the predictive accuracy of the internally estimated PD by banks with the highest and lowest relationship length for predicting realized default for both micro and small firms and medium and large firms, using the area under the receiver operating curve (AUC). Panel (a) presents the results for micro and small firms. Panel (b) presents the results for medium and large firms. The x-axis plots sensitivity (true positive rate). The y-axis plots 1-specificity (false positive rate). The blue and red ROC curves represent the PD from banks with the highest and lowest relationship length, respectively. The AUCs measure how well each PD discriminates ex-post realized default. A statistical test estimates if the difference between the AUCs is significant at conventional levels. The straight black line, with an AUC of 0.5, suggests a prediction no better than random. The data are from the Spanish Credit Registry. The sample is from the fourth quarter of 2021 to the second quarter of 2024. *** indicates significance at the 0.01 level.

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Table 1: Summary Statistics

	Micro & Small Firms						Medium & Large Firms					
	N	mean	p25	p50	p75	sd	N	mean	p25	p50	p75	sd
Amount (thousand €)	5,955,692	48.753	3.175	12.000	35.000	454.399	3,705,853	143.063	0.648	6.935	36.707	6,915.424
Amount (log)	5,955,692	2.308	1.155	2.485	3.555	1.849	3,705,853	1.629	-0.434	1.937	3.603	2.744
Interest Rate (%)	5,955,692	4.065	2.180	3.659	5.640	2.438	3,705,853	3.814	1.789	4.000	5.580	2.199
Maturity (remaining quarters)	5,955,692	5.561	1.000	1.000	4.000	9.460	3,705,853	2.693	1.000	1.000	2.000	6.111
Secured	5,955,692	0.030	0.000	0.000	0.000	0.171	3,705,853	0.030	0.000	0.000	0.000	0.170
NP	5,955,692	0.017	0.000	0.000	0.000	0.128	3,705,853	0.005	0.000	0.000	0.000	0.069
RelLength (quarters)	5,955,692	32.382	10.000	24.000	51.000	27.130	3,705,853	46.942	25.000	42.000	72.000	27.464
Local Spec	5,939,099	0.029	0.000	0.001	0.009	0.074	3,697,362	0.034	0.001	0.003	0.020	0.075
Local MktSh	5,939,099	0.175	0.080	0.166	0.248	0.120	3,697,362	0.128	0.055	0.106	0.174	0.104
Sector Spec	5,955,524	0.144	0.078	0.163	0.186	0.080	3,705,760	0.153	0.102	0.167	0.185	0.090
Sector MktSh	5,955,524	0.137	0.042	0.153	0.216	0.091	3,705,760	0.097	0.050	0.065	0.156	0.078

Notes. This table presents summary statistics at the loan level for the period from the third quarter of 2018 to the second quarter of 2024. The data are reported quarterly. Loans are counted only at their origination. Amount is the total committed exposure of the granted loans. Interest rate is the rate charged for the loan. Maturity is the remaining maturity in quarters of the loan. Secured is an indicator that takes the value of 1 if the loan is collateralized. NP is an indicator that takes the value of 1 if the loan enters in default after its origination, defined as being overdue by 90 days or more. RelLength is the number of quarters where the bank-firm relationship has a positive amount of total outstanding lending, starting from the first quarter of the year 2000. Local Spec is the degree of local specialization of a given bank in a municipality and quarter, as defined in equation 1. Local MktSh is the bank's local market share in a given municipality and quarter. Sector Spec is the degree of sector specialization of a given bank in a sector and quarter. Sector MktSh is the bank's sector market share in a given sector and quarter. The statistics are split based on whether a loan is granted to a micro and small firm or to a medium or large firm. The data are from the Spanish Credit Registry.

Table 2: Summary Statistics of Local and Sector Specialization

Specialization type	Top municipality or industry					All other municipalities or industries				
	mean	p25	p50	p75	sd	mean	p25	p50	p75	sd
Local Spec (municipality)	0.396	0.191	0.329	0.575	0.249	0.001	0.000	0.000	0.000	0.008
Sector Spec (21 sectors)	0.369	0.252	0.312	0.423	0.177	0.046	0.006	0.019	0.060	0.061

Notes. This table presents summary statistics for the local specialization and sector specialization measures. The variables are defined in Table 1. The statistics for both specialization measures are divided based on whether the municipality or sector is the top municipality or sector. The top municipality is defined as the municipality where a given bank has its highest degree of local specialization. The top sector is the sector where a given bank has its highest degree of sector specialization. The data are from the Spanish Credit Registry.

Table 3: Specialization, Loan Performance, and Firm Size

| | NP | | | | | | |
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Local Spec	-0.0103***	-0.0210***	0.0109	-0.0213***	-0.0189**	0.0115	0.00142
	(0.00395)	(0.00500)	(0.00672)	(0.00613)	(0.00842)	(0.00865)	(0.0119)
Sector Spec	0.00214	0.0100***	-0.0198***	0.0159***	-0.00267	-0.0143*	-0.0374**
	(0.00260)	(0.00303)	(0.00682)	(0.00389)	(0.00531)	(0.00739)	(0.0174)
Observations	9,350,812	5,717,604	3,633,052	2,868,821	2,848,603	1,842,658	1,790,200
R-squared	0.204	0.180	0.337	0.158	0.229	0.325	0.370
Bank-Quarter FE	Y	Y	Y	Y	Y	Y	Y
MIST FE	Y	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y	Y
Cluster s.e.	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter
Sample of firms	All	MicroSmall	MedLarge	Micro	Small	Medium	Large

Notes. This table estimates the relationship between banks' local and sector specialization and loan non-performance for firms of different sizes. The data are at the loan level, focusing on the first observation of a loan at the time it is granted, from the third quarter of 2018 to the second quarter of 2024. NP is an indicator that takes the value of 1 if the loan enters in default after its origination. Column (1) includes all firms, regardless of size. Column (2) focuses on micro and small firms, while Column (3) focuses on medium and large firms. Columns (4) to (7) further break down the analysis by micro, small, medium, and large firms, respectively. MIST includes the set of municipality-sector-size-time fixed effects. The other variables are defined in Table 1. The data are from the Spanish Credit Registry. Fixed effects are denoted at the bottom of the table. Standard errors are clustered by firm-quarter. *, **, *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Table 4: Local Specialization, Loan Performance, and Micro-Small Firms: Robustness

	NP									
	Excess (1)	Relative (2)	Spec MicroSmall (3)	Number (4)	Spec Without Firm (5)	No Sector (6)	No Sector MktSh (7)	Quartiles (8)	Top (9)	Spec > Median (10)
Panel A: Specialization measures and controls										
Local Spec	-0.0210*** (0.00500)	-1.89e-05*** (5.55e-06)	-0.0172*** (0.00479)	-0.0109* (0.00570)	-0.0155*** (0.00505)	-0.0207*** (0.00500)	-0.0296*** (0.00486)			
Local Spec d4								-0.00775*** (0.000850)	-0.00209*** (0.000389)	
Local Spec d3								-0.00577*** (0.000756)		
Local Spec d2								-0.00458*** (0.000731)		
Local Spec d34										-0.00179*** (0.000324)
Observations	5,717,604	5,717,604	5,713,151	5,717,604	5,072,579	5,717,709	5,717,709	5,717,604	5,717,604	5,717,604
R-squared	0.180	0.180	0.180	0.180	0.199	0.180	0.180	0.180	0.180	0.180
Bank-Quarter FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
MIST FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Cluster s.e.	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter
Sample of firms	MicroSmall	MicroSmall	MicroSmall	MicroSmall	MicroSmall	MicroSmall	MicroSmall	MicroSmall	MicroSmall	MicroSmall
Period	2018q3-2024q2	2018q3-2024q2	2018q3-2024q2	2018q3-2024q2	2018q3-2024q2	2018q3-2024q2	2018q3-2024q2	2018q3-2024q2	2018q3-2024q2	2018q3-2024q2

	NP									
	NP1y (1)	NPdud (2)	Drawn (3)	No ICOs (4)	Not Only New (5)	PD Banks (6)	PD Banks (7)	PD Banks (8)	Before 2022q1 (9)	Province&NACE2d (10)
Panel B: Dependent variables, sample periods, drawn amount and locality										
Local Spec	-0.0159*** (0.00445)	-0.0119* (0.00644)	-0.0198*** (0.00538)	-0.0151*** (0.00466)	-0.0165*** (0.00239)	-0.0329*** (0.0230)	-0.0737*** (0.0235)	-0.0939*** (0.0317)	-0.0232*** (0.00656)	-0.0149*** (0.00253)
PD								0.0774*** (0.0049)		
Observations	5,717,604	5,717,604	5,512,399	4,942,859	30,294,492	3,629,117	1,516,440	1,516,440	3,283,455	5,951,659
R-squared	0.204	0.193	0.181	0.188	0.117	0.173	0.236	0.242	0.158	0.047
Bank-Quarter FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
MIST FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Cluster s.e.	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter
Sample of firms	MicroSmall	MicroSmall	MicroSmall	MicroSmall	MicroSmall	MicroSmall	MicroSmall	MicroSmall	MicroSmall	MicroSmall
Period	2018q3-2024q2	2018q3-2024q2	2018q3-2024q2	2018q3-2024q2	2018q3-2024q2	2018q3-2024q2	2021q4-2023q2	2021q4-2023q2	2018q3-2022q1	2018q3-2024q2

Notes. This table examines the robustness of the relationship between local specialization and loan performance for micro and small firms. Panel A and B report results for different specification of the specialization variable, included controls, dependent variables, sample periods, and local market and sector definition. The variables are defined in Tables 1 and 3. The data are sourced from the Spanish Credit Registry. Fixed effects are indicated at the bottom of the table. Standard errors are clustered by firm-quarter. *, *** denote significance at the 0.1 and 0.01 levels, respectively.

Table 5: Local Specialization, Loan Supply, and Micro-Small Firms

| | LoanGranted | | | |
	(1)	(2)	(3)	(4)
Local Spec	0.204***	0.160***	0.0861**	0.109***
	(0.0348)	(0.0338)	(0.0425)	(0.0419)
Observations	200,031	200,031	198,810	198,810
R-squared	0.506	0.532	0.548	0.560
Bank-Month FE	N	N	Y	Y
Firm-Month FE	Y	Y	Y	Y
Controls	Y	Y	Y	Y
Control RelLength	N	Y	N	Y
Cluster s.e.	Firm-Month	Firm-Month	Firm-Month	Firm-Month
Sample of firms	MicroSmall	MicroSmall	MicroSmall	MicroSmall
Period	2018m9-2024m6	2018m9-2024m6	2018m9-2024m6	2018m9-2024m6

Notes. This table examines the relationship between local specialization and loan supply for micro and small firms. The analysis is conducted at the application level. The data cover from September 2018 to June 2024. LoanGranted is an indicator that takes the value of 1 if the loan application is approved within three months of the application. Column (1) includes firm-month fixed effects and controls for local market share, sector specialization, and sector market share, and column (2) adds a control for the length of prior firm-bank relationships. Column (3) includes firm-month and bank-month fixed effects, and controls for local market share, sector specialization, and sector market share, with column (4) adding a control for the length of prior firm-bank relationships. The variables are defined in Table 1. The data are sourced from the Spanish Credit Registry. Fixed effects are indicated at the bottom of the table. Standard errors are clustered by firm-month. **, *** denote significance at the 0.05, and 0.01 levels, respectively.

Table 6: Sector Specialization, Loan Supply, and Medium-Large Firms

| | LoanGranted | | | |
	(1)	(2)	(3)	(4)
Sector Spec	0.125**	0.0969*	0.117	0.0994
	(0.0583)	(0.0561)	(0.0775)	(0.0762)
Observations	38,669	38,669	37,337	37,337
R-squared	0.534	0.572	0.628	0.642
Bank-Month FE	N	N	Y	Y
Firm-Month FE	Y	Y	Y	Y
Controls	Y	Y	Y	Y
Control RelLength	N	Y	N	Y
Cluster s.e.	Firm-Month	Firm-Month	Firm-Month	Firm-Month
Sample of firms	MediumLarge	MediumLarge	MediumLarge	MediumLarge
Period	2018m9-2024m6	2018m9-2024m6	2018m9-2024m6	2018m9-2024m6

Notes. This table examines the relationship between sector specialization and loan supply for medium and large firms. The analysis is conducted at the application level. The data cover from September 2018 to June 2024. LoanGranted is an indicator that takes the value of 1 if the loan application is approved within three months of the application. Column (1) includes firm-month fixed effects and controls for sector market share, local specialization, and local market share, and column (2) adds a control for the length of prior firm-bank relationships. Column (3) includes firm-month and bank-month fixed effects, and controls for sector market share, local specialization, and local market share, with column (4) adding a control for the length of prior firm-bank relationships. The variables are defined in Table 1. The data are sourced from the Spanish Credit Registry. Fixed effects are indicated at the bottom of the table. Standard errors are clustered by firm-month. **, *** denote significance at the 0.05, and 0.01 levels, respectively.

Table 7: Relationship Lending, Loan Performance, and Firm Size

				NP			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
RelLength	-0.000197***	-0.000250***	-6.37e-05***	-0.000379***	-0.000118***	-6.11e-05***	-6.14e-05***
	(3.66e-06)	(4.12e-06)	(7.49e-06)	(5.61e-06)	(6.15e-06)	(1.10e-05)	(9.61e-06)
Observations	9,350,812	5,717,604	3,633,052	2,868,821	2,848,603	1,842,658	1,790,200
R-squared	0.204	0.180	0.337	0.158	0.229	0.325	0.370
Bank-Quarter FE	Y	Y	Y	Y	Y	Y	Y
MIST FE	Y	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y	Y
Cluster s.e.	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter
Sample of firms	All	MicroSmall	MedLarge	Micro	Small	Medium	Large

Notes. This table examines the association between relationship lending and loan performance for firms of different sizes. The data are at the loan level, focusing on the first observation of a loan at the time it is granted, from the third quarter of 2018 to the second quarter of 2024. NP is an indicator that takes the value of 1 if the loan enters in default after its origination. Column (1) includes all firms, regardless of size. Column (2) focuses on micro and small firms, while Column (3) focuses on medium and large firms. Columns (4) to (7) further break down the analysis by micro, small, medium, and large firms, respectively. The variables are defined in Tables 1 and 3. The data are from the Spanish Credit Registry. Fixed effects are denoted at the bottom of the table. Standard errors are clustered by firm-quarter. *** indicates significance at the 0.01 level.

Table 8: Relationship Lending and Loan Supply

| | LoanGranted | | | |
	(1)	(2)	(3)	(4)
RelLength	0.00825***	0.00650***	0.00809***	0.00582***
	(0.000106)	(0.000119)	(0.000195)	(0.000235)
Observations	200,031	198,810	38,669	37,337
R-squared	0.532	0.560	0.572	0.642
Bank-Month FE	N	Y	N	Y
Firm-Month FE	Y	Y	Y	Y
Controls	Y	Y	Y	Y
Cluster s.e.	Firm-Month	Firm-Month	Firm-Month	Firm-Month
Sample of firms	MicroSmall	MicroSmall	MedLarge	MedLarge
Period	2018m9-2024m6	2018m9-2024m6	2018m9-2024m6	2018m9-2024m6

Notes. This table examines the association between relationship lending and loan supply for micro and small firms and for medium and large firms. The analysis is conducted at the application level. The data cover from September 2018 to June 2024. LoanGranted is an indicator that takes the value of 1 if the loan application is approved within three months of the application. Columns (1) and (3) include firm-month fixed effects and controls for local and sector specialization, and local and sector market shares. Columns (2) and (4) add bank-month fixed effects. The variables are defined in Table 1. The data are sourced from the Spanish Credit Registry. Fixed effects are indicated at the bottom of the table. Standard errors are clustered by firm-month. *** denotes significance at the 0.01 level.
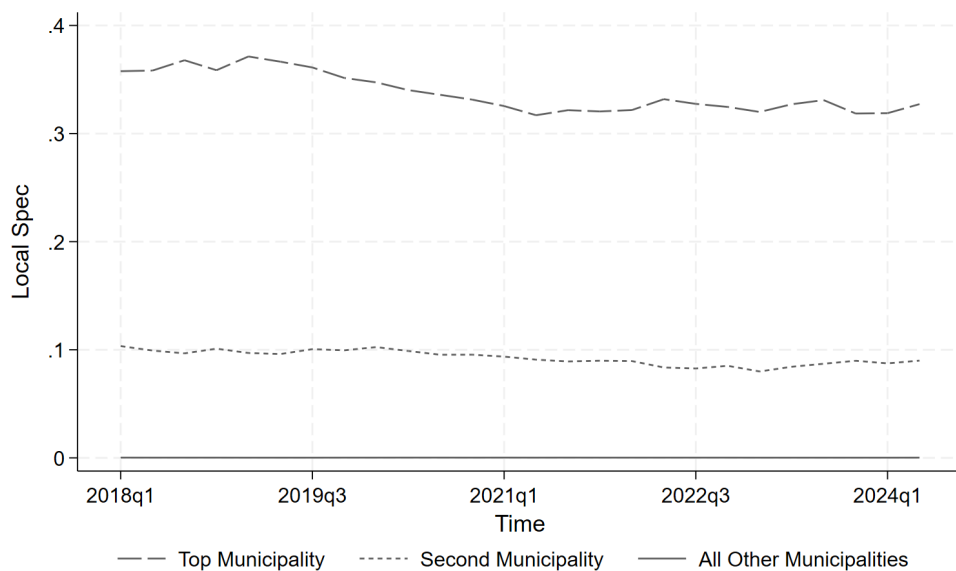
A Appendix

Figure A1: Local Specialization (Excess)

(a) Local Specialization (Excess & Volume Unweighted)
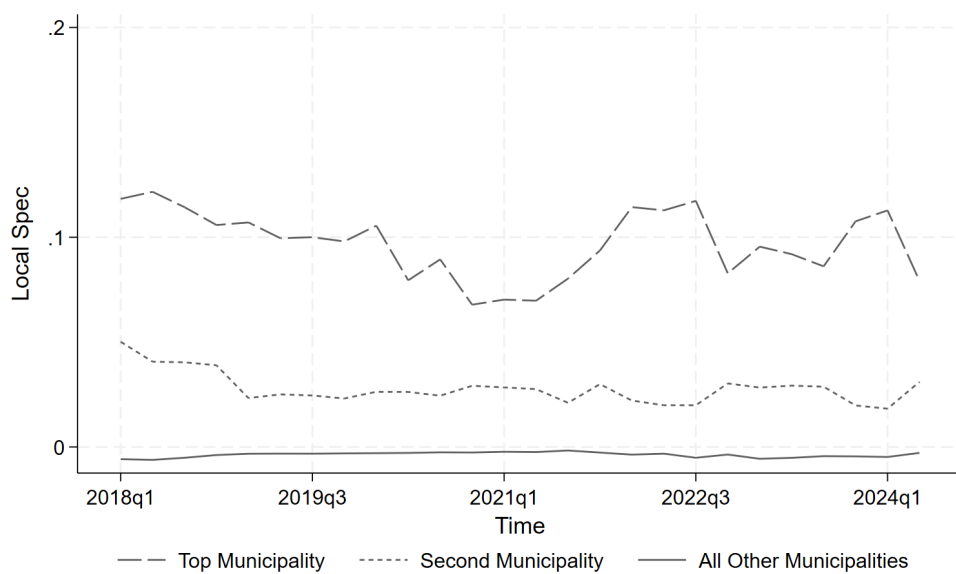
(b) Local Specialization (Excess & Volume Weighted)

Notes. This figure plots the degree of local excess specialization of banks in their top, second, and all other municipalities, using excess specialization as an alternative specification of the variable. Panel (a) presents the unweighted average local excess specialization. Panel (b) presents the weighted average local excess specialization using lending amounts as weights. The underlying data is from the Spanish Credit Registry. The sample is from the third quarter of 2018 to the second quarter of 2024.

Figure A2: Sector Specialization (Excess)
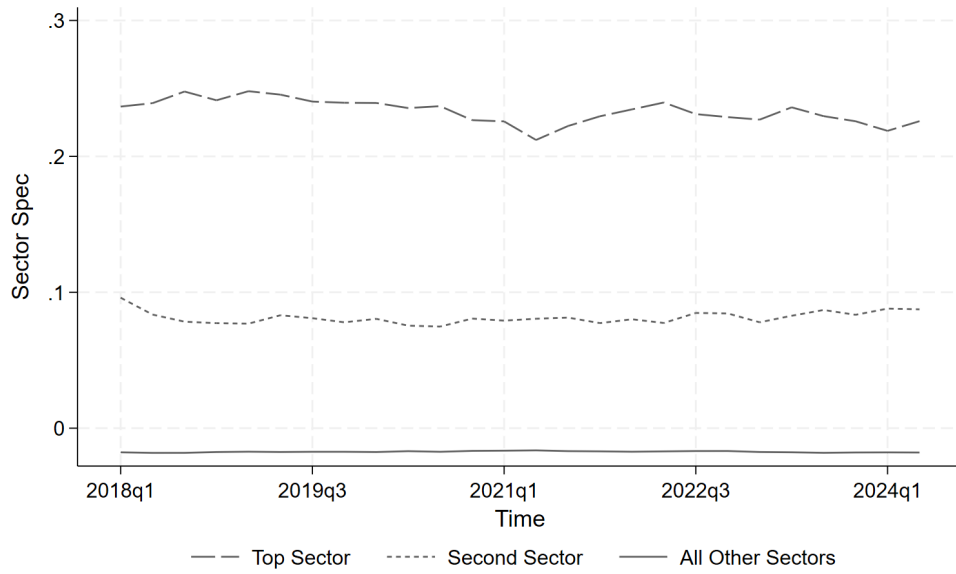
(a) Sector Specialization (Excess & Volume Unweighted)
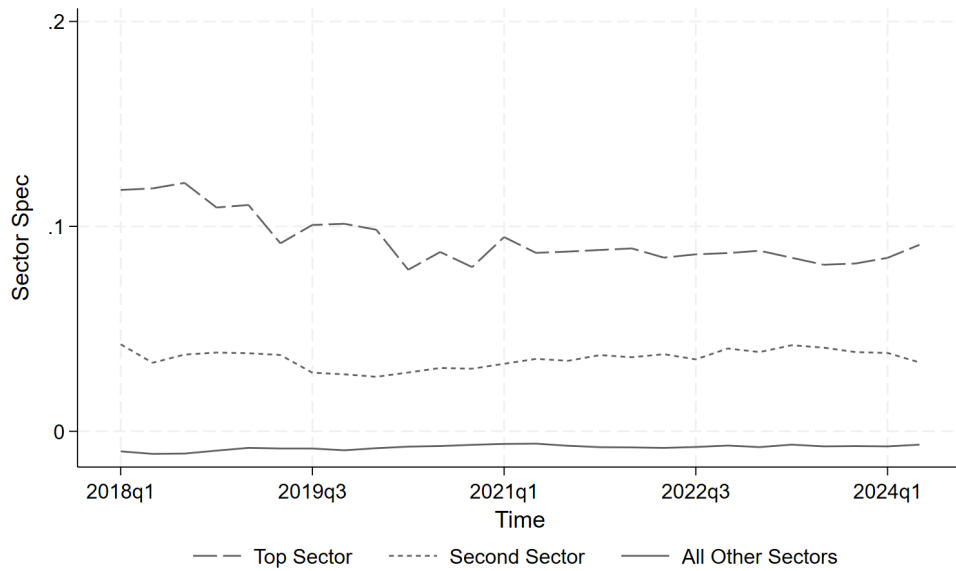
(b) Sector Specialization (Excess & Volume Weighted)

Notes. This figure plots the degree of sector excess specialization of banks in their top, second, and all other sector, using excess specialization as an alternative specification of the variable. Panel (a) presents the unweighted average Sector excess specialization. Panel (b) presents the weighted average Sector excess specialization using lending amounts as weights. The underlying data is from the Spanish Credit Registry. The sample is from the third quarter of 2018 to the second quarter of 2024.

Figure A3: Average Local Specialization in Spain: Micro-Small Firms
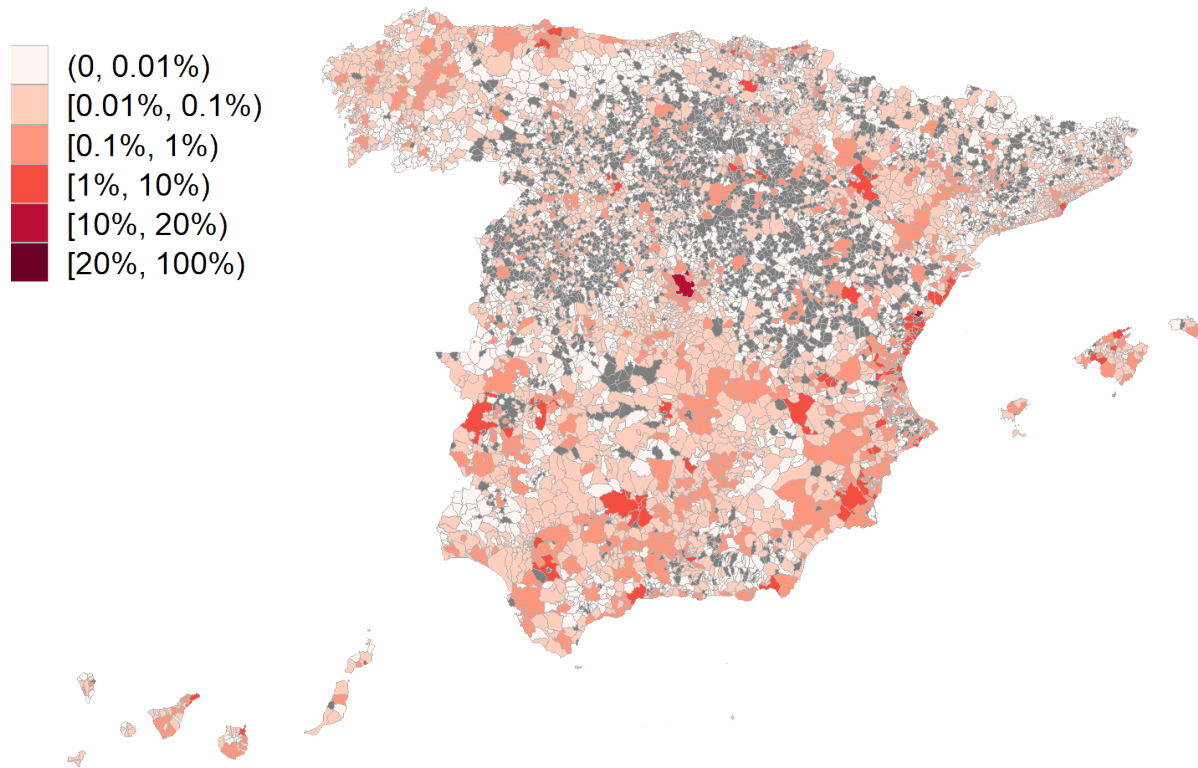
Notes. This map displays the average local specialization of banks across Spanish municipalities, presented as a percentage (%), based on lending to micro and small firms. Municipalities colored in grey indicate areas without headquartered firms having outstanding loans. The underlying data is from the Spanish Credit Registry. The sample is from the second quarter of 2024.

Figure A4: Average Sector Specialization: Medium-Large Firms
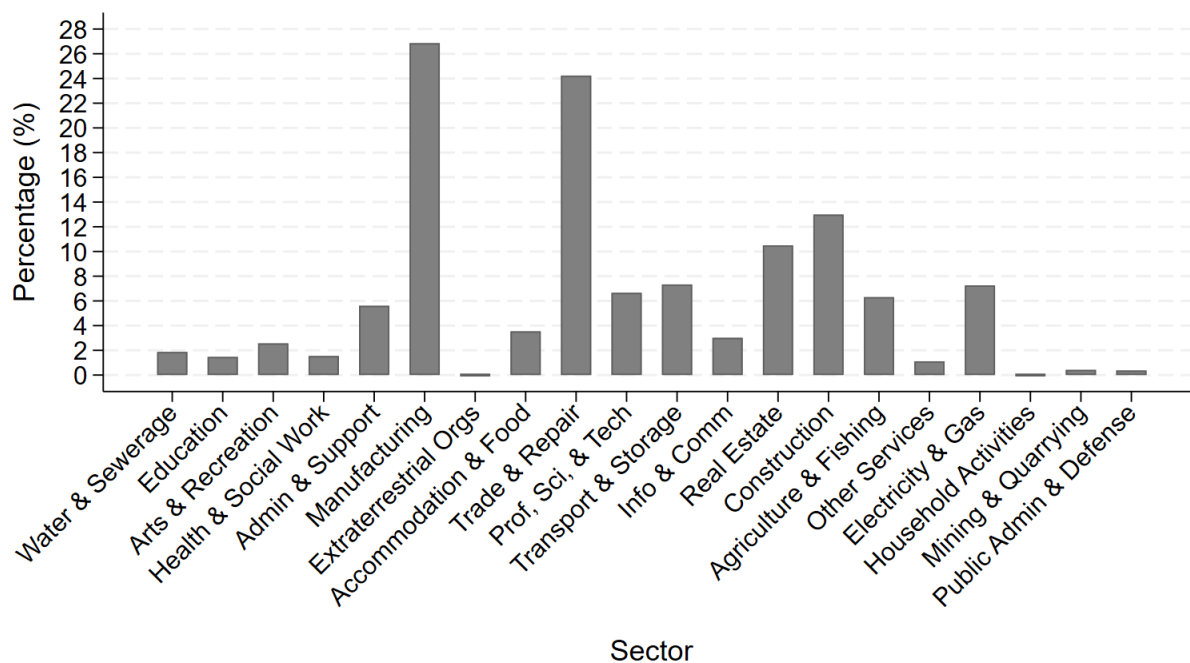
Notes. This figure displays the average sector specialization of banks across sectors, presented as a percentage (%), based on lending to medium and large firms. The underlying data is from the Spanish Credit Registry. The sample is from the second quarter of 2024.

Figure A5: Frequency Distributions of PD and ln(PD)

(a) PD   **(b)** LnPD
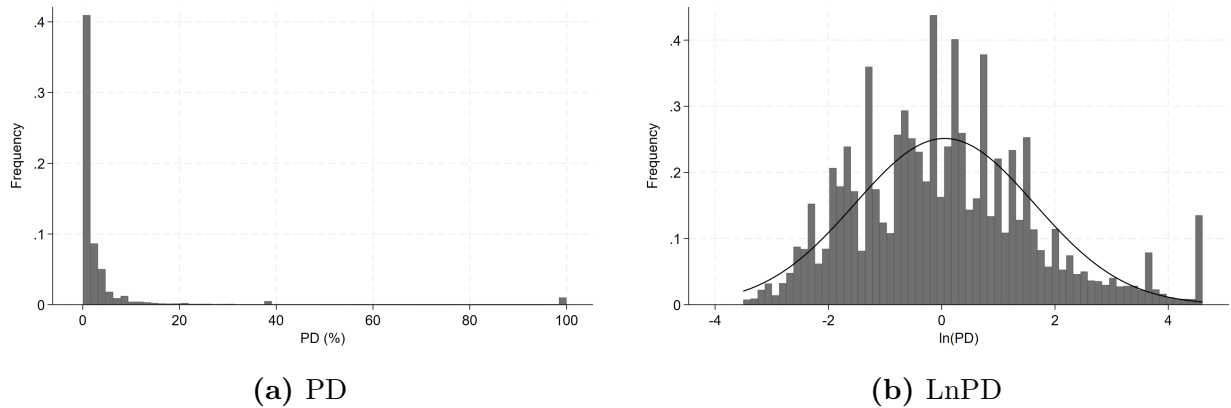
Notes. This figure plots the frequency distributions of the internally estimated PD and natural logarithm of PD. Panel (a) shows the graph for PD. Panel (b) shows the graph for the natural logarithm of PD. The underlying data is from the Spanish Credit Registry. The sample is from the fourth quarter of 2021 to the second quarter of 2024.

Figure A6: Realized Default Rates and Internally Estimated PD Quintiles
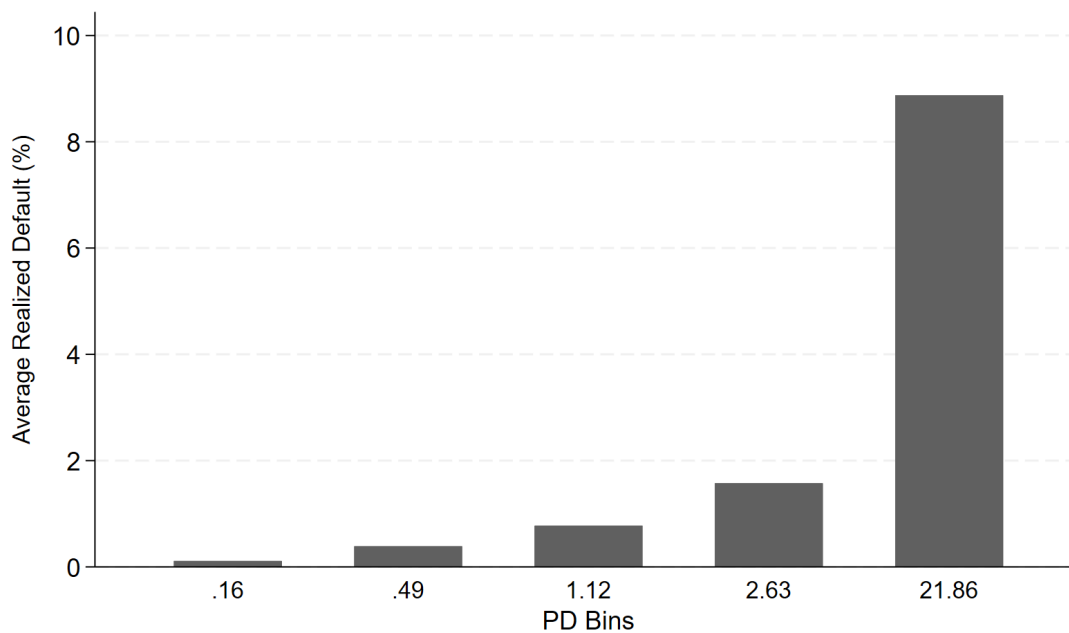
Notes. This figure shows the average realized default rates across internally estimated PD Quintiles. The y-axis presents the average default rate as a percentage (%), and the x-axis presents the average internally estimated PD within each quintile. The underlying data is from the Spanish Credit Registry. The sample is from the fourth quarter of 2021 to the second quarter of 2024.

Figure A7: Sector Specialization, Private Information, and Medium-Large Firms: 2-digit NACE
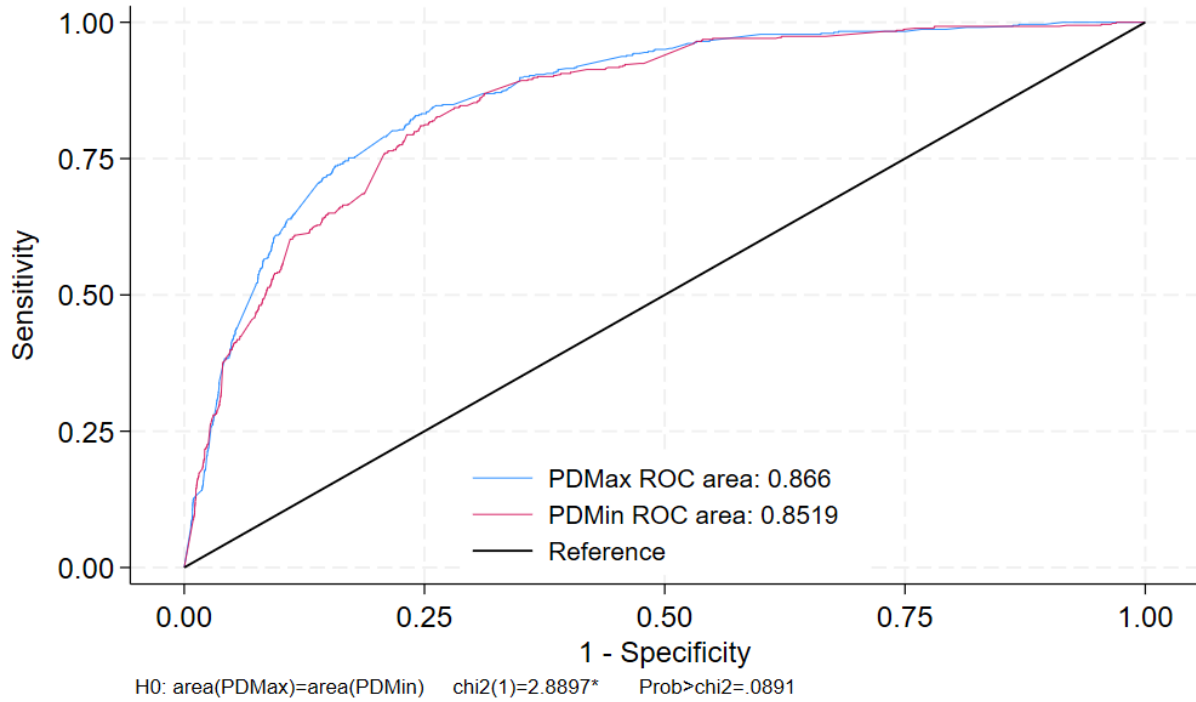
Notes. This figure illustrates the predictive accuracy of the internally estimated PDs by banks with the highest and lowest sector specialization, using 2-digit NACE codes for sector definition, in predicting realized defaults in medium and large firms. The area under the receiver operating characteristic curve (AUC) is used for this evaluation. The y-axis plots 1-specificity (false positive rate). The blue and red ROC curves represent the PD from banks with the highest and lowest sector specialization, respectively. The AUCs measure how well each PD discriminates ex-post realized default. A statistical test estimates if the difference between the AUCs is significant at conventional levels. The straight black line, with an AUC of 0.5, suggests a prediction no better than random. The data are from the Spanish Credit Registry. The sample is from the fourth quarter of 2021 to the second quarter of 2024. * indicates significance at the 0.1 level.

Figure A8: Relationship Share and Private Information
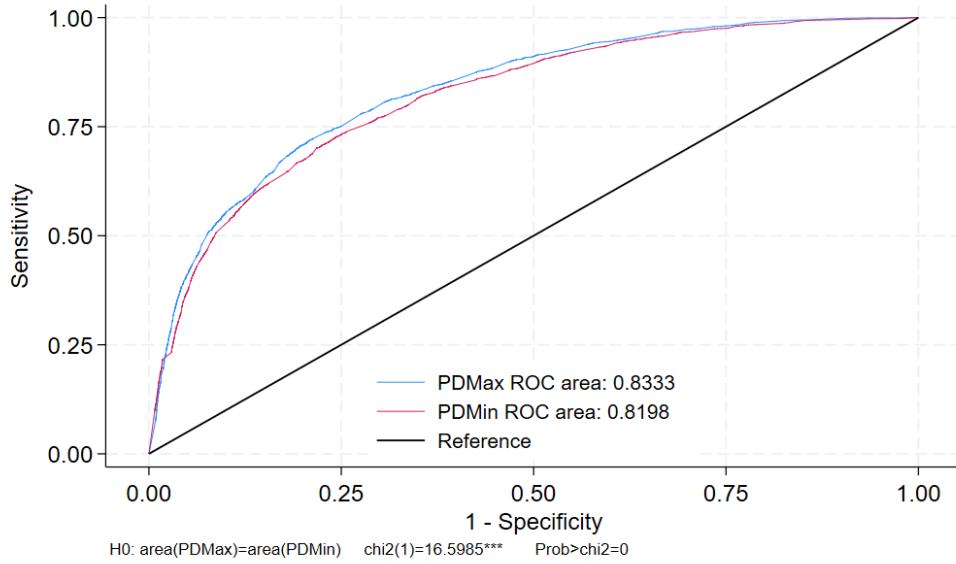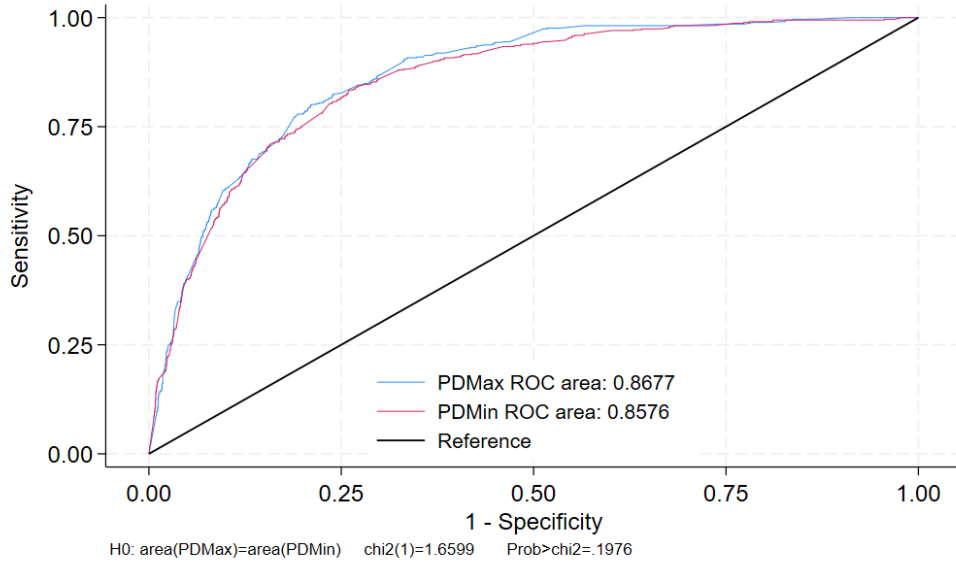
(a) Micro-Small Firms

(b) Medium-Large Firms

Notes. This figure shows the predictive accuracy of the internally estimated PD by banks with the highest and lowest relationship share for predicting realized default for both micro and small firms and medium and large firms, using the area under the receiver operating curve (AUC). Panel (a) presents the results for micro and small firms. Panel (b) presents the results for medium and large firms. The x-axis plots sensitivity (true positive rate). The y-axis plots 1-specificity (false positive rate). The blue and red ROC curves represent the PD from banks with the highest and lowest relationship length, respectively. The AUCs measure how well each PD discriminates ex-post realized default. A statistical test estimates if the difference between the AUCs is significant at conventional levels. The straight black line, with an AUC of 0.5, suggests a prediction no better than random. The data are from the Spanish Credit Registry. The sample is from the fourth quarter of 2021 to the second quarter of 2024. *** indicates significance at the 0.01 level.

Table A1: Specialization, Loan Performance, and Firm Size: Reporting Controls

				NP			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Local Spec	-0.0103***	-0.0210***	0.0109	-0.0213***	-0.0189**	0.0115	0.00142
	(0.00395)	(0.00500)	(0.00672)	(0.00613)	(0.00842)	(0.00865)	(0.0119)
Local MktSh	-0.00809***	-0.0105***	-3.91e-05	-0.0139***	-0.00844***	-0.00401	0.00797**
	(0.00115)	(0.00136)	(0.00203)	(0.00184)	(0.00205)	(0.00252)	(0.00335)
Sector Spec	0.00214	0.0100***	-0.0198***	0.0159***	-0.00267	-0.0143*	-0.0374**
	(0.00260)	(0.00303)	(0.00682)	(0.00389)	(0.00531)	(0.00739)	(0.0174)
Sector MktSh	0.00660	-0.00299	0.0354**	-0.00845	0.0141	0.0676***	-0.0145
	(0.00540)	(0.00559)	(0.0173)	(0.00659)	(0.0107)	(0.0237)	(0.0200)
Secured	0.00183	0.00324**	-0.00212	0.00146	0.00707***	0.000153	-0.00453***
	(0.00125)	(0.00159)	(0.00135)	(0.00200)	(0.00260)	(0.00221)	(0.00148)
RelLength	-0.000197***	-0.000250***	-6.37e-05***	-0.000379***	-0.000118***	-6.11e-05***	-6.14e-05***
	(3.66e-06)	(4.12e-06)	(7.49e-06)	(5.61e-06)	(6.15e-06)	(1.10e-05)	(9.61e-06)
Amount	-8.72e-05*	-0.000221***	-7.89e-05	-3.14e-05	-0.000361***	0.000172	-0.000313***
	(4.75e-05)	(8.17e-05)	(5.60e-05)	(0.000111)	(0.000116)	(0.000122)	(4.83e-05)
Interest rate	0.00181***	0.00185***	0.00182***	0.00189***	0.00188***	0.00171***	0.00200***
	(5.03e-05)	(5.49e-05)	(0.000139)	(6.76e-05)	(9.47e-05)	(0.000152)	(0.000291)
ProductType2	-0.0291***	-0.0402***	-0.00661***	-0.0552***	-0.0228***	-0.00626**	-0.00701***
	(0.00135)	(0.00169)	(0.00164)	(0.00216)	(0.00274)	(0.00254)	(0.00211)
ProductType3	0.00101***	0.00101***	0.00158**	-0.000715*	0.00325***	0.00250***	-0.000439
	(0.000270)	(0.000313)	(0.000640)	(0.000380)	(0.000530)	(0.000963)	(0.000944)
ProductType4	-0.00253***	-0.00311***	-0.00226***	-0.00434***	-0.00219***	-0.00246***	-0.00290***
	(0.000402)	(0.000564)	(0.000564)	(0.000965)	(0.000691)	(0.000761)	(0.000967)
ProductType5	-0.0124***	-0.0146***	-0.00527***	-0.0162***	-0.0125***	-0.00426***	-0.00787***
	(0.000476)	(0.000560)	(0.000867)	(0.000836)	(0.000712)	(0.00105)	(0.00152)
Maturity	0.00113***	0.00130***	0.000565***	0.00142***	0.00113***	0.000630***	0.000417***
	(1.25e-05)	(1.48e-05)	(2.44e-05)	(1.85e-05)	(2.58e-05)	(3.21e-05)	(3.63e-05)
Observations	9,350,812	5,717,604	3,633,052	2,868,821	2,848,603	1,842,658	1,790,200
R-squared	0.204	0.180	0.337	0.158	0.229	0.325	0.370
Bank-Quarter FE	Y	Y	Y	Y	Y	Y	Y
MIST FE	Y	Y	Y	Y	Y	Y	Y
Cluster s.e.	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter
Sample of firms	All	MicroSmall	MedLarge	Micro	Small	Medium	Large

Notes. This table estimates the relationship between banks' local and sector specialization and loan non-performance for firms of different sizes reporting the coefficients for the controls. The data are at the loan level, focusing on the first observation of a loan at the time it is granted, from the third quarter of 2018 to the second quarter of 2024. NP is an indicator that takes the value of 1 if the loan enters in default after its origination. Column (1) includes all firms, regardless of size. Column (2) focuses on micro and small firms, while Column (3) focuses on medium and large firms. Columns (4) to (7) further break down the analysis by micro, small, medium, and large firms, respectively. Product types are classified similarly to the approach in Ivashina et al. (2022). ProductType1 represents cash flow loans and is the omitted category. ProductType2, ProductType3, ProductType4, and ProductType5 represent asset-based loans, credit lines, trade finance, and leasing, respectively. The other variables are defined in Tables 1 and 3. The data are from the Spanish Credit Registry. Fixed effects are denoted at the bottom of the table. Standard errors are clustered by firm-quarter. *, **, *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Table A2: Local Specialization, Loan Performance, and Micro-Small Firms

	NP		
	(1)	(2)	(3)
Local Spec	-0.0155***	-0.0198***	-0.0210***
	(0.00455)	(0.00490)	(0.00500)
Observations	5,921,551	5,783,376	5,717,604
R-squared	0.065	0.144	0.180
Bank-Quarter FE	Y	Y	Y
MT FE	Y	N	N
IT FE	Y	N	N
MIT FE	N	Y	N
MIST FE	N	N	Y
Controls	Y	Y	Y
Cluster s.e.	Firm-Quarter	Firm-Quarter	Firm-Quarter
Sample of firms	MicroSmall	MicroSmall	MicroSmall
Period	2018q3-2024q2	2018q3-2024q2	2018q3-2024q2

Notes. This table estimates the relationship between banks' local specialization and loan non-performance for micro and small firms with different sets of fixed effects. The data are at the loan level, focusing on the first observation of a loan at the time it is granted, from the third quarter of 2018 to the second quarter of 2024. NP is an indicator that takes the value of 1 if the loan enters in default after its origination. Column (1) includes bank-quarter, municipality-quarter, and sector-quarter fixed effects. Column (2) includes bank-quarter and municipality-sector-quarter fixed effects. Column (3) includes bank-quarter and municipality-sector-size-quarter fixed effects. The variables are defined in Tables 1 and 3. The data are from the Spanish Credit Registry. Fixed effects are denoted at the bottom of the table. Standard errors are clustered by firm-quarter. *** indicates significance at the 0.01 level.

Table A3: Local Specialization, Loan Performance, and Micro-Small Firms Across Sectors

	(1)	(2)	(3)	(4)	NP (5)	(6)	(7)	(8)	(9)	(10)
Local Spec	-0.295**	-0.138**	-0.106*	-0.0907**	-0.0569**	-0.0421***	-0.0413	-0.0351	-0.0245***	-0.0142
	(0.121)	(0.0663)	(0.0584)	(0.0365)	(0.0258)	(0.0152)	(0.328)	(0.0284)	(0.00897)	(0.0138)
Observations	18,654	37,025	42,425	61,893	152,951	1,149,108	212	208,115	2,431,291	308,269
R-squared	0.468	0.272	0.254	0.199	0.233	0.208	0.577	0.173	0.126	0.157
Bank-Quarter FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
MIST FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Cluster s.e.	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter
Sample of firms	MicroSmall	MicroSmall	MicroSmall	MicroSmall	MicroSmall	MicroSmall	MicroSmall	MicroSmall	MicroSmall	MicroSmall
Sector	Water & Sewerage	Education	Arts & Recreation	Health & Social Work	Admin & Support	Manufacturing	Extraterrestrial Orgs	Accomodation & Food	Trade & Repair	Prof, Sci, & Tech
Sector Type	NT	O	O	O	O	T	O	NT	NT	NT

	(11)	(12)	(13)	(14)	NP (15)	(16)	(17)	(18)	(19)
Local Spec	-0.0117	-0.00689	0.00379	0.00538	0.0175	0.0190	0.0211	0.178	0.189
	(0.0211)	(0.0317)	(0.0175)	(0.0135)	(0.0184)	(0.0722)	(0.0693)	(0.307)	(0.172)
Observations	318,753	106,597	103,574	551,234	146,553	53,735	12,750	226	10,083
R-squared	0.270	0.191	0.171	0.211	0.319	0.345	0.439	0.542	0.614
Bank-Quarter FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
MIST FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Cluster s.e.	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter
Sample of firms	MicroSmall	MicroSmall	MicroSmall	MicroSmall	MicroSmall	MicroSmall	MicroSmall	MicroSmall	MicroSmall
Sector	Transport & Storage	Info & Comm	Real Estate	Construction	Agriculture & Fishing	Other Services	Electricity & Gas	Household Activities	Mining & Quarr
Sector Type	NT	NT	NT	NT	T	O	NT	O	T

Notes. This table estimates the relationship between banks' local specialization and loan non-performance for micro and small firms across different sectors. The data are at the loan level, focusing on the first observation of a loan at the time it is granted, from the third quarter of 2018 to the second quarter of 2024. NP is an indicator that takes the value of 1 if the loan enters in default after its origination. Columns (1) to (19) present the results for water & sewerage, education, arts & recreation, health & social work, admin & support, manufacturing, extraterrestrial orgs, accommodation & food, trade & repair, professional, scientific & technical, transport & storage, information & communication, real estate, construction, agriculture & fishing, other services, electricity & gas, household activities, and mining & quarrying, respectively. The variables are defined in Tables 1 and 3. The data are from the Spanish Credit Registry. Fixed effects are denoted at the bottom of the table. Standard errors are clustered by firm-quarter. *, **, *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Table A4: Local Specialization, Loan Performance, and Medium-Large Firms Across Sectors

	NP								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Local Spec	0.0442	0.0495	0.205**	-0.0889	0.0788	0.0141*	0.0318	0.00584	0.0139
	(0.0695)	(0.0406)	(0.0894)	(0.0572)	(0.0538)	(0.00823)	(0.0607)	(0.00856)	(0.0285)
Observations	27,256	9,387	8,465	34,752	230,496	967,517	69,358	1,467,494	78,630
R-squared	0.736	0.434	0.446	0.359	0.368	0.319	0.357	0.338	0.238
Bank-Quarter FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
MIST FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Cluster s.e.	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter
Sample of firms	MedLarge	MedLarge	MedLarge	MedLarge	MedLarge	MedLarge	MedLarge	MedLarge	MedLarge
Sector	Water & Sewerage	Education	Arts & Recreation	Health & Social Work	Admin & Support	Manufacturing	Accomodation & Food	Trade & Repair	Prof, Sci, & Tech
Sector Type	NT	O	O	O	O	T	NT	NT	NT

	NP							
	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Local Spec	-0.00326	0.0868*	-0.0284	0.0617	-0.0402	-0.253**	-0.0181	-0.0731
	(0.0185)	(0.0466)	(0.0720)	(0.0461)	(0.0358)	(0.128)	(0.0125)	(0.263)
Observations	163,139	53,038	13,122	386,211	49,459	7,672	57,632	6,016
R-squared	0.435	0.308	0.334	0.439	0.438	0.396	0.403	0.651
Bank-Quarter FE	Y	Y	Y	Y	Y	Y	Y	Y
MIST FE	Y	Y	Y	Y	Y	Y	Y	Y
Cluster s.e.	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter
Sample of firms	MedLarge	MedLarge	MedLarge	MedLarge	MedLarge	MedLarge	MedLarge	MedLarge
Sector	Transport & Storage	Info & Comm	Real Estate	Construction	Agriculture & Fishing	Other Services	Electricity & Gas	Mining & Quarr
Sector Type	NT	NT	NT	NT	T	O	NT	T

Notes. This table estimates the relationship between banks' local specialization and loan non-performance for medium and large firms across different sectors. The data are at the loan level, focusing on the first observation of a loan at the time it is granted, from the third quarter of 2018 to the second quarter of 2024. NP is an indicator that takes the value of 1 if the loan enters in default after its origination. Columns (1) to (17) present the results for water & sewerage, education, arts & recreation, health & social work, admin & support, manufacturing, accommodation & food, trade & repair, professional, scientific & technical, transport & storage, information & communication, real estate, construction, agriculture & fishing, other services, electricity & gas, and mining & quarrying, respectively. The variables are defined in Tables 1 and 3. The data are from the Spanish Credit Registry. Fixed effects are denoted at the bottom of the table. Standard errors are clustered by firm-quarter. *, ** indicate significance at the 0.1 and 0.05 levels, respectively.

Table A5: Local Specialization, Private Information, and Micro-Small Firms: Robustness

	Main		Province		NP1y Spec MicroSmall		NPdud1y		Controls	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	PDMax	PDMin	PDMax	PDMin	PDMax	PDMin	PDMax	PDMin	PDMax	PDMin
ROC area	0.8338	0.8247	0.8352	0.8261	0.8354	0.8208	0.8383	0.8315	0.7817	0.7730
S.e.	(0.0028)	(0.0029)	(0.0028)	(0.0029)	(0.0028)	(0.0029)	(0.0016)	(0.0016)	(0.0036)	(0.0036)
Observations	399,457	399,457	399,474	399,474	399,448	399,448	399,457	399,457	399,457	399,457

H0: area(PDMax)=area(PDMin)										
Chi2(1)	7.67***		7.77***		19.58***		10.90***		10.06***	
Prob>chi2	0.0056		0.0053		0.0000		0.0010		0.0015	

Notes. This table evaluates and compares the predictive accuracy of the PD assigned by banks with the highest and lowest degrees of local specialization within the same micro or small firm. The goodness of fit is assessed using the Area Under the Receiver Operating Curve by comparing the predicted PDs and the one-year ahead observed default (NP1y). Columns (1) and (2) present the baseline result using the PD for the bank with the highest degree of local specialization (PDMax) and the PD for the bank with the lowest degree of local specialization (PDMin), respectively. Columns (3) and (4) use provinces instead of municipalities. Columns (5) and (6) compute the specialization variable using lending for micro and small firms. Columns (7) and (8) include doubtful loans in the computation of one-year ahead observed default (NPdud1y). Columns (9) and (10) incorporate controls for bank-firm characteristics for both specialized and non-specialized banks. These controls include local market share, sector specialization, sector market share, percentage of collateralized lending, average loan rate, average maturity, natural logarithm of total lending amount, and the length of the relationship. A statistical test estimates if the difference between the AUCs is significant at conventional levels. The data are from the Spanish Credit Registry. The sample is from the fourth quarter of 2021 to the second quarter of 2024. *** indicates significance at the 0.01 level.

Table A6: Local Specialization, Loan Supply, and Micro-Small Firms: Robustness

| | LoanGranted | | | |
| | Province&NACE2d | Spec MicroSmall | LoanGranted4m | LoanGranted5m |
	(1)	(2)	(3)	(4)
Local Spec	0.0784***	0.133***	0.0990**	0.0952**
	(0.0198)	(0.0461)	(0.0425)	(0.0426)
Observations	209,416	196,137	198,810	198,810
R-squared	0.560	0.560	0.556	0.555
Bank-Month FE	Y	Y	Y	Y
Firm-Month FE	Y	Y	Y	Y
Controls	Y	Y	Y	Y
Control RelLength	Y	Y	Y	Y
Cluster s.e.	Firm-Month	Firm-Month	Firm-Month	Firm-Month
Sample of firms	MicroSmall	MicroSmall	MicroSmall	MicroSmall
Period	2018m9-2024m6	2018m9-2024m6	2018m9-2024m6	2018m9-2024m6

Notes. This table examines the relationship between local specialization and loan supply for micro and small firms with various specifications for robustness. The analysis is conducted at the application level. The data cover from September 2018 to June 2024. LoanGranted is an indicator that takes the value of 1 if the loan application is approved within three months of the application. Column (1) uses provinces and 2-digit NACE codes instead of municipalities and sectors. Column (2) computes the specialization variable using lending for micro and small firms. Columns (3) and (4) use as dependent variables an indicator that takes the value of 1 if the loan application is approved within four and five months, respectively. The variables are defined in Table 1. The data are sourced from the Spanish Credit Registry. Fixed effects are indicated at the bottom of the table. Standard errors are clustered by firm-month. **, *** denote significance at the 0.05, and 0.01 levels, respectively.

Table A7: Local Specialization, Loan Rate, and Micro-Small Firms

| | Interest Rate | |
	(1)	(2)
Local Spec	-0.0551	-0.0474
	(0.0791)	(0.0791)
NP		0.366***
		(0.0102)
Observations	5,717,604	5,717,604
R-squared	0.559	0.559
Bank-Quarter FE	Y	Y
MIST FE	Y	Y
Controls	Y	Y
Cluster s.e.	Firm-Quarter	Firm-Quarter
Sample of firms	MicroSmall	MicroSmall

Notes. This table estimates the relationship between banks' local special-
ization and loan rates for micro and small firms. The data are at the loan
level, focusing on the first observation of a loan at the time it is granted,
from the third quarter of 2018 to the second quarter of 2024. Interest Rate
is the rate charged for the loan. The variables are defined in Tables 1 and 3.
The data are from the Spanish Credit Registry. Fixed effects are denoted
at the bottom of the table. Standard errors are clustered by firm-quarter.
*** indicates significance at the 0.01 level.

Table A8: Sector Specialization, Loan Rate, and Medium-Large Firms

	Interest Rate	
	(1)	(2)
Sector Spec	-0.0505	-0.0444
	(0.105)	(0.105)
NP		0.416***
		(0.0361)
Observations	3,582,657	3,582,657
R-squared	0.849	0.849
Bank-Quarter FE	Y	Y
MIST FE	Y	Y
Controls	Y	Y
Cluster s.e.	Firm-Quarter	Firm-Quarter
Sample of firms	MedLarge	MedLarge

Notes. This table estimates the relationship between banks' sector specialization and loan rates for medium and large firms. The data are at the loan level, focusing on the first observation of a loan at the time it is granted, from the third quarter of 2018 to the second quarter of 2024. Interest Rate is the rate charged for the loan. The variables are defined in Tables 1 and 3. The data are from the Spanish Credit Registry. Fixed effects are denoted at the bottom of the table. Standard errors are clustered by firm-quarter. *** indicates significance at the 0.01 level.

Table A9: Relationship Lending, Loan Performance, and Micro-Small Firms

	NP		
	(1)	(2)	(3)
RelLength	-0.000253***	-0.000256***	-0.000250***
	(4.00e-06)	(4.08e-06)	(4.12e-06)
Observations	5,921,551	5,783,376	5,717,604
R-squared	0.065	0.144	0.180
Bank-Quarter FE	Y	Y	Y
MT FE	Y	N	N
IT FE	Y	N	N
MIT FE	N	Y	N
MIST FE	N	N	Y
Controls	Y	Y	Y
Cluster s.e.	Firm-Quarter	Firm-Quarter	Firm-Quarter
Sample of firms	MicroSmall	MicroSmall	MicroSmall
Period	2018q3-2024q2	2018q3-2024q2	2018q3-2024q2

Notes. This table estimates the association between relationship lending and loan non-performance for micro and small firms with different sets of fixed effects. The data are at the loan level, focusing on the first observation of a loan at the time it is granted, from the third quarter of 2018 to the second quarter of 2024. NP is an indicator that takes the value of 1 if the loan enters in default after its origination. Column (1) includes bank-quarter, municipality-quarter, and sector-quarter fixed effects. Column (2) includes bank-quarter and municipality-sector-quarter fixed effects. Column (3) includes bank-quarter and municipality-sector-size-quarter fixed effects. The variables are defined in Tables 1 and 3. The data are from the Spanish Credit Registry. Fixed effects are denoted at the bottom of the table. Standard errors are clustered by firm-quarter. *** indicates significance at the 0.01 level.

Table A10: Relationship Lending and Loan Rate

| | Interest Rate | | | |
	(1)	(2)	(3)	(4)
RelLength	-0.00266***	-0.00256***	-0.00183***	-0.00181***
	(0.000121)	(0.000122)	(0.000387)	(0.000387)
NP		0.366***		0.416***
		(0.0102)		(0.0361)
Observations	5,717,604	5,717,604	3,582,657	3,582,657
R-squared	0.559	0.559	0.849	0.849
Bank-Quarter FE	Y	Y	Y	Y
MIST FE	Y	Y	Y	Y
Controls	Y	Y	Y	Y
Cluster s.e.	Firm-Quarter	Firm-Quarter	Firm-Quarter	Firm-Quarter
Sample of firms	MicroSmall	MicroSmall	MedLarge	MedLarge
Period	2018q3-2024q2	2018q3-2024q2	2018q3-2024q2	2018q3-2024q2

Notes. This table estimates the association between relationship lending and loan rates for micro and small firms and for medium and large firms. The data are at the loan level, focusing on the first observation of a loan at the time it is granted, from the third quarter of 2018 to the second quarter of 2024. Interest Rate is the rate charged for the loan. The variables are defined in Tables 1 and 3. The data are from the Spanish Credit Registry. Fixed effects are denoted at the bottom of the table. Standard errors are clustered by firm-quarter. *** indicates significance at the 0.01 level.