Firm-bank relationships: a cross-country comparison *

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Abstract

We document the structure of firm-bank relationships for the eleven largest euro area countries and present new stylized facts using data from the Eurosystem credit registry - AnaCredit. We look at the number of banking relationships, reliance on the main bank, credit instruments, loan maturity, and interest rates. Firms in Southern Europe borrow from more banks and obtain a lower share of credit from the main bank than those in Northern Europe. They also tend to borrow more on short-term, more expensive instruments and to obtain loans with shorter maturity. This is consistent with the hypothesis that firms in Southern Europe rely less on relationship banking and obtain credit less conducive to firm growth, in line with their smaller average size. Relationship lending does not translate into lower rates, possibly because banks appropriate part of the surplus generated by relationship lending through higher rates. Finally, assortative matching, according to which small banks specialize in supplying credit to small firms, is stronger in Northern European countries.

Keywords: AnaCredit, Firm-bank relationship, Corporate financing, Bank Credit

JEL codes: G21, G3, G32

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1 Introduction

How much cross-country heterogeneity is there in the number of banks firms borrow from? Do firms in different countries borrow on different credit instruments and at different maturities? Do they pay different interest rates? The answers to these questions have important implications for lending outcomes. For example, firms may borrow from one or multiple banks. A single bank can enhance relationship lending, positively impacting lending outcomes [Boot, 2000; Kysucky and Norden, 2016], while multiple banks can provide insurance against bank-specific shocks [Detragiache, Garella, and Guiso, 2000] and additional lending [Gopalan, Udell, and Yerramilli, 2011]. Systematic cross-country differences in firm-bank relationships can result in structural differences in firms' characteristics and performance. Such differences are particularly important in a monetary union, as they can differentially affect the transmission of monetary policy.

Until recently, no homogeneous data existed that allowed to rigorously compare the structure of firm-bank relationships across-countries.[1] In this paper, we provide novel evidence by uncovering the features of the firm-bank relationships for the 11 largest euro area countries: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal and Spain. We use AnaCredit, the new harmonized euro area credit registry recently developed by the Eurosystem - the European Central Bank (ECB) and the National Central Banks of the euro area - that covers all firm-bank credit relationships larger than €25,000. The database was constructed to provide a harmonized reference for bank credit to corporations in the euro area. AnaCredit therefore represents the ideal database to carry out meaningful cross-country comparisons, typically plagued by issues of data comparability.[2]

We take 2019 as our reference year and we analyze firm-bank relationships along five dimensions.[3] First, we look at to what extent firms in different countries rely on single or multiple banking relationships. Second, we consider the extent to which firms borrow through different credit instruments, such as revolving credit (short-term) vs. loans (long-term). Third, we look at

[1] We are aware of only one paper that carries out a similar analysis in intent, the work by Ongena and Smith [2000], which is based on evidence from a survey conducted in 1996 on 1,079 firms across 20 European countries.

[2] For further information AnaCredit, see https://www.ecb.europa.eu/stats/money_credit_banking/anacredit/html/index.en.html.

[3] AnaCredit has all information on bank loans starting from September 2018. We do not take the most recent data, because we don't want our analysis to be confounded by the potentially significant effects of the Covid-19 pandemic.

the cross-country maturity of long-term credit. Fourth, we analyse whether there is evidence of assortative matching, i.e., whether firms and banks tend to match according to size and whether this pattern differs across countries. Finally, we consider differences in the interest rates. Our goal is to document differences in the firm-bank relationship above and beyond those due to the firm characteristics. For example, small firms tend to borrow from a smaller pool of banks, and small firms are more prevalent in certain European countries than in others. Therefore, in those countries the average number of banking relationships should be lower. By conditioning our analysis on firm characteristics, we can control for these effects and single out the supply-side determinants of the credit relationship.

A crucial feature of the firm-bank relationship is the number of credit ties a firm maintains with different banks. We find that the number of banking relationships varies significantly across the euro area countries. In particular, the countries can be grouped in three main clusters. On the one hand, firms in Italy, Spain, and Portugal rely more on multiple banks. Large firms in these countries borrow on average from four to five banks. A second group includes Germany, Austria, France, Greece, Finland, and Belgium, where the median large firm borrows from two banks. At the other side of the spectrum, large firms in the Netherlands and Ireland mainly rely on one bank. Most importantly, similar patterns emerge also for smaller firms, as well as when directly accounting for size and sector effects in a regression framework, suggesting that these cross-country differences are not explained by the different industrial structures across countries.

Consistently, the extent to which firms rely on the main bank – measured by the share of credit of the main bank over total credit – is lowest for the first cluster and highest for the third. Similarly, firms in countries where the one bank model is more common, tend to have more credit contracts (instruments) with the same bank. The extent to which a firm relies on credit from its main bank is a measure of how strong the firm-bank relationship is. Several recent studies show that the strength of the firm-bank relationship can mitigate the credit contraction during downturns [Gobbi and Sette, 2014; Sette and Gobbi, 2015] and have a beneficial effect on firms' investment and employment [e.g., Banerjee, Gambacorta, and Sette, 2021, see below for a review of the literature], suggesting that cross-country differences documented in this paper could affect firm performance.

We then analyze the instruments through which firms obtain credit, distinguishing between

loans, non-revolving credit lines, leases, trade receivables, and revolving credit.[4] This analysis crucially depends on the new credit registry developed for the euro area, which for the first time contains harmonized and therefore comparable definitions for different instruments. First, we find that, across countries, loans and non-revolving credit lines, both long-term instruments, are substantially cheaper than other forms of credit. For example, the overall average rate on loans and non-revolving credit lines is just above 2%, while that on revolving credit is around 5%. And in fact, we find that reliance on long-term credit varies between more than 80% in France to less than 60% in Greece, Italy, and Ireland. In general, long-term credit accounts for a larger share of credit in Northern European countries.[5] These cross-country differences in the reliance on different instruments translate into significant differences in the overall cost of credit for firms, as we show below. We also consider whether firms tend to borrow from the main bank using certain credit instruments and from the other banks on others. For firms borrowing from multiple banks, we compute the share of instruments obtained from the main bank only, from fringe banks only, and from both the main and fringe banks. In a nutshell, approximately half the instruments are supplied both by the main and the fringe banks. Italy and Spain have the highest share of instruments supplied by both the main and the fringe banks, suggesting that the main bank's role is less "special" in these countries.

A key question in the study of relationship lending has been how this relationship affects the terms of credit. We focus on two main features of credit contracts: average maturity and interest rates. First, we look at the maturity of the long-term instruments, that is, loans and non-revolving credit lines. We find very large cross-country differences in average maturity. Large Dutch firms borrow at the longest maturity (15 years) while large Irish firms have the shortest maturity (5 years). This indicates that the main bank model, which is prevalent in these two countries, can result in very different maturity of long-term credit. For other countries, the North vs. South clusters are confirmed, with large Greek, Spanish, Italian and Portuguese firms relying on bank credit with lower maturity. The results are however more nuanced when we look at smaller firms, and indeed we find that, overall, the maturity does not vary systematically with size. In terms of countries, the overall picture is confirmed, the main difference being that Greek and Spanish SMEs show average

[4]Non-revolving credit lines are similar to loans, with the difference that the funds are given in pre-established tranches over time, rather than all at once.

[5]Consistent with our result, Feraboli, Häkkinen, and Gutiérrez [2015] show that firms in countries more affected by the Great Financial Crisis have a higher share of short-term credit compared to firms in countries that were less affected.

maturity more similar to Northern European countries.

Finally, we consider the interest rate. Here, the most striking result is the large cross-country difference in the average interest rate, which is only partly related to the strength of the firm-bank relationship. For large firms, we find that Greek and Irish firms pay the highest rates, between 6% and 5%, followed by the Netherlands (4%). Large firms in the other countries pay more similar rates, around 2%. These patterns are broadly confirmed for other size classes and for the overall distribution. Moreover, controlling for size and sector fixed effects changes the distribution only marginally, indicating that the differences are due to some country attributes rather than to differences in the firm characteristics.

To dig further into these differences in interest rates, we perform three shift-and-share exercises according to size, sector, and reliance on different credit instruments. These exercises allow us to determine how much of the observed cross-country difference in average rates is due to differences in the distribution of firm characteristics and instrument type and how much to differences within firm type or instrument type average rates. We find that size and sector effects play only a marginal role. Some more action emerges in terms of type of instrument. In particular, in Greece, Ireland, Austria, and Italy the average interest rate is between 30 and 50 basis points higher than what would have been if firms in these countries had the same share of credit by instrument type as the overall average. These are in fact the countries that rely the most on more expensive, short term instruments. For all decompositions, the within component remains the dominant factor, indicating that country effects play a predominant role in determining cross-country heterogeneity in interest rates.[6].

Finally, we study assortative matching between firms and banks according to size. We ask whether firms and banks tend to match according to size and whether this pattern differs across countries [Chen and Song, 2013]. We find that, in general, there is positive assortative matching: on average, small banks tend to specialize in supplying credit to small firms. However, this propensity

[6]In this paper, we do not investigate potential explanations of the cross-country differences in the interest rates, as the main focus is to document those. The OECD [2022] also documents differences in interest rates across countries, highlighting access to credit issues as a key explanatory factor. Feraboli et al. [2015] show that the monetary policy pass-through during the low interest rates period was much more sluggish for countries more affected by the financial crisis and thus led to higher interest rates for firms in these countries compared to firms in countries in the euro area less affected by the financial crisis.

is substantially stronger in Northern European countries, while is weak or absent in Southern European countries. We also find that, in Northern Europe, small banks have a greater propensity to act as main lenders of both small and large firms than in Southern Europe. These results imply that a consolidation process in the banking sector, resulting in larger average banks, would have larger effects on credit supply in Northern than in Southern Europe.

To summarize, the overall picture suggests that Northern European firms rely more on one bank, more on long-term instruments, and within these, enjoy longer maturities. This is consistent with the idea that relationship lending is more common in Northern Europe, with potential advantages in terms of credit quality. Of course, this is a rough representation of a very complex picture, in which there are several exceptions. Possibly, the most noticeable one is Ireland, where firms tend to heavily rely on a single bank but other features of the credit relation are similar to those of countries in which multiple banking relationships are more common.

The analysis presented in this paper provides a valuable contribution for researchers and policy makers interested in the features of bank-firm relationships and how those affect corporate financing. Most of the previous academic literature has focused on how the strength of the firm-bank relationship influences loan contract terms offered by the banks. For example, it is often stated that the German model of the firm-bank relationship is based on a main bank that provides long-term financing, helping German firms to fully achieve their growth potential [Harhoff and Körting, 1998; Lehmann and Neuberger, 2001; Ongena, Tümer-Alkan, and v. Westernhagen, 2012]. Consistently, many papers find that firms benefit from their banking relationships on one or more contract terms [e.g., Petersen and Rajan, 1994; Berger and Udell, 1995; Berger, Frame, and Ioannidou, 2011]. Other studies give a less favorable picture of relationship lending [e.g., Angelini, Di Salvo, and Ferri, 1998; Degryse and Van Cayseele, 2000; Calomiris and Pornrojnangkool, 2009; Gopalan et al., 2011].[7] Mostly, these analyses are based on evidence from a single country or from data of different countries however difficult to compare. Our analysis sheds light on these topics leveraging on a fully harmonized dataset that allows the investigation of the structural differences across-countries of corporate funding, the use of different credit contract and the reliance on one main bank vs.

[7] See Degryse, Kim, and Ongena [2009] for a survey. Kysucky and Norden [2016] collect the findings of over 100 empirical studies on this topic and conclude that stronger relationships are generally beneficial to borrowers in terms of lower loan rates and higher credit volume.

multiple banking relationships. We find that the the strength of the firm-bank relationship (measured in terms of number of relationships and of the share of credit supplied by the main bank) is correlated with more long-term credit, while no clear association emerges in terms of interest rates. This evidence supports the theory that the main bank extracts part of the surplus that the relationship creates by charging higher rates [Rajan, 1992].

Previous literature on firm-bank relationship has also focused on the impact of the relationship during crisis or bad times – particularly during the Global Financial Crisis and European Sovereign Debt Crisis, generally finding positive implications (see Beck, Degryse, De Haas, and Van Horen [2018] for evidence from Central and Eastern Europe and Jiménez, Ongena, Peydró, and Saurina [2012] and Sette and Gobbi [2015] for analysis of lending from Spanish and Italian banks respectively during a credit crunch). While we do not analyze specifically episodes of crisis or credit crunches, our study provides relevant novel insights on the effect of banks' relationships during crises. We show that firms in Southern countries borrow more at shorter maturity both at the extensive margin (they rely more on short-term credit instruments) and the extensive margins (they get shorter maturities on long-term instruments). A greater dependence on short-term credit is likely to play a role should a crisis occur and could exacerbate firms' financing constraints.

Previous literature has also investigated how multiple lending relationships are shaped by the different roles played by the banks. In particular, exploiting credit registry data from Italy, Bolton, Freixas, Gambacorta, and Mistrulli [2016] make a distinction between relationship banks and transactions banks based on the distance between a bank's headquarters and the firm's headquarters. They find that firms are more likely to default during a crisis if they are more dependent on transaction banks. Our analysis provides two additional contributions to this debate. First, we provide new evidence on the role of multiple banks, by computing the share of instruments obtained from the main bank only, from fringe banks only, and from both the main and fringe banks. In countries with multiple lending relationships, like Italy and Spain, the main banks and the fringe banks supply all credit instruments, suggesting a general lack of specialization of the banks with which firms have a credit relationship. Second, we find that, in general, there is positive assortative matching: on average, small banks tend to specialize in supplying credit to small firms, but more so in Northern Europe.

Our analysis has implications for the transmission of policies affecting the provision of credit to the corporate sector. Jiménez et al. [2012] analyze the transmission of monetary policy shocks and show that the probability that a firm is granted a loan is significantly impacted by the number of banks it borrows from. Degryse, De Jonghe, Jakovljević, Mulier, and Schepens [2019] show that the estimated effects of credit shocks crucially depend on the number of relationships firms entertain. We document substantial cross-country differences in the number of banks, contract terms, and the degree of assortative matching. These facts can enhance our understanding of the impact of monetary policies on firms' access to credit.

The rest of the paper is organized as follows. In Section 2 we describe the data, while Section 3 analyzes the number of firm-bank relationships and the reliance on the main bank. Section 4 studies the type of credit instruments, Section 5 looks at maturity and Section 6 analyzes the interest rate. Section 7 studies assortative matching and Section 8 concludes.

2 Data

The core dataset of this analysis comes from the harmonized credit registry of the euro area, AnaCredit, which contains confidential loan-by-loan information on bank credit to enterprises.[8] The purpose of our analysis is to identify structural cross-country differences in bank-firm relationships in the euro area. Thus, we focus on the cross-section and restrict the data only to December 2019. We are restricted in the use of historical data Because the AnaCredit database starts in September 2018. Moreover, in the first quarter of 2020 the Covid19 pandemic arrives, with profound and very idiosyncratic consequences on credit allocation, such as the ample use of government and other guarantees to support corporate funding from the banks. Given that we are interested in the structural characteristics of the business loan markets, we want to abstract from those. At the same time, it can be argued that 2019 was indeed a "normal", and therefore representative year, in particular for what concerns the firm-bank relationships. After the turbulent times of the global financial crisis

[8] AnaCredit reports all loans granted by credit institutions residing in euro area Member States. The data is maintained by the ECB and the Eurosystem National Central Banks and is harmonized across Member States. A credit instrument is subject to reporting if the borrower is a legal entity, and if the total committed amount at the creditor-debtor level is greater or equal to €25.000 at any point within the reference period. Counterparties operate across all institutions and reside globally, although for the purpose of this study we focus only on euro area borrowers. The data is available at the monthly frequency, beginning in September 2018.

and of the sovereign crisis, the economic environment was substantially stable as reflected by the stability of the monetary policy decisions.[9] After the recovery following the sovereign crisis, bank lending to the private sector in euro area countries was stable in 2018 and 2019. Also, the banking sector was overall financially stable, and the cost of financing was very similar across countries.[10]

2.1 AnaCredit

For the purpose of this analysis, we restrict our sample to credit granted to non-financial corporations residing in Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, and Spain. Together, these countries account for approximately 95% of euro area nominal gross domestic product (GDP) in 2019,[11] and 97.0% of the total outstanding bank credit in the euro area at the end of 2019.[12]

To restrict the analysis to non-financial corporations,[13] we exclude all firms operating in financial services, insurances and pension funds, and activities auxiliary to financial services and insurance activities (NACE codes 64–66). Moreover, to ensure that we compare similar firms in terms of credit risk across countries, we exclude firms that are in default. This is because firms in default are typically engaged in complex debt write-offs and transfers, which involve different banking relationships. Thus, we exclude all firms that either defaulted on any of their active loans in December-2019, or were classified as in default with any of their creditors in December-2019.[14]

Next, to accurately estimate the number of firm-bank relationships, we omit firms that have active syndicated loans in December 2019 and we exclude all loans associated with multiple creditors. This is because only the euro area credit institutions are recorded for syndicated loans in AnaCredit, independent of the reporting agent's role as lead arranger or agent. Thereby, the actual number of all banks involved in the syndicate is not available through AnaCredit.[15]

[9] Interest rates in the euro area had been stable since March 2016 and in September of 2019 there was only the decision to decrease the deposit rate of 25 basis points, to support stability in the money markets.

[10] See ECB Economic Bulletin, December 2019.

[11] Calculations are based on Eurostat data, GDP at current market prices.

[12] The calculation is based on our final data set including all applied filters. The reference period for our analysis is December 2019, but our results are robust to the selection of previous or subsequent reference periods.

[13] Non-financial corporations are defined using the ESA 2010 classification equal to S.11

[14] Default can arise either due to the unlikelihood to pay, to past-due of more than 90/180 days, or to both.

[15] A recent study by Ongena, Osberghaus, and Schepens [2024] examines the banks' choice to grant loans to firms bilaterally or in syndicates using AnaCredit data. The authors find that syndicated loans are more expensive and

We perform the analysis at the bank, rather than the banking group level. We choose to use the bank level information because entrepreneurs deal directly with a bank and not with a group. For example, loan officers from different banks within the same group are not generally expected to share information on single customers.

At the instrument level, we exclude all instruments classified as reverse repurchase agreements and deposits as these are complex financial instruments usually linked to a financial subsidiary of a corporation. We also exclude loans flagged as 'Project Finance' since these are associated with large infrastructure projects with multiple creditors. To simplify the analysis of the credit type, we group the remaining instrument types into five categories: (1) loans; (2) financial leases; (3) trade receivables; (4) credit lines; and (5) revolving credit, where revolving credit captures overdrafts, credit card debt, and revolving credit other than overdrafts and credit card debt.

Finally, to ensure comparability across products, we restrict the analysis to loans granted in EUR, which corresponds to 84.0% of all instruments in December 2019. At the instrument level, we further winsorize outstanding and commitment amounts at the 0.01% level.

To ensure the data quality of the sample, we apply several filters at the debtor and instrument levels. On the debtor level, we exclude values that exceed or are equal to the 0.01% level for the number of employees, annual turnover, and balance sheet total. On the instrument level, we exclude values of the outstanding amounts below or equal to 0 and above or equal to the 0.01% level in the empirical distribution.[16] The final sample consists of 2,737,561 firms that received loans from 2,482 banks.

To classify debtors according to firm size, we proceed in three steps. First, we combine information on the balance sheet size, number of employees, and annual turnover at the unconsolidated firm level in AnaCredit. Second, for those firms that do not have any information available in AnaCredit, we link AnaCredit to Bureau van Dijk's Orbis to incorporate external firm-size characteristics. We link AnaCredit to Orbis using the firm's RIAD code and national identifier. Finally, for those firms without individual information on firm characteristics neither in AnaCredit nor in Orbis, we utilize

more sensitive to loan risk than bilateral loans.

[16]This threshold ensures that clearly implausible data points are discarded without significantly restricting the data coverage.

the enterprise size as defined in AnaCredit.

We categorize firms into four size classes: micro, small, medium, and large. Following the official definition of the European Union,[17] firms are classified as micro if they have less than 10 employees, and either have total assets or annual turnover less than EUR 2 million. Small firms have less than 50 employees, and either have total assets or annual turnover less than EUR 10 million. Medium-sized firms have less than 250 employees, and either have total assets less than EUR 43 million or annual turnover less than EUR 50 million. The remainder are classified as large firms. We describe the procedure in detail in the Online Appendix.

2.2 Summary statistics

Table 1 presents the summary statistics of the main variables for each size class for the whole sample.[18] The sample of the large firms consists of 42,609 firms, the medium of 144,204 firms, the small of 593,337 firms, and the micro of approximately 2 million firms. Based already on the aggregate summary statistics, significant differences emerge in the firm-bank relationships by firm size. Larger firms on average borrow from more banks, while the share of credit used from the main bank, defined as the bank which accounts for the largest share of outstanding debt, decreases with firm size - smaller banks are more dependent on the funding of their main bank. Moreover, the cost of bank credit, measured as the average interest rate of the loans, is lower for larger firms. As expected, the total amount outstanding, the number of employees, the total size of the balance sheet, and the annual turnover of the firm are increasing with firm size. We analyze the cross-country differences in firm-bank relationships as well as the terms of credit received in detail in the rest of the paper.

In the Appendix Table A1, we also report the summary statistics of outstanding amounts for instrument type by firm size. The last column shows the share of firms that use each instrument. The vast majority of firms use loans and revolving credit, with micro firms having the highest share of loans. As expected, outstanding amounts are increasing with firm size.

[17] https://ec.europa.eu/growth/smes/sme-definition_en

[18] The Online Appendix report the same information separately by country.

Table 1: Summary statistics by size

	No.	p25	p50	p75	mean
(a) Large firms					
Outstanding amount (in thousands)	42,609	132	1,103	9,000	15,091
Number of banks	42,609	1	2	4	3.40
Share from main bank	42,609	0.55	0.90	1.00	0.77
Interest rate (%)	39,134	0.78	1.52	2.63	2.09
Maturity (in years)	27,234	4.17	6.57	11.36	8.50
Number of employees	37,009	167	330	626	3,013
Balance sheet total (in thousands)	35,813	17,899	65,750	170,000	574,186
Annual turnover (in thousands)	38,070	9,132	63,300	150,974	8,194,879
(b) Medium firms					
Outstanding amount (in thousands)	144,204	130	705	2,888	3,226
Number of banks	144,204	1	2	4	2.77
Share from main bank	144,204	0.58	0.96	1.00	0.80
Interest rate (%)	135,238	0.99	1.71	2.83	2.26
Maturity (in years)	104,914	4.10	6.30	10.30	8.05
Number of employees	132,921	52	70	108	83
Balance sheet total (in thousands)	124,685	1,934	8,768	17,484	21,620
Annual turnover (in thousands)	125,064	791	8,000	19,025	64,984
(c) Small firms					
Outstanding amount (in thousands)	593,337	69	229	707	824
Number of banks	593,337	1	2	3	2.04
Share from main bank	593,337	0.67	1.00	1.00	0.84
Interest rate (%)	565,804	1.25	2.07	3.38	2.65
Maturity (in years)	450,580	4.12	6.02	10.18	7.95
Number of employees	562,694	11	15	24	18
Balance sheet total (in thousands)	528,375	408	1,452	3,250	4,512
Annual turnover (in thousands)	517,446	75	1,255	3,075	51,049
(d) Micro firms					
Outstanding amount (in thousands)	1,957,411	37	89	228	302
Number of banks	1,957,411	1	1	1	1.33
Share from main bank	1,957,411	1.00	1.00	1.00	0.93
Interest rate (%)	1,861,200	1.44	2.30	3.76	2.92
Maturity (in years)	1,529,970	5.00	7.07	14.18	9.57
Number of employees	1,510,323	1	2	4	3
Balance sheet total (in thousands)	1,500,110	131	328	710	1,309
Annual turnover (in thousands)	1,491,672	48	202	489	32,562

Note: The table reports descriptive statistics at the firm level by firm size. Outstanding amount is the total credit used. Maturity includes only long-term credit (loan and non-revolving credit lines). The differences in the number of observations stem from the data availability for firms and instruments.

2.3 Credit contracts

Firms borrow using different instruments, which differ in terms of maturity, collateral, and revolving nature. A revolving instrument is one in which the bank guarantees credit up to a certain pre-set amount and the firm can, up to that amount, increase and decrease exposure as needed. Instruments can be grouped into five broad categories:

1. Loans. This instrument includes all loans and advances as well as bills not included in any of the other categories. Any instrument classified as other loans is of a non-revolving nature. This type of instrument includes lump-sum credits (where the total credit is paid out in one installment).

2. Non-revolving credit lines. Non-revolving credit lines have the following features: (a) the debtor may withdraw funds up to a pre-approved credit limit without giving prior notice to the creditor; (b) the credit may be used in tranches; (c) it is not of a revolving nature (i.e., the amount of available credit can only decrease as funds are drawn and repaying funds does not increase the available amounts).

3. Trade receivables. This instrument includes loans granted based on bills or other documents that give the right to receive the proceeds of transactions for the sale of goods or provision of services. This item includes all factoring transactions (both with and without recourse) as well as forfeiting and discounting of invoices, bills of exchange, commercial papers, and other claims on the condition that the credit institution buys the trade receivables. Note that the instrument "trade receivables" is distinguished from financing against trade receivables. While "trade receivables" means purchasing trade receivables (the factoring client sells the trade receivables), in financing against trade receivables the credit institutions typically advance funds against a pool of receivables which serve as protection. In other words, financing against trade receivables is an instance of credit that involves the use of the trade receivables as collateral.

4. Financial leases. A financial lease is a contract under which the lessor as legal owner of an asset conveys the risks and benefits of ownership of the asset to the lessee. Under a financial lease, the lessor is deemed to make, to the lessee, a loan with which the lessee acquires the

asset. Thereafter, the leased asset is shown on the balance sheet of the lessee and not the lessor; the corresponding loan is shown as an asset of the lessor and a liability of the lessee. The lessor is recorded as the creditor to the instrument whereas the lessee is the debtor to the instrument. The leased asset is usually used as protection.

5. Revolving credit. The revolving credit instrument includes (a) overdraft, (b) credit card debt, and, (c) revolving credit other than overdrafts and credit card debt. All these instruments are revolving and for that reason, we grouped them under one instrument.

Loans and credit lines are typically used to finance long-term investments, the main difference being that a loan is given out lump-sum while the credit line allows the firm to withdraw in tranches. Therefore, this instrument is used to finance projects that imply payments staggered in times. We define the firm-level average maturity of instrument j as:

$$m_{ijc} = \sum_b \omega_{ijbc} m_{ijbc} \tag{1}$$

where m_{ijbc} is the maturity at origination of credit instrument j that bank b extends to firm i in country c, $\omega_{ijbc} = \frac{\mathsf{ONA}_{ijbc}}{\mathsf{ONA}_{ijc}}$ and $\mathrm{ONA}_{ijc} = \sum_b \mathrm{ONA}_{ijbc}$ is the total credit firm i obtains through instrument j. ONA stands for outstanding nominal amount of the credit granted and we use this abbreviation throughout the paper. We classify loans and credit lines as long-term instruments. Trade receivables are used to cash in on yet-to-be-paid bills, and as such they are a short-term source of liquidity. The instrument is largely used to finance working capital, as well as import and export. Finally, revolving instruments provide firms with short-term liquidity and are typically used to finance working capital and liquidity shocks. They have no maturity, as by contract they can be revoked by the bank with no prior notice.

2.4 Interest rate definition

Firms borrow from multiple banks and use different instruments. Moreover, a firm can have different contracts for the same type of instrument from the same bank, such as two loans issued at two different dates. We proceed by aggregating the granular instrument level information to obtain a meaningful measure of the cost of credit for the firm. First, we aggregate the data at the firm-

bank-instrument level by taking the weighted interest rate on each contract of a given instrument, weighted by the size of the contract. Our basic interest rate observation is therefore r_{ijbc}, that is, the interest rate that firm i pays on instrument j from bank b in country c, with ONA_{ijbc} being the corresponding outstanding nominal amount. Next, we aggregate at the borrower level and we take all credit a firm obtains on instrument j from all banks and construct the firm-instrument level interest rate as:

$$r_{ijc} = \sum_b \omega_{ijbc} r_{ijbc}. \tag{2}$$

where $\omega_{ijbc} = \frac{\text{ONA}_{ijbc}}{\text{ONA}_{ijc}}$ and $\text{ONA}_{ijc} = \sum_b \text{ONA}_{ijbc}$ is the total credit firm i obtains through instrument j. In each period, a firm will have at most five different values of r_{ijc}, one for each instrument it uses.

The next level of aggregation is at the firm level, and we construct the firm level interest rate as:

$$r_{ic} = \sum_j \omega_{ijc} r_{ijc} \tag{3}$$

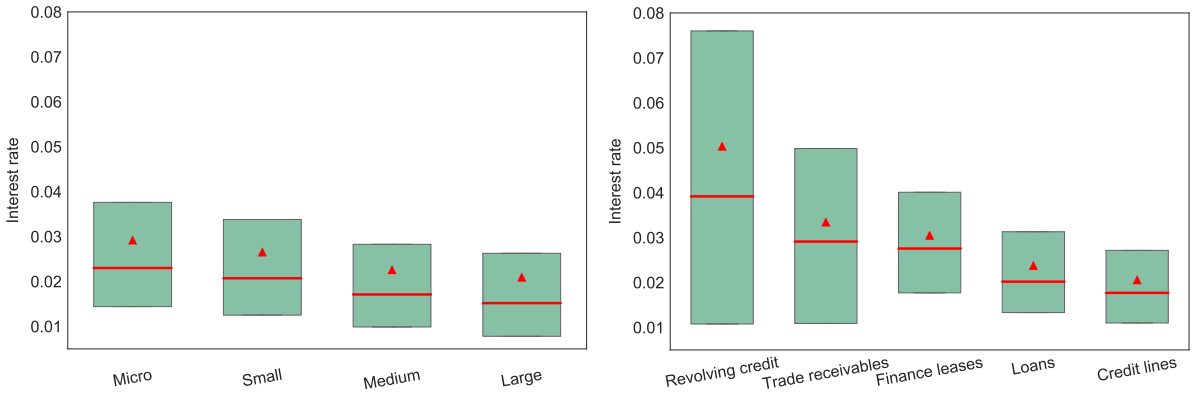
where $\omega_{ijc} = \frac{\text{ONA}_{ijc}}{\text{ONA}_{ic}}$ and $\text{ONA}_{ic} = \sum_j \text{ONA}_{ijc}$ is the total credit firm i obtains through all instruments.

It is well known that large firms pay lower rates. This relationship is confirmed in the AnaCredit data. Figure 1a plots the distribution of the interest rate by firm size for the whole sample of firms, that is, without distinguishing by country. There is a clear declining trend when going from micro to large firms. The variation is however not large: the average rate for micro firms is 2.92%, and it drops to 2.09% for large firms (with basically no differences with medium firms).[19]

Different instruments also command different rates, as shown by Figure 1b. In this case differences are more pronounced, with revolving credit (5.03%) costing on average twice as much as loans and credit lines, as well as being substantially more dispersed than the other instruments. Interest rates on trade receivables and leases are slightly above 3%, while rates on loans and credit lines are equal to 2.37% and 2.06%, respectively.

[19]For reference, the monetary policy rates in the euro area at the end of 2019 were -0.5 for the deposit rate, 0 for the Main Refinancing Operations (MRO), and 0.25 for the Marginal Lending Facility (MLR).

Figure 1: Interest rates



(a) **By firm size class** (b) **By instrument type**

Note: The figure shows the distribution of interest rates by (a) firm size and (b) by instrument type. The box plot's bars depict the interquartile range, the red line indicates the median and the red triangle the average interest rate. The bars are arranged in descending order according to the average interest rates. The sample period is December 2019.

3 Number of firm-bank relationships and reliance on the main bank

Theory suggests that firms might want to entertain more than one bank relationship both for insurance reasons – to be able to access credit from multiple sources in case one or more banks run into liquidity problems [Detragiache et al., 2000] – and to increase their bargaining power against banks [Rajan, 1992]. At the same time, multiple relationships might induce a "free riding" problem on banks, according to which none of them has sufficient incentives to invest in information production to reduce asymmetric information. In fact, relationship lending is based on the main bank model, in which a firm mostly borrows from a single bank, forming a strong tie that allows to reduce the extent of asymmetric information. The prevalence of a model in which firms rely more or less on multiple bank relationships ultimately should depend on the tradeoff between the benefit of greater diversification and the costs of free-riding problems and duplication of efforts [Carletti, Cerasi, and Daltung, 2007]. In this section we describe how the nature of the firm-bank relationship varies across-countries, focusing on the number of banks a firm borrows from, the share of credit supplied by the main bank and credit concentration across the different firm's lenders.

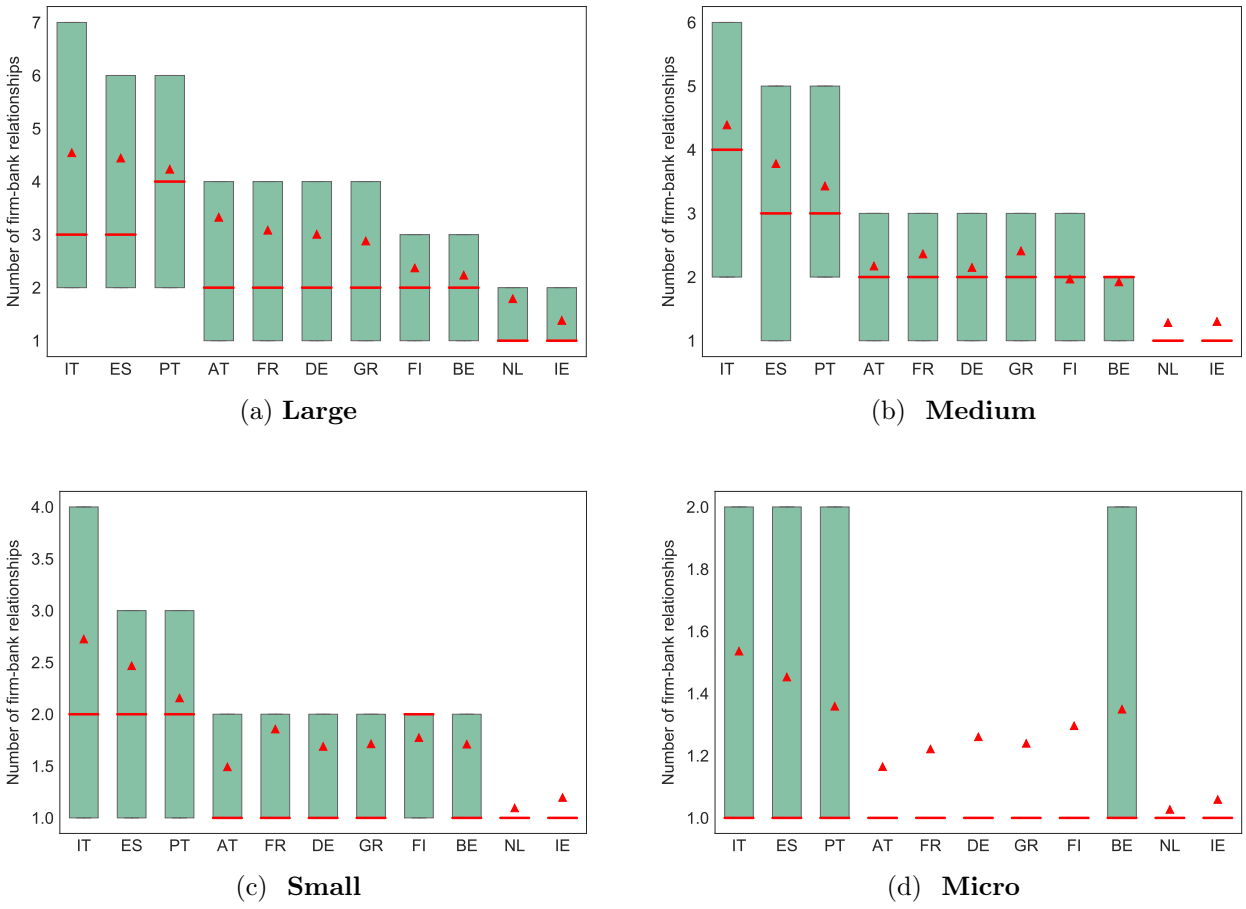
3.1 Number of firm-bank relationships

First, we analyze the number of banks firms borrow from. Given that a firm is in AnaCredit only if it borrows from at least one bank, our statistics refer to the intensive margin, that is, the number of relationships conditional on having at least one. Figure 2 reports box plots of the distribution of the number of banks separately by firm size and country. We rank countries in descending order in terms of the average number of banks for large firms and keep the same ranking in all four panels. For large firms (Panel 2a), three groups of countries emerge. Firms in Italy, Spain, and Portugal have the largest number of banks, with an average between 4 and 5, a median between 3 (Italy and Spain) and 4 (Portugal) and the 75^{th} percentile between 6 and 7. A second group includes Germany, Austria, France, Greece, Finland, and Belgium, where the median firm borrows from 2 banks (the mean is around 3). Finally, large firms in the Netherlands and Ireland follow the one bank model: the median is 1, the 75^{th} percentile is 2 and the mean is between 1 and 2. This ranking also holds in terms of dispersion: the interquartile range (the difference between the 75^{th} and the 25^{th} percentile) is 5 in Italy, 4 in Spain and Portugal, 3 or 2 in the intermediate cluster, and just 1 in Ireland and the Netherlands.

Not surprisingly, Panel (b), (c) and (d) of Figure 2 show that the number of firm-bank relationships decreases monotonically with size in all countries. However, the three-clusters pattern described above emerges in all size classes. For the first cluster, the ranking of Italy, Spain, and Portugal is also confirmed in all size classes. The second cluster shows very similar values across-countries, with an average of 3 for medium firms, 2 for small and 1.3 for micro. With the exception of Finland, the median small firm in this cluster borrows only from 1 bank. The fact that the average is closer to 2 implies that there is a long tail of firms entertaining multiple relationships with banks. The Netherlands and Ireland always display low and similar values: in all size classes the one bank model is prevalent. The fact that we obtain similar patterns in all size classes supports the notion that there are important cross-country structural differences in the determination of the number of banks a firm borrows from.

To obtain a summary measure of the cross-country differences, in the first bar of Figure 3 we plot the overall average number of relationships, that is, without distinguishing by size class. We keep the same ranking as in Figure 2. The overall average, between 1 and 2 in all countries, resembles

Figure 2: Number of bank relationships by firm size



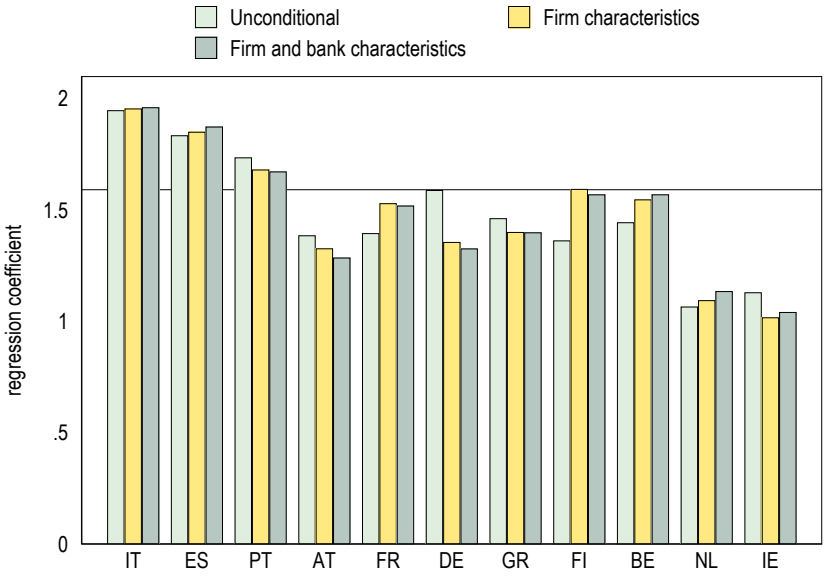
(a) **Large** (b) **Medium**

(c) **Small** (d) **Micro**

Note: The figure shows the firm-bank relationship distribution by country and firm size. The number of relationships is computed at the firm level. The box plot's bars depict the interquartile range, the red line indicates the median and the red triangle represents the average number of relationships. For readability, upper and lower whiskers are omitted. Countries are ordered by descending average number of relationships of large firms. The sample period is December 2019.

that of small and especially micro firms, as they represent the vast majority of firms and therefore substantially affect the mean. The three clusters of countries are again confirmed. At one extreme, Italian firms have almost two relationships on average, while at the other extreme, Irish and Dutch firms have approximately around 1.1 relationships. Within the middle cluster, the ranking is slightly different from the one based on large firms: in particular, German firms display the highest value, followed by Greek firms.

Figure 3: Average number of bank relationships



Note: The figure shows the average number of firm-bank relationships by country. The Unconditional bar represents the unconditional average. The Firm characteristics bar represents the conditional average controlling for size and sector dummies as specified in Equation 4. The Firm and bank characteristics bar includes also the bank size, regional concentration, and bank specialization variables. The horizontal line represents the overall unconditional average. The country order is that of large firms.

One issue with the mean plotted in the first bar of Figure 3 is that it mixes a country attribute (the firm propensity to develop multiple relationships) and firm characteristics. It is well known that both the firm size distribution and sectoral specialization differ systematically across European countries [Pagano and Schivardi, 2003]. As shown above, smaller firms on average borrow from a lower number of banks. Sectoral specialization might also induce different borrowing patterns. For example, due to the sectoral differences in the importance of tangible assets, some sectors tend to rely more on debt financing [Falato, Kadyrzhanova, Sim, and Steri, 2022]. To account for this, we

estimate the following regression specification:

$$\text{Nrel}_{isgc} = \sum_{c=1}^{11} \alpha_c^N D_c^{\mathsf{Ctry}} + \sum_{g=1}^{4} \beta_g^N D_g^{\mathsf{Size}} + \sum_{s=1}^{20} \gamma_s^N D_s^{\mathsf{Sect}} + \epsilon_{isgc} \tag{4}$$

where Nrel_{isgc} is the number of bank relationships entertained by firm i in sector s, size class g and country c, D_c^{Ctry} is a dummy equal to one if firm i belongs to country c and similarly for the four size classes and the twenty sector dummies. We omit the constant to retrieve all coefficients of the country dummies, α_c^N, which represent the *conditional* means, that is, conditional on size and sector effects. To retain comparability with the unconditional mean, we normalize the values so that the overall conditional mean is equal to the overall unconditional mean.[20]

The second column of Figure 3 reports the average number of relationships when controlling for firm characteristics. We detect some changes in the countries' rankings. Specifically, the conditional mean for Germany decreases (from 1.59 to 1.36), consistently with the fact that German firms are on average larger, so that the number of relationships decreases once we account for firm size. To a lesser extent, the same holds for Austria, Greece, Ireland, and Portugal. At the other end, Finland records the largest increase (from 1.36 to 1.59), followed by France and Belgium. The values are almost identical for the other countries. Overall, the differences between the conditional and the unconditional mean are small. This indicates that cross-country differences in the propensity of firms to entertain multiple banking relationships are mostly explained by some country attributes rather than by differences in the size or sectoral composition of firms. Stated differently, Italian and Spanish firms have on average almost twice as many relationships as Dutch and Irish firms also when accounting for sectoral and size differences.

It is also interesting to account for potential differences in the banking structure to determine their impact on firm-bank relationships, distinguishing these effects from other country-specific supply factors. Specifically, we control for bank size, lending market concentration, and banks' sectoral specialization, all of which can be consistently measured in AnaCredit. As a measure of bank size, we use the logarithm of the total credit of the bank across all firms, $size_b = ln(\sum_i \text{ONA}_{ib})$.

[20] In fact, the regression drops one size and one sector dummy, so that the country dummy refers to that size-sector cell. Of course, the choice of the excluded sector and size class affects the absolute values of the α_c but not the cross-country differences $\alpha_{c_1} - \alpha_{c_2}$. We re-base the coefficients by subtracting the average of the conditional country dummies $1/n \sum_c \alpha_c$ and adding the average unconditional country means, so that by construction the overall country mean is equal for the conditional and unconditional means.

Then, we construct the size variable at the firm level to account for firms that have multiple bank relationships as $size_i = \sum_{b \in i} \frac{\text{ONA}_{ib}}{\text{ONA}_i} size_b$, where $b \in i$ is the set of banks that lend to firm i, ONA_{ib} is the credit firm i obtains from bank b and $\text{ONA}_i = \sum_{b \in i} \text{ONA}_{ib}$ is firm i's total credit. As an indicator of market concentration, we use the Hirschman-Herfindahl index (HHI) at the regional level, defined as NUTS3 regions. For each region r, we compute $HH_r = \sum_b \left(\frac{\text{ONA}_{br}}{\text{ONA}_r} \right)^2$ where ONA_{br} is total outstanding credit of bank b to firms located in region r and ONA_r is total outstanding credit to firms located in region r. We then assign to each firm the HH_r corresponding the the region in which the firm is located. Lastly, we quantify the extent of a firm's pool of lenders' specialization in providing credit to the sector in which the firm operates. To do so, we first construct a bank-sector level measure of specialization as $Spec_{bk} = \frac{\text{ONA}_{bk}}{\text{ONA}_b} - \frac{\text{ONA}_{ck}}{\text{ONA}_c}$, where ONA_{bk} is the amount of credit provided by bank b to firms in sector k and ONA_{ck} is the total amount of credit provided to firms in sector k in country c.[21] For a i firm in sector k, we then match to each of its relationships the corresponding bank's specialization in sector k and construct a firm level measure of its lenders' specialization in sector k as the weighted average, $Spec_i = \sum_b \frac{\text{ONA}_{ib}}{\text{ONA}_i} Spec_{bk}$.

The third column of Figure 3 includes the controls for the banking structure, in addition to those for firm characteristics. Controlling for bank characteristics does not change significantly the average number of relationships per country. This suggests that the country attributes that determine the cross-country differences go beyond the features of the lending markets accounted for in the regression. Finally, Column 1 of Appendix Table A2 reports the coefficients on the bank characteristics. Firms borrowing from larger banks or located in more concentrated markets have a smaller number of relationships. Instead, having a pool of more specialized banks increases the number of relationships. A possible explanation could be that the insurance motive against banks' liquidity shocks becomes more salient when banks are specialized in the same sector as the firm, exposing them to common sectoral shocks.

3.2 Reliance on the main bank

Having established that there are substantial differences in the number of relationships across countries, we now check if they translate into differences in the extent to which firms actually rely on

[21] Note here that we winsorize this measure at the top and bottom 1% due to extreme values.

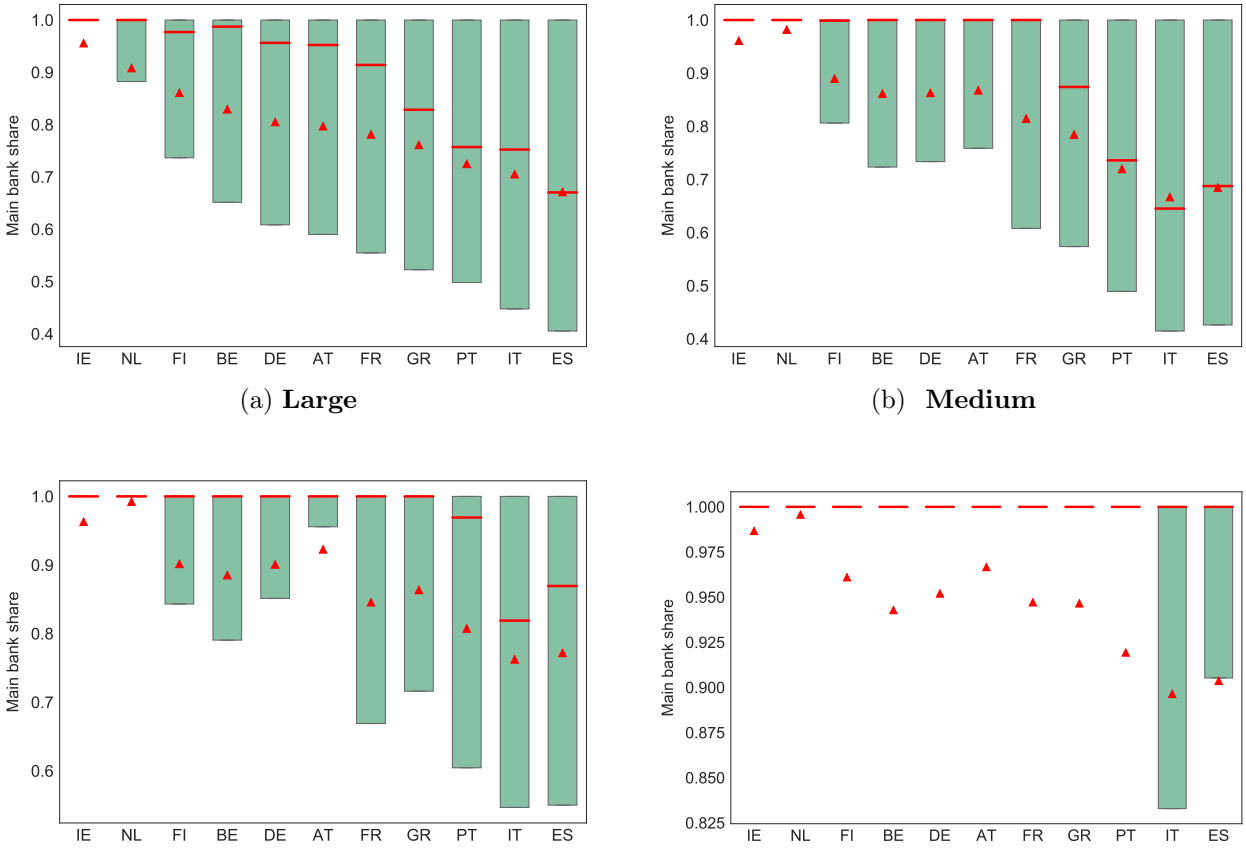
a plurality of banks. In particular, it could be that firms in the first cluster of countries nominally borrow from more banks, but they mostly operate with a single bank, keeping the other relationships in place for insurance reasons. To assess this, we first consider the share of credit a firm gets from the "main bank", defined as the bank that accounts for the largest share of the outstanding credit. We consider the outstanding amount, that is, the credit that a firm is actually using (as opposed to the granted amount, which includes unused commitments).

Figure 4 reports the box plots for the share of credit from the main bank, by firm size and country. As for the number of relationships, we rank the countries from highest to lowest average value of large firms. The pattern of three clusters is broadly confirmed, despite some small differences. For large firms (Panel 4a), the average amount supplied by the main bank is around 0.7 for Italy, Spain, and Portugal, the lowest values, in accordance with the results on the number of banks. In the second cluster, the average value is around 0.8, with Greece and France recording the lowest values and Finland the highest. The average large firm in the Netherlands and Ireland borrows more than 90% of its credit from the main bank.

The mean masks more marked differences in the distribution. In particular, in Austria, Belgium, Finland, France, Germany, Ireland, and the Netherlands, the distribution is left-skewed and the median is substantially higher than the mean; the median firm borrows more than 90% of the total amount from the main bank, while the figure is 70%-80% in Greece, Italy, Portugal, and Spain. This means that, despite a long left tail of firms that do not concentrate their credit demand on one bank, most of the firms in Northern European countries tend to heavily rely on one bank. Firms in Southern countries are also characterized by a higher dispersion in reliance on the main bank, as shown by the higher values of the interquartile range.

The general patterns found for large firms are confirmed for other size classes. The overall values for medium firms are very similar to those for large ones. In this size class, the median firm in all countries but Italy, Greece, Portugal, and Spain borrows only from the main bank. Irish and Dutch medium firms basically draw all their credit from one bank. The share of credit of the main bank increases somehow for small firms but remains below 80% at the mean for Italy, Portugal, and Spain. In these countries, even micro firms on average borrow only around 90% of the total amount from the main bank.

Figure 4: Share of credit from the main bank by firm size



(a) **Large** (b) **Medium**

(c) **Small** (d) **Micro**

Note: The figure shows the share of outstanding nominal amount from the main bank by country and firm size. The share is computed at the firm level and the main bank is defined as the bank that accounts for the largest share of the outstanding credit. The box plot's bars depict the interquartile range, the red line indicates the median and the red triangle represents the average share of credit from the main bank. For readability, upper and lower whiskers are omitted. Countries are ordered by the descending average share of large firms. The sample period is December 2019.

As for the number of relationships, we also report the average value of credit from the main bank at the country level in Figure 5, unconditional (left bar), conditional on size and sector fixed effects (middle bar), and conditional on firm and bank characteristics (right bar). The clusters also emerge clearly in this case. Moreover, as before, controlling for firm and bank characteristics only induces some visible changes in the ranking for Germany and Finland, while for other countries the three means are very similar. This confirms that cross-country differences in the firm-bank relationship and the reliance on funding from the main bank are dictated more by country attributes and less by differences in banks or firm characteristics.

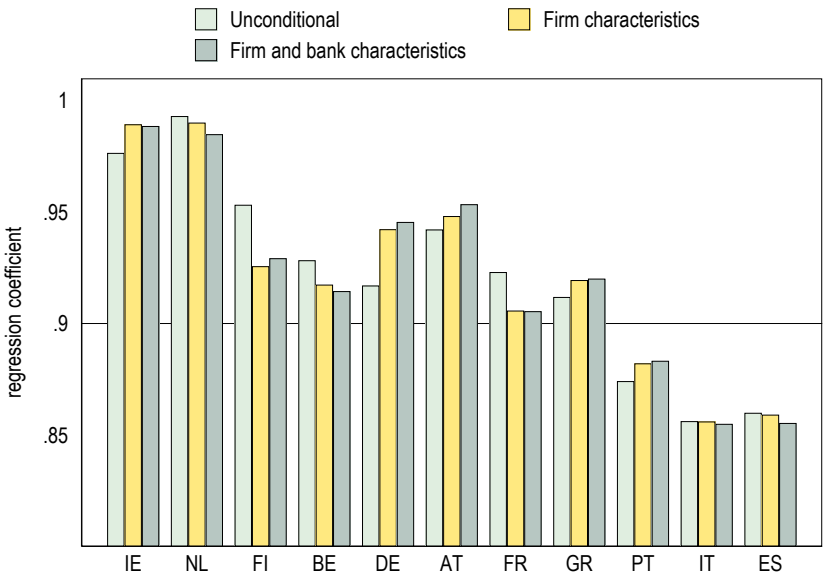
Column 2 of Appendix Table A2 reports the coefficients of the banks' characteristics. For bank size and market concentration, the estimates are consistent with those for the number of relationships: borrowing from larger banks or being located in a more concentrated market increases the reliance on the main bank. Interestingly, the result is instead opposite for bank specialization: having a pool of more specialized banks in the firm's sector increases the number of relationships but also the reliance on the main lender. This could be due to the fact that the firm relies more heavily on one specialized bank, but keep also fringe relationships with other banks for insurance reasons.

As a further indicator of reliance on multiple banking relationships, we calculate the Hirschman-Herfindahl index (HH) to measure credit concentration across banks. The indicator is defined as $HH_i = \sum_{b \in i} \left(\frac{\mathsf{ONA}_{ib}}{\mathsf{ONA}_i} \right)^2$, where the variables are defined above. The results, reported in Appendix Figure A1, fully confirm those based on the main bank.

3.3 Main takeaways

Overall, the evidence presented in this section points to substantial differences in the firm-bank relationship across European countries. At one extreme, Ireland and the Netherlands are well represented by a model in which firms tend to do business mostly with one bank. At the other, Italian, Spanish, and Portuguese firms display a greater tendency to entertain multiple banking relationships and draw a lower share of credit from the main bank. The other countries are in between these two models, with Greece and, to a lesser extent, France closer to the Southern European model and Finland, Germany, Belgium, and Austria closer to the main bank model. We

Figure 5: Average share of credit from the main bank



Note: The figure shows the average share of outstanding nominal amount from the main bank. The Unconditional bar represents the unconditional average. The Firm characteristics bar represents the conditional average controlling for size and sector dummies as specified in Equation 4. The Firm and bank characteristics bar includes also the bank size, regional concentration, and bank specialization variables. The horizontal line represents the cross-country overall unconditional average. Note that the y-axis begins at 0.80. The country order is that of large firms.

have shown that firm size distribution, sector specialization and banks' characteristics may explain some of these differences, but other (unidentified) factors play a more important role.

The differences in the number and importance of firm-bank relationships could have important consequences on firms' performance. On the one hand, higher credit concentration allows firms to develop a closer link with the main bank, which might be more willing to act like an equity holder, providing more long-term finance and a more stable credit supply also to face large, unexpected shocks [see, for example, Petersen and Rajan, 1994]. On the other hand, being dependent on one bank might expose the firm to liquidity and funding shocks affecting its lenders [Detragiache et al., 2000; De Jonghe, Dewachter, Mulier, Ongena, and Schepens, 2019]. Moreover, being dependent on only one bank might reduce the bargaining power of the firm against the bank, implying higher interest rates [Rajan, 1992]. In what follows, we study the types of credit contracts, the loan maturity and the interest rates to gain further insights on these issues.

4 Credit contracts

In section 2.3 we have defined five broad instruments used by firms to obtain credit from banks: loans, credit lines, trade receivables, financial leases, and revolving credit. In terms of maturity, we have classified the first two instruments as long-term and the others as short-term. Long-term credit is particularly suitable to finance investments, while short-term credit is typically used to finance working capital. Moreover, as shown above, the costs of borrowing short term is typically higher. It is therefore interesting to analyze to what extent European firms differ in terms of the instruments used to get credit from banks. We focus on cross-country differences.

We construct the shares by instrument type at the country level as follows:

$$\text{ShInstr}_{jc} = \frac{1}{\text{N}_c} \sum_{i \in c} \left(\frac{\text{ONA}_{ijc}}{\text{ONA}_{ic}} \right) \tag{5}$$

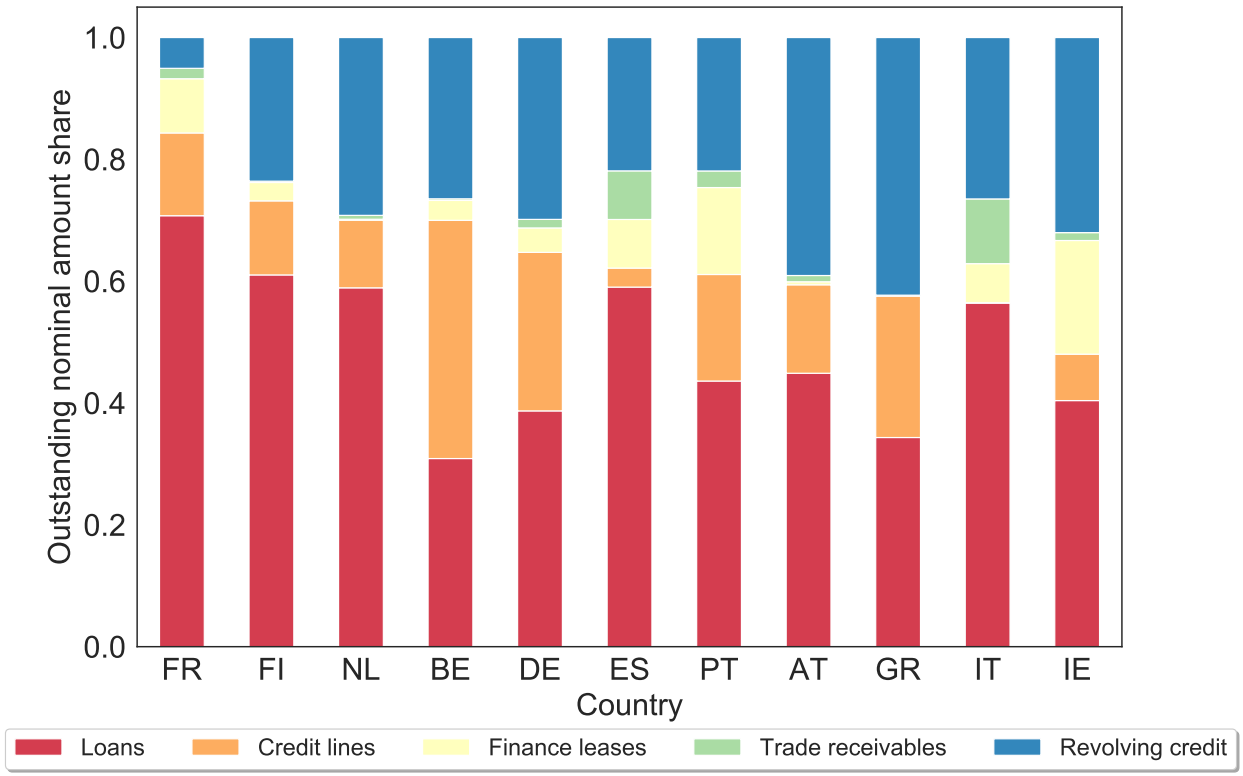
where j is the type of instrument, N_c is the total number of firms in country c, ONA_{ijc} is the total credit firm i has in country c and instrument type j, and ONA_{ic} is firm i total credit. Figure 6 plots the share of credit by instrument for each country.[22] We rank countries in terms of the share of credit obtained through loans and credit lines – that is, long-term credit. The graph shows large cross-country differences in the relative importance of the credit instruments. French firms show the highest reliance on long-term credit (more than 80%), followed by Finnish and Dutch firms. At the other extreme, Greek, Italian and Irish firms borrow less than 60% in long-term instruments.

Other interesting differences emerge. In terms of short-term instruments, revolving credit is particularly used in Austria, Ireland, and Greece (which records the highest share). Italy and Spain have relatively high shares of trade receivables, possibly reflecting longer payment terms used in business-to-business transactions. Credit lines are important in Belgium and Greece, where they account for a share of credit similar to that of loans, as well as in Germany. These instruments are not used in Italy, and not much used in Spain. Leases are more common in France, Ireland, and Portugal, while they are used very little in Austria, Germany, Greece, and the Netherlands.

If firms have several banking relationships, it is possible that they borrow on long-term instru-

[22] To better summarize the information, we only report country aggregates in the main text. Appendix Figure A4 shows the share by firm size. The country rankings by instrument type tend to be less stable across size classes compared to the other variables that we consider in the analysis.

Figure 6: Instrument type shares by country



Note: The figure shows the shares of total outstanding amount by loan types coming from all banks aggregated at the country level. Countries are ordered by descending combined shares of loans and credit lines.

ments mainly from the main bank, whilerelyingy on other instruments when dealing with fringe banks. In fact, long-term financing might require a deeper understanding of firm projects and growth prospects, which is more likely to be developed by the main bank. Moreover, the main bank's willingness to provide financing may be affected by the knowledge that the firm is acquiring funds also from other banks [Degryse, Ioannidou, and von Schedvin, 2016]. To analyze this aspect of the firm-bank relationship, Appendix Figure A3 plots the instrument type shares separately for all banks except the main bank (first bar) and for the main bank only (second bar). The figure supports this conjecture: in all countries except Belgium, the main bank supplies a larger fraction of credit through long-term instruments.[23] This suggests that "fringe" banks act mostly as liquidity

[23]Berger and Udell [1995] assume that lines of credit produce more information than loan contracts and measure the intensity of relationship lending using the length of the relationship based only on lines of credit. They find that longer relationships are related to lower rates and less collateral. We do not find similar evidence in our analysis, as the main bank could also be the one with the longest relationship in terms of short-term instruments, despite providing a smaller share than fringe banks. Unfortunately, the time-series dimension of AnaCredit is still too short

providers, in line with the hypothesis that firms entertain multiple banking relationships to insure themselves against banks' liquidity shocks (see Detragiache et al. [2000]). Of course, there may be other sources behind these pronounced differences in the use of borrowing contracts. For example, Degryse, De Jonghe, and Karagiannis [2021] show that as a result of a legal change supporting credit to small firms, banks in Belgium reduced the supply of term loans while increasing revolving credit lines.

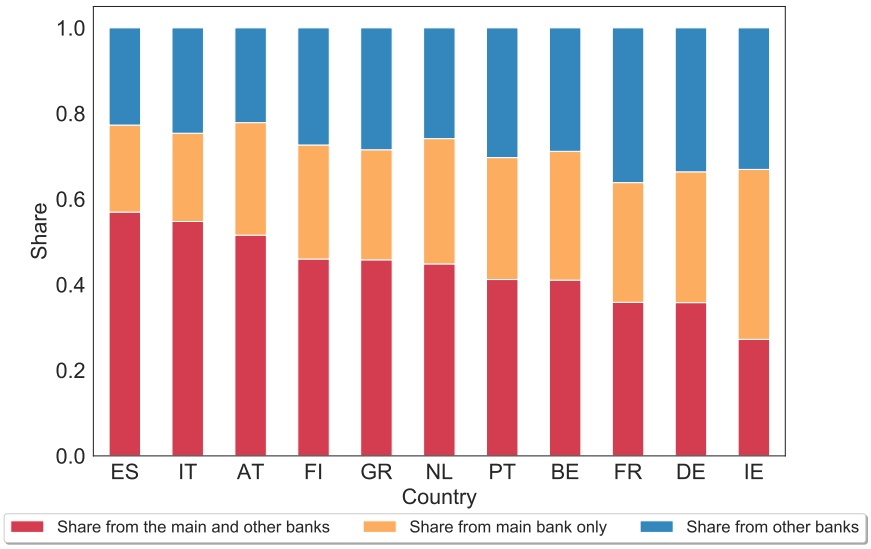
Specialization could occur at the extensive margins, that is, the main bank providing long-term instruments and the other banks more short-term instruments, or at the intensive margins, with main and fringe banks supplying the same instruments but with different intensities. To analyze if firms tend to obtain some instruments from the main bank and other instruments from the fringe banks, we proceed as follows. First, we sample from our database only firms borrowing from multiple banks. For each firm, we compute the share of instruments obtained from the main bank only, from fringe banks only, and from both the main and fringe banks. We then take the country average. If credit demand from firms is specialized, the overlap of instruments from both the main and fringe banks should be small.

Results are reported in Figure 7. Overall, approximately half of the instruments are supplied by both the main and the fringe banks, slightly less than a quarter by the main bank only, and slightly more than a quarter by the other banks only. This indicates that credit demand is far from fully specialized, as a substantial portion of instruments are obtained contemporaneously from the main bank and from fringe banks.

In terms of cross-country differences, Spain and Italy have a larger share of instruments from both types of banks, indicating that credit demand is less specialized in these countries. They are also the countries with less credit from the main bank. At the other extreme, in Germany, France, and Ireland, credit demand is most specialized. Note that the share of instruments from the main bank only is very similar for all countries at around 30% except Spain (20%), Italy (21%), and Ireland (14%).

to analyze the duration of relationships.

Figure 7: Shares of instruments by country for firms with multiple relationships



Note: The figure shows the share of instruments by country obtained from both main and fringe banks, from main bank only and from fringe banks only. Countries are ordered by descending share of instruments obtained from both the main and fringe banks.

5 Maturity

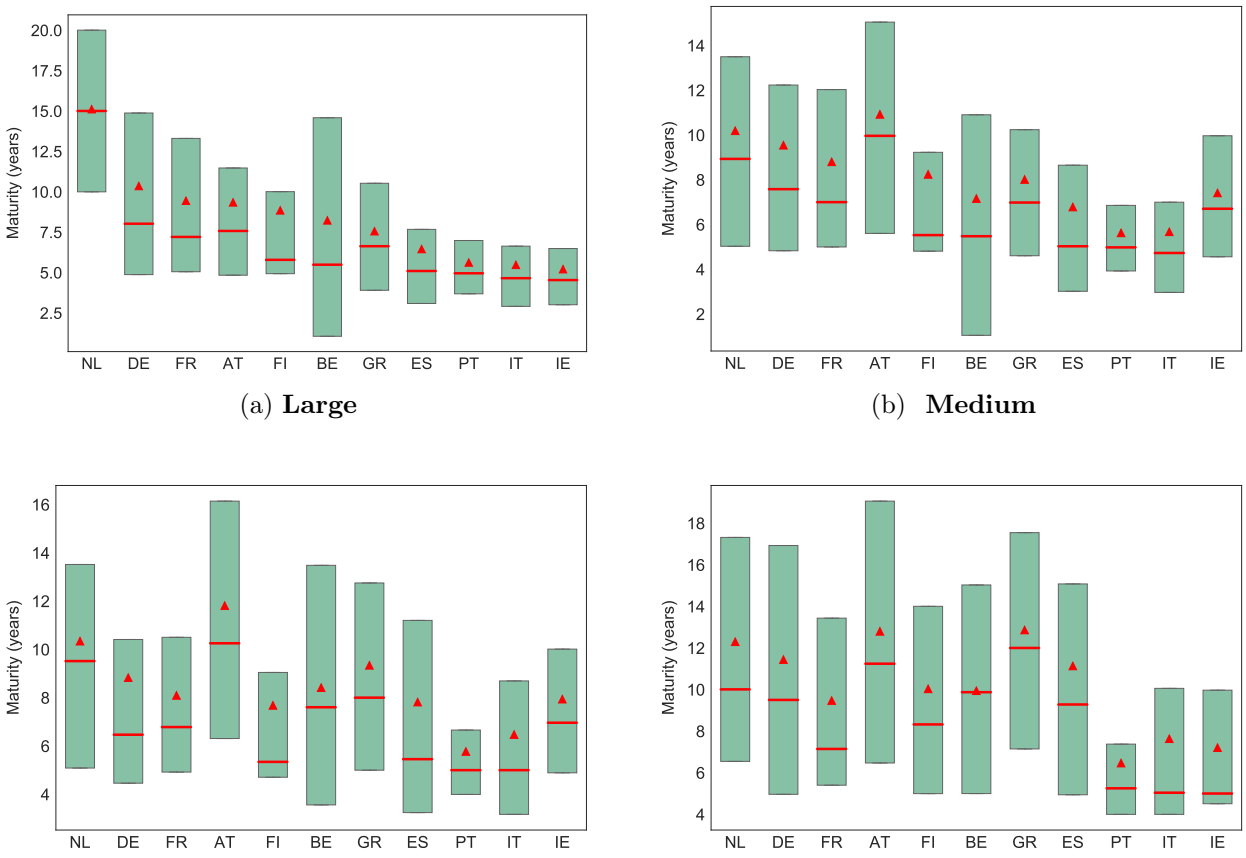
In the previous section, we have analyzed the reliance on different types of credit contracts and found that there are substantial cross-country differences in how much firms borrow on long-term credit, that is, loans and credit lines. This can be seen as the extensive margin of credit maturity. In this section, we further deepen this aspect and analyze in details the maturity of the two long-term instruments. We focus on loans and credit lines because for the short-term instruments maturity is less meaningful: for example, revolving credit has no maturity, as the firm can draw on the facility as long as the bank keeps it open. To simplify the analysis, we consider total long-term credit and construct its average maturity at the firm level as follows:

$$m_{ic} = \sum_{b} \sum_{j=L,CL} \overline{w}_{ijbc} m_{ijbc} \tag{6}$$

where we only sum over loan (L) and credit lines (CL), $\overline{w}_{ijbc} = \frac{\text{ONA}_{ijbc}}{\overline{\text{ONA}}_{ic}}$ and $\overline{\text{ONA}}_{ic} = \sum_b \sum_{j=L,CL} \text{ONA}_{ijc}$ and the bar indicates that we are summing over loans and credit lines only.

Figure 8 reports the results by firm size, ordering countries in descending order of maturity for

Figure 8: Maturity by firm size



(a) **Large** (b) **Medium**

(c) **Small** (d) **Micro**

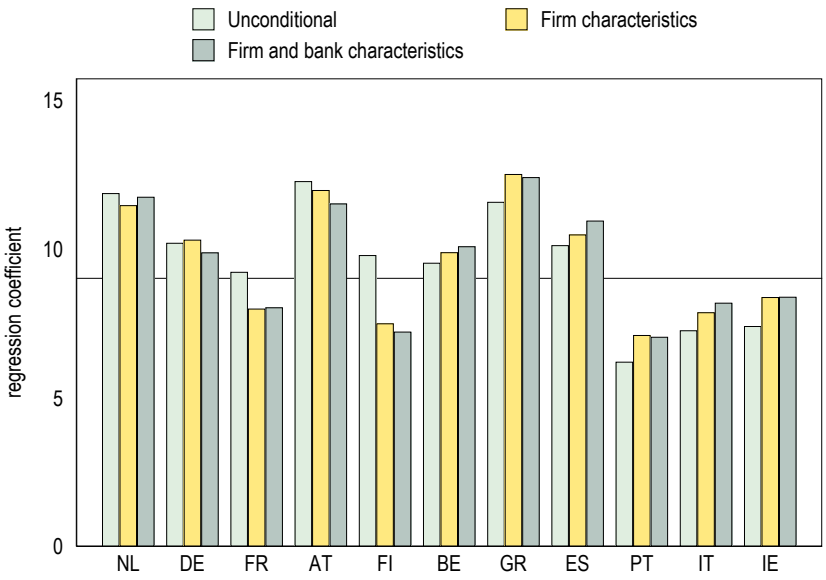
Note: The figure shows the distribution of maturity by country and firm size. The values are computed at the firm level as specified in Equation 6. The box plot's bars depict the interquartile range, the red line indicates the median and the red triangle represents the average maturity. For readability, upper and lower whiskers are omitted. The credit contracts include only long-term maturity instruments, i.e., loans and credit lines. Countries are ordered by the descending average maturity of large firms. The sample period is December 2019.

large firms. Maturity has a large degree of cross-country variability. Large Dutch firms have an exceptionally high average maturity of 15 years for bank credit. German firms, which rank second, have an average maturity of 10 years. Next, we have France (9.5), Austria (9.4), Finland (8.9), Belgium (8.2) and Greece (7.6). Spain, Portugal, Italy and Ireland display a maturity between 7 and 5 years. Interestingly, this ranking also indicates a cluster of Northern countries with longer maturities and one of Southern countries with shorter maturity. For example, the average maturity of long-term bank debt of Italian firms is 47.0% lower than that of German firms. This pattern resembles to a large extent what we have seen for the number of relationships and the type of instruments. The Netherlands and Ireland represent a special case, as they display very similar values in terms of the number of relationships and of the share of credit from the main bank, but are at opposite extremes in terms of maturity. Together with the evidence on the extensive margin of credit maturity, where Irish firms display the lowest share of borrowing long-term while the Dutch firms are in the middle of the distribution (see Figure 6), this suggests that the single bank model may generate very different outcomes in these two countries.

In terms of other size classes, first, we notice that average maturity seems to be fairly similar across size–if anything, large firms tend to have a shorter maturity. This might be due to the fact that they tend to finance long-term projects more with the issuance of bonds compared to smaller firms. The country ranking is broadly confirmed across size classes. The most noticeable exception is Austria, which ranks at the top of maturity for all size classes but the large one, and, to a smaller extent, Greece and Ireland.

Figure 9 plots the country averages unconditional (left bar), conditional on firm size and sector fixed effects (middle bar), and conditional on firm and bank characteristics (right bar). The average unconditional maturity ranges from around 12 years for Austria, the Netherlands, and Greece to 6 years for Portugal, broadly confirming the cross-country variation. The increase in the ranking of Greece is due to the fact that small and especially micro firms in Greece tend to borrow at longer maturities than large firms (see Figure 8c and 8d). As for the number of relationships and share of credit from the main bank, the differences between the unconditional and the conditional mean – both with or without bank characteristics – are fairly small, confirming that there is an important country component in the determination of the firm-bank relationship. Finally, Column

Figure 9: Average Maturity



Note: The figure shows the average maturity of long-term instruments. The Unconditional bar represents the unconditional average. The Firms characteristics bar represents the conditional average controlling for size and sector dummies as specified in Equation 4. The Firm and bank characteristics bar includes also the bank size, regional concentration and bank specialization variables. The horizontal line represents the overall cross-country unconditional average. The country order is that of large firms.

3 of Appendix Table A2 reports the coefficients of the banks' characteristics. Firms borrowing from larger banks have lower maturity of credit, while the opposite occurs for those located in more concentrated markets and borrowing more from banks specialized in the same sector as the firm.

6 Interest rates

In Section 2.4 we have constructed the measure of interest rate at the firm level as the weighted average of the interest rate on each contract, weighted by the share of the outstanding amount the contract accounts for (see Equation 3). We now analyze how this measure differs across countries. As for the other variables, we use simple means, that is,

$$r_c = \frac{1}{N_c} \sum_{i \in c} r_{ic}. \tag{7}$$

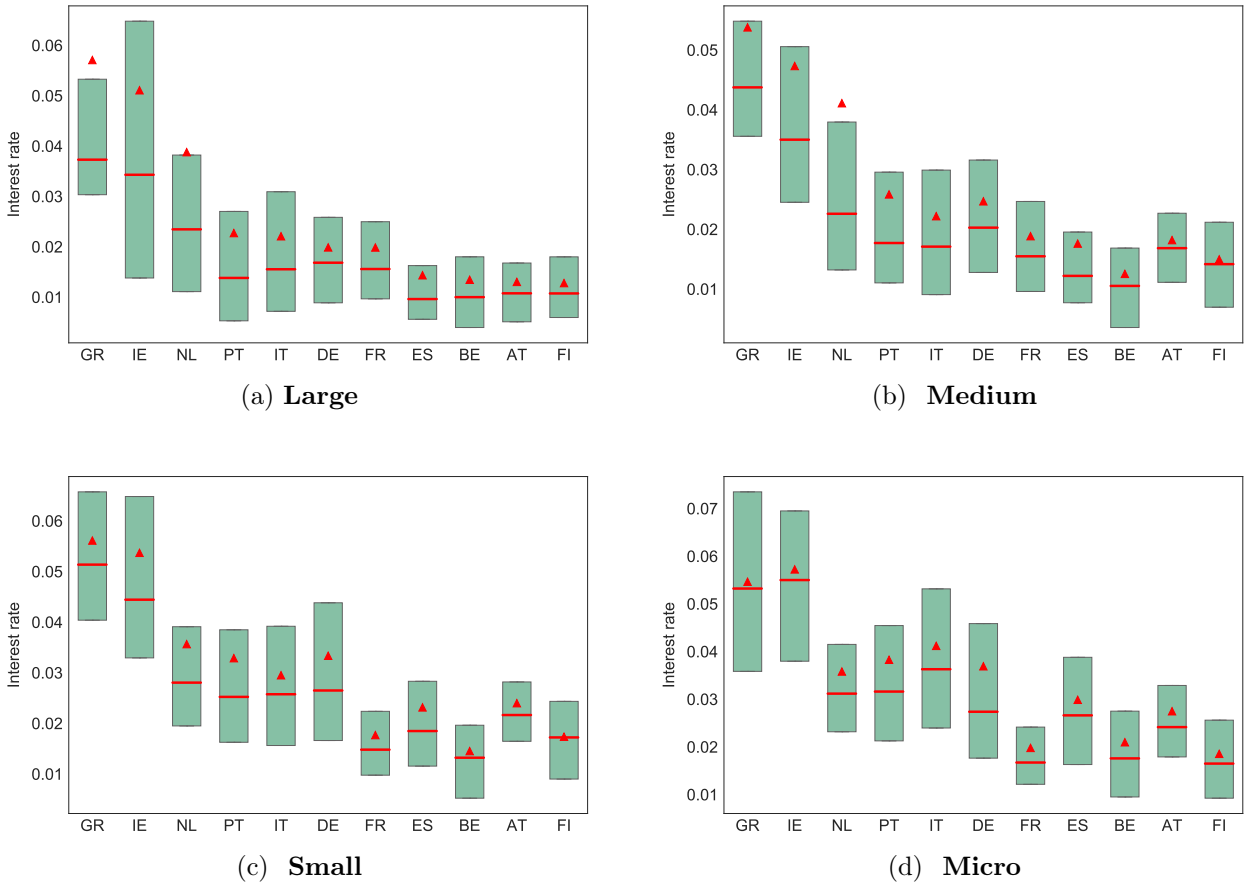
We then perform a shift and share decomposition to assess how much of the observed heterogeneity is due to differences in the firms' size and to sector structure, to the reliance on different instruments or to country-specific effects unexplained by firm and contract characteristics.

6.1 Cross-country differences in interest rates

Figure 10 shows the interest rate by country and firm size, ranking countries in terms of the average interest rate paid by large firms. Greek firms are at the top of the distribution, with an average rate of almost 6%. Note that the mean is above the 75^{th} percentile, suggesting a long tail of firms paying very high interest rates. In fact, the median is below 4%, but even in this case, it represents the highest value among the 11 countries. Next, Irish firms pay an average rate of 5%, and Dutch firms of 4%. Ireland is also the country with the largest interquartile range: the 75^{th} percentile of the distribution is 6.5% and the 25^{th} is 1.4%. The other countries record lower and similar average rates, with Portugal, Italy, Germany, and France just above 2% and Spain, Belgium, Austria and Finland just below 2%. This pattern is basically identical for medium-size firms, and very similar for small and micro firms. Two differences emerge for the smaller size classes: Dutch firms pay rates more similar to the middle group of countries and French firms are closer to the countries that pay the lowest rates. In all cases, the difference between the highest rate and the lowest is between 3% and 4%, a very large figure compared to a cross-country mean of 3%. The observed differences in interest rates may arise from to the number of firm-bank relationships that we have analyzed in the previous sections. Recent evidence has shown that banks with close ties with firms exploit their informational advantage and charge interest rates higher than those that would prevail were all banks symmetrically informed. However, these differences do not generally persist [Schenone, 2009; Ioannidou and Ongena, 2010]).

We have seen in Figure 1 that interest rates are more dispersed across instrument types than size classes. In Appendix Figure A2 we report the interest rates by country and instrument. To a large extent, the same country pattern of Figure 10 emerges within instruments, with Ireland and Greece showing higher rates. Moreover, in Figure 6 we have seen that firms in different countries rely to a different extent on different instruments. In particular, Ireland and Greece, which record the highest average rate, are also the countries where firms borrow the most through revolving

Figure 10: Interest rates by firm size



(a) **Large** (b) **Medium**

(c) **Small** (d) **Micro**

Note: The figure shows the distribution of interest rates by country and firm size. The interest rate is computed at the firm level as specified in Equation 7. The box plot's bars depict the interquartile range, the red line indicates the median and the red triangle represents the average interest rate. For readability, upper and lower whiskers are omitted. Countries are ordered by the descending average interest rate of large firms. The sample period is December 2019.

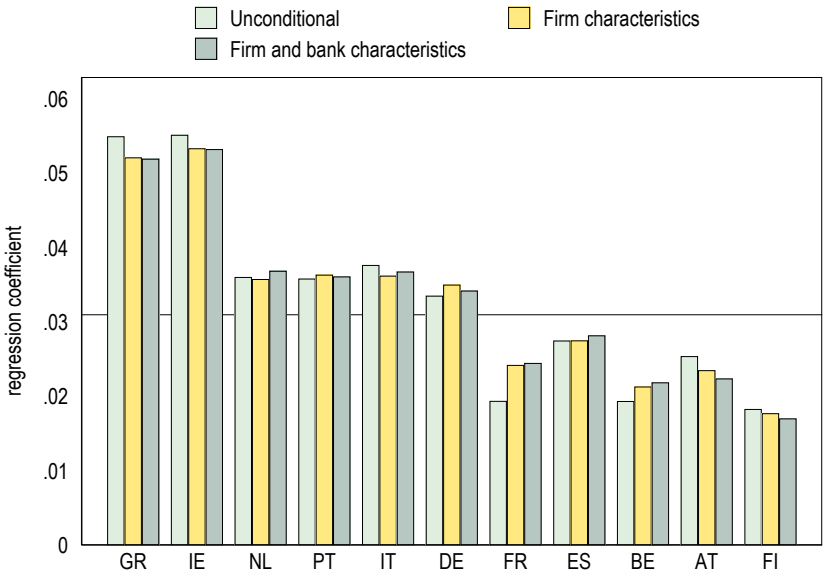
credit, which is also the most expensive form of credit, as shown in Figure 1b. We will come back to this point in the decomposition exercise that we perform in the next subsection.

One potential concern is that interest rates differ across countries because the age distribution of long-term credit differs. For example, in some countries, a larger share of credit might have been issued when interest rates were particularly high. Note that the age distribution is an endogenous factor and it is unclear that we should control for it. In any case, we directly check for this possibility in Appendix Figure A5 where we plot the average interest rate on long-term instruments issued at any date and those issued in 2019 only. The second set compares instruments issued in the same year, controlling for this possibility. We find that the average interest rates on the two sets of

long-term instruments are very similar in all countries.

Figure 11 reports the cross-country average interest rate and shows that there are substantial differences across countries. At one extreme, Greece and Ireland have an average interest rate of almost 6%. At the other, Belgium, France, and Finland have an interest which is around a third of such value (2%). The other countries are somewhere in the middle, with the interest rate ranging between 3% and 4%. The standard deviation of r_c is 1.2%, about a third of the mean value.

Figure 11: Average Interest Rate



Note: The figure shows the weighted average interest rates. The Unconditional bar represents the unconditional average as defined in Equation 7. The Firms characteristics bar represents the conditional average controlling for size, sector and instrument type dummies as specified in Equation 8. The Firm and bank characteristics bar includes also the bank size, regional concentration, and bank specialization variables. The horizontal line represents the overall cross-country unconditional average. The country order is that of large firms.

Cross-country differences in the interest rates may reflect differences in the underlying firm characteristics and/or in the types of borrowing contracts. If similar firms in different countries pay different rates on the same credit contract, one would need to resort to a "country effect" to explain rates, such as the competitiveness of the banking sector, or differences in the overall cost of funding for banks, that are passed over to borrowers. If instead differences are mostly due to firm characteristics and instrument types, similar firms borrowing on the same instrument would

be paying similar rates, indicating a higher degree of homogeneity in credit conditions than that suggested by the unconditional means. The previous analysis indicates that the differences also emerge within size class and instrument type. However, considering one aspect at a time might not be able to fully account for firm and contract characteristics. As we did for the number of banking relationships, we run the following regression:[24]

$$r_{isgjc} = \sum_{c=1}^{11} \alpha_c^r D_c^{\mathsf{Ctry}} + \sum_{g=1}^{4} \beta_g^r D_g^{\mathsf{Size}} + \sum_{s=1}^{20} \gamma_s^r D_s^{\mathsf{Sect}} + \sum_{j=1}^{5} \theta_j^r D_j^{\mathsf{Instr}} + \eta_{isgjc} \tag{8}$$

where r_{isgjc} is the interest rate for instrument type j of firm i in size class g, sector s and country c, D_j^{Instr} are dummies for the five instruments, D_g^{Size} are size dummies that are equal to 1 if firm i belongs to size class g, D_s^{Sect} are two-digit sector dummies, D_c^{Ctry} are country dummies and η_{isgjc} is the residual. The constant is omitted to include all levels of D_c^{Ctry}, which represents the conditional average interest rates, and we use the same normalization as we have done for the number of firm-bank relationships to obtain an overall mean equal to the unconditional one. To make the estimates comparable to the unconditional averages, we weight each observation by ω_{ijc} as defined in Equation 2.[25] As before, we complement the regression results with a specification that we include also bank characteristics as controls. Specifically, we control for bank size, bank concentration at the regional level, and bank specialization[26].

The middle bars of Figure 11 plot the estimated country dummies $\hat{\theta}_c$, which represents the conditional mean after controlling for firm size and sector fixed effects, as well as instrument type fixed effects. There is some evidence of convergence, as most countries with value above the horizontal bar - the overall mean - have lower conditional mean. But there are also a few cases in which the opposite occurs, or in which the two values are almost identical. The standard deviation of the average interest rate drops somehow, from 1.3% to 1.2%, but remains substantial. The third column displays the estimates obtained after adding bank characteristics, yielding very similar results.[27] This indicates that, while firm and bank characteristics partially account for cross-country differ-

[24] Note that, compared to Equation 4 where the unit of observation is a firm-period, here we are at the more granular level of firm-instrument-period.

[25] In fact, if we run the regression with only country dummies, we recover exactly the unconditional mean rates.

[26] The definitions of the control variables are provided in section 3.1.

[27] Column 4 of Appendix Table A2 reports the coefficients of the banks' characteristics. Firms borrowing from larger banks pay lower rates. Surprisingly, the same happens for firms located in more concentrated markets. Borrowing more from banks specialized in the same sector as the firm is related to higher rates.

ences in interest rates, most of the heterogeneity remains unexplained. Finally it is important to underline how these differences persist across-countries that have been in a monetary union for more than two decades. The presence of these differences affects the transmission of monetary policy and the provision of banks' credit supply to firms [Bittner, Bonfim, Heider, Saidi, Schepens, and Soares, 2022].

6.2 Shift and share decomposition

Next, we want to provide a quantitative assessment of how much of the cross-country difference in average rates is due to differences in firm characteristics and instruments across-countries and how much is due to differences within firms and instruments. Our unit of analysis is a sector s, firm size g and instrument type j. For size and sector, the exercise is straightforward. Consider the case of firm size. For class size $g = 1, ..., 4$, define the average interest rate $r_{gc} = \frac{1}{N_{gc}} \sum_{i \in g} r_{ic}$, where N_{gc} is the number of firms in size class g and we sum over all firms by size class. Define the share of firms in class g as $\omega_{gc} = \frac{N_{gc}}{N_c}$. By construction, $r_c = \sum_g \omega_{gc} r_{gc}$, where $r_c = \frac{1}{N_c} \sum_i r_{ic}$. Define barred variables as those constructed using firms in all countries. We can now decompose the difference in the mean rate for a country c with respect to the overall level using the Baily, Hulten, and Campbell [1992] decomposition:

$$r_c - \bar{r} = \sum_{g=1}^{4} \left\{ \underbrace{(\omega_{gc} - \bar{\omega}_g)\bar{r}_g}_{\text{Between}} + \underbrace{(r_{gc} - \bar{r}_g)\bar{\omega}_g}_{\text{Within}} + \underbrace{(\omega_{gc} - \bar{\omega}_g)(r_{gc} - \bar{r}_g)}_{\text{Cross}} \right\} \tag{9}$$

The Between term captures the deviation in the country interest rate relative to the overall average due to differences in firm size structure. For example, a country with a higher share of small and micro firms, paying a slightly higher interest rate (see Figure 1a), will register a positive Between component. The Within term captures differences within size class, fixing the size composition at the overall sample average. When this component is large relative to the Between, it means that the average rate is higher because firms pay a higher rate. The cross term is a covariance, and it is positive when a country has a larger share of firms in the size classes with higher rate. The method applies identically for sectors.

Things are more complicated for instrument types, as the firm level interest rate is weighted

by the share of ONA each instrument accounts for within firm. In this case, we define the average interest rate for instrument j as:

$$r_{jc} = \sum_i \frac{\omega_{ijc}}{\sum_i \omega_{ijc}} r_{ijc} \tag{10}$$

where, as defined in Section 2.4, $\omega_{ijc} = \frac{\mathsf{ONA}_{ijc}}{\mathsf{ONA}_{ic}}$, $\mathrm{ONA}_{ic} = \sum_j \mathrm{ONA}_{ijc}$. That is, we weight each interest rate by its contribution to the firm-level interest rate and normalize the weights so that they sum to one. The overall weight of instrument j is defined as:

$$\omega_{jc} = \frac{1}{N_c} \sum_i \omega_{ijc}. \tag{11}$$

With this definition, the average cross-instruments interest rates coincides with r_c.

Table 2 reports the results of the decomposition. At the high end, in Ireland and Greece the average rate is 2.7% higher than the cross-country average of 2.8%. At the other end, in Belgium and Finland the average rate is almost 1% lower than the cross-country average. The size decomposition confirms that the differences in the size structure are a minor determinant of cross-country differences in the interest rate. In fact, the Within component explains basically all the differences for all countries. The largest Between component is for German firms: due to the higher share of large firms, the average rate in Germany is 10 basis point lower than it would be if it had the same size structure as the cross-country average. This negative component is more than compensated by the higher rates that German firms pay within size class. The Cross component is generally small. This result is partially explained by the fact that the differences in the interest rates across size classes are not very large (see Figure 1a)

Table 2: Shift and share decomposition by size class, sector and instrument

Country	Rate	Difference	By Size			By Sector			By Instrument		
			Between	Within	Cross	Between	Within	Cross	Between	Within	Cross
IE	5.52	2.71	-0.05	2.77	-0.01	0.12	2.35	0.24	0.46	2.19	0.06
GR	5.50	2.69	-0.02	2.68	0.02	0.19	2.37	0.13	0.50	1.90	0.29
IT	3.77	0.96	0.01	0.92	0.02	0.11	0.88	-0.03	0.33	0.45	0.17
NL	3.61	0.79	0.00	0.80	-0.01	0.06	0.65	0.09	0.20	0.52	0.08
PT	3.59	0.77	-0.02	0.81	-0.02	0.10	0.70	-0.03	0.13	0.72	-0.08
DE	3.36	0.54	-0.10	0.71	-0.07	0.08	0.50	-0.03	0.17	0.22	0.15
ES	2.75	-0.06	0.00	-0.06	-0.00	0.09	-0.12	-0.03	0.16	-0.13	-0.09
AT	2.54	-0.27	-0.04	-0.21	-0.02	0.05	-0.29	-0.02	0.46	-0.41	-0.32
FR	1.94	-0.87	0.03	-0.88	-0.01	-0.17	-0.91	0.20	-0.42	-0.67	0.22
BE	1.94	-0.87	0.02	-0.91	0.01	0.11	-0.88	-0.10	-0.19	-1.09	0.40
FI	1.83	-0.98	0.06	-1.01	-0.03	-0.11	-0.80	-0.07	0.08	-0.93	-0.14

Note: The table reports the shift and share decomposition by size class, sector and instrument. Rate is the average interest rate, Difference is the difference of the country interest rate with respect to the total sample average. This difference is decomposed in the Between, Within and Cross components based on Equation (9) by size class, sector and instrument type.

Some more action from the Between component emerges when decomposing in terms of sectoral specialization. In this case, for most countries, this component accounts for around 10 basis points (in absolute value) of the total difference. However, even in this case, the Within component is much more important. The Cross component is also relevant for some countries. For example, it accounts for 20 basis points higher average rate for France, implying that, compared to the overall sample, France tends to have a larger share of firms in sectors in which firms pay higher rates and vice-versa.

The Between component is more important when we decompose in terms of the type of instrument. Greece, Ireland, Austria and Italy record an average rate that is between 30 and 50 basis points higher than the overall average. The Netherlands, Portugal, Spain, Germany, and Belgium also have a positive contribution from this component, while France and Belgium are the only countries with a negative contribution. The within component still plays a prominent role but to a lesser extent than for size structure and sector specialization. The cross term is also somehow important, but less than the other two.

Overall, the decomposition exercise indicates that size structure and sector specialization play a relatively minor role in explaining the cross-country differences in the average rates. Instead, differences in the reliance on credit instruments play a more prominent role. This is consistent with the substantial differences recorded in the interest rates across instruments, as shown in Figure 1b. However, most of the variation in the average interest rate across countries is still not accounted for by these factors, pointing to unexplained country effects.

7 Assortative matching between firms and banks by size

In this section, we study whether small firms tend to match with small banks and whether this pattern differs across countries. Using US data from the Federal Deposit Insurance Corporation, Mkhaiber and Werner [2021] show that firms and banks tend to match assortatively in terms of size. Our data provide a unique opportunity to test the degree of assortative matching and the extent to which it differs across countries. To the best of our knowledge, this is the first analysis of assortative matching based on uniform data that cover the majority of lending relationships in a

cross-country setting.

Whether assortative matching between firms and banks has positive or negative implications for firms is ambiguous. On the one hand, small banks may rely more on the relationship lending model and the collection of soft information and in this way provide better credit terms to smaller firms [Berger and Udell, 1995]. On the other hand, smaller firms that have only a single lending relationship with a small bank may face a negative credit shock if a banking consolidation takes place [Peek and Rosengren, 1998; Di Patti and Gobbi, 2007; Degryse, Masschelein, and Mitchell, 2011]. The same holds true if small banks are more exposed to liquidity shocks. As in the rest of the paper, our aim is not to assess the benefits or the costs of assortative matching but to highlight cross-country differences concerning assortative matching.

We proceed as follows. Using our firm size classification, we split firms into two categories, combining micro and small firms (that we call small for brevity) in one group and medium and large firms (large) in the other group. To classify banks, we rank them from smallest to largest in terms of outstanding nominal amounts within each country. We then split the sample between large and small banks in such a way as to minimize the difference in the total outstanding nominal amount of credit of the two groups of banks. This procedure splits banks in such a way that the differences in shares across the two groups are always below 5%, except in Greece, where the share of small banks is 58%, Ireland (42%), and the Netherlands (37%).

7.1 Credit to small and large firms by bank size

First, we analyze the propensity of small and large banks to specialize in lending to small and large firms. To do so, we compute $SpecCr_f^b = \text{ONA}_f^b/\text{ONA}^b$, where the subscript $f = \{SF, LF\}$ indicates small and large firms respectively, and the superscript $b = \{SB, LB\}$ indicates small and large banks. For example, ONA_{SF}^{SB} represents the total credit extended by small banks to small firms, while ONA^{SB} denotes the total credit by small banks. This statistic answers the following question: for one euro of credit supplied by each bank size class, what share is allocated to small and large firms respectively? This is the natural measure of bank specialization (by size) and it is informative of the potential effects of changes in the bank size structure on credit availability for firms of different sizes. Note that, by construction, $SpecCr_{SF}^b + SpecCr_{LF}^b = 1$, so we only report

$SpecCr^b_{SF}$.[28]

As a measure of assortative matching, we use the difference in the share of credit to small firms between small and large banks:

$$\Delta SpecCr_{SF} = SpecCr^{SB}_{SF} - SpecCr^{LB}_{SF}. \tag{12}$$

The perfect assortative matching implies $\Delta SpecCr_{SF} = 1$. Small banks only lend to small firms ($SpecCr^{SB}_{SF} = 1$) and large banks only lend to large firms ($SpecCr^{LB}_{SF} = 0$). No assortative matching occurs when small and large banks allocate the same share of credit to small firms so that $\Delta SpecCr_{SF} = 0$. When $\Delta SpecCr_{SF} < 0$, there is *reverse* assortative matching: small banks allocate less credit to small firms relative to large banks.

Table 3 reports $SpecCr^{SB}_{SF}, SpecCr^{LB}_{SF}$, and $\Delta SpecCr_{SF}$, with countries listed in descending order of $\Delta SpecCr_{SF}$. There is assortative matching in 9 out of 11 countries: small banks allocate a larger portion of their overall lending to small firms with respect to large banks. The difference between the share of credit allocated to small firms by small and large banks is largest in Finland, Germany, Austria, and the Netherlands: in these countries, one additional euro of lending by small banks generates between 11 and 23 cents more lending to small firms than one additional euro of lending by large banks. Italy and France display more moderate levels of assortative matching ($\Delta SpecCr_{SF} \approx 0.05$) while Belgium, Greece, Portugal, Spain, and Ireland display very little or no assortative matching (with Ireland showing a high degree of reverse assortative matching). Interestingly, a North-South divide emerges: Northern European countries are characterized by a substantially large level of assortative matching than Southern European countries, where assortative matching is almost absent.

It is also instructive to consider the *level* of specialization $SpecCr^b_f$, in addition to its difference. Columns (1) and (2) show that, despite being characterized by a large degree of specialization, Finnish banks allocate a substantial portion of their total lending to SMEs: 67% in small banks and 46% in large banks. The same occurs in France, while the opposite occurs in Greece, where both

[28] Given that the bank specialization index is normalized by the total credit offered by each bank size class, it is to a first approximation independent from the overall share of credit offered by the size class. That is, this indicator is computed *within bank size class*, therefore accounting for differences in ONA between bank size classes. This implies that it is comparable even across countries in which the share of credit of small and large banks is substantially different.

small and large banks allocate slightly more that one-third of their total lending to small firms. Large Finnish banks, therefore, lend approximately the same share of credit to SMEs as small Italian, Spanish, and Portuguese banks. In Austria, instead, the large degree of specialization is due to the fact that large banks allocate a small share of credit to small firms (27%). Note however that these comparisons depend on total credit demand by firm size: in fact, overall, Finnish SMEs account for a larger share of bank credit to firms than in other countries. This could be due to differences in the firm size structure or to different access to alternative sources of finance by firm size. For example, large Finnish firms may tend to use less bank lending as a source of finance compared to large firms in other countries.

Table 3: Lending of small and large banks to firms by firm size classes

	(1) $SpecCr_{SF}^{SB}$	(2) $SpecCr_{SF}^{LB}$	(3) $\Delta SpecCr_{SF}$
AT	0.50	0.27	0.23
FI	0.67	0.46	0.21
DE	0.52	0.34	0.18
NL	0.57	0.46	0.11
IT	0.48	0.42	0.06
FR	0.67	0.62	0.05
BE	0.54	0.51	0.03
PT	0.50	0.48	0.02
GR	0.37	0.36	0.01
ES	0.44	0.46	-0.02
IE	0.26	0.56	-0.30

Note: The table reports the share of credit that each bank type allocates to small firms, as well as its difference. Specifically, $SpecCr_{SF}^{SB}$ is the share of credit that small banks extend to small firms, $SpecCr_{SF}^{SB}$ is the share of large banks to small firms and $\Delta SpecCr_{SF}$ is their difference. The share of credit to large firms is the complement to one of that to small firms.

7.2 Main lender by firm and bank size

Next, we look at another dimension of assortative matching: the share of firms of different sizes with a small or a large bank as their main lender. First, we compute the overall share of firms that have a small bank as the main lender, ML^{SB}, defined as the ratio between the number of firms that have a small bank as the main lender over the total number of firms (note that $ML^{LB} = 1 - ML^{SB}$). Next, we construct the same measure *within firm size class*, ML_f^b, that is, the number of firms of size class f that have a bank of size class b as the main lender, over the total number of firms in

class f. Note that this analysis relies on small and large banks having similar shares of outstanding credit.[29] For this reason, we exclude the three countries that substantially violate this requirement, that is, Greece, Ireland, and the Netherlands. Note that, by construction, $ML_f^{SB} + ML_f^{LB} = 1$, so we only report ML_f^{SB}. As a measure of assortative matching, we use

$$\Delta ML^{SB} = ML_{SF}^{SB} - ML_{LF}^{SB}, \tag{13}$$

the difference between the share of small firms that have a small bank as the main lender and the share of large firms that have a small bank as the main lender.

Results are reported in Table 4, where we again list countries in descending order of ΔML^{SB}. For all countries but Spain, small banks are relatively more likely to be the main bank for small firms. The average value is around 10%, implying that small firms are 10% more likely to have a small bank as the main lender relative to large firms. We find no clear North-South pattern, with Italy and Portugal ranking high in terms of assortative matching, and Germany low.

Table 4: Share of firms for which a Small or a Large bank is the main bank, by firm size

	(1) ML^{SB}	(2) ML_{SF}^{SB}	(3) ML_{LF}^{SB}	(4) ΔML^{SB}
AT	0.70	0.72	0.52	0.20
PT	0.57	0.58	0.45	0.13
IT	0.51	0.52	0.40	0.12
FI	0.76	0.76	0.65	0.11
BE	0.57	0.57	0.49	0.08
FR	0.54	0.54	0.47	0.07
DE	0.67	0.68	0.59	0.06
ES	0.43	0.43	0.41	-0.02

Note: This table reports the share of firms that have a small or a large bank as main bank. Specifically, ML^{SB} is the overall share of firms that have a small bank as the main lender, ML_{SF}^{SB} is the share of small firms that have a small bank as the main lender, ML_{SF}^{SB} the share of large firms that have a small bank as the main lender and ΔML^{SB} is their difference. The share of firms that have a large bank as the main lender is the complement to one of that of small banks.

If we consider the absolute shares rather than their differences, an interesting pattern emerges. First, Column (1) shows that, in all countries but Spain, firms are more likely to have a small bank as the main lender. The share is particularly high in Finland (76%, Austria (70%), and Germany

[29] While the specialization index discussed in the previous subsection is (to a first approximation) independent from the total share of the credit of a bank size class, this does not hold for the main bank indicator. Intuitively, if small banks account for a lower share of credit than large banks, this mechanically increases the probability that both small and large firms have a small bank as the main lender.

(67%). So, small banks play a crucial role in relationship lending. However, this is mostly explained by assortative matching: given that small firms are the vast majority of the overall firm population, they have a large weight in determining the overall mean. In fact, the values for all firms in Column 1 are very close to those for small firms in Column 2.

More interestingly, we find that, while more likely to be the main lender to small firms, small banks have a high likelihood of being the main lender to large firms as well. Except for Spain, Portugal, and Italy, small banks are the main lenders for close to or above 50% of large firms. This implies that small banks are more likely to be the main lenders for the overall firm population. This suggests that small banks tend to specialize in relationship lending. And, especially in Northern European countries, this also holds when considering only large firms.

Taken together, this evidence indicates larger differences in lending policies between large and small banks in Northern Europe compared to Southern Europe. First, assortative matching is strong in Northern Europe, and weak or absent in Southern Europe. Second, in Northern Europe, small banks are more likely to be the main banks of both small and large firms. All in all, these findings suggest that changes in the bank size structure would have larger effects in terms of credit supply in Northern Europe than in Southern Europe.

8 Conclusions

Firm-bank relationships in euro area countries differ significantly across firm size and countries. In some countries, the traditional model of relationship banking in which one main bank is providing the large part of corporate financing is prevalent while in other countries multiple lending relationships are the norm. The instruments used to provide financing to euro area firms are also different in maturities and other important characteristics, such as the revolving feature. These important differences also translate in significant divergences in the interest rates that are charged to corporate borrowers.

We provide a picture of corporate financing through banks in the euro area, highlighting the important structural differences that remain in the area, notwithstanding the ongoing process of financial integration in the euro area/EU and, of course, a monetary union that has been implemented

more than 20 years ago. This analysis is of particular value for policy makers taking decisions on macroeconomic and regulatory policies affecting the bank-firm relationships. It is clear that the transmission and the impact induced by these policies - monetary policy, but also supervisory and regulatory policies as well as industrial policy - depend crucially on the differences that we unveil and that should be duly taken into account in the evaluation of these policies.

Code Availability Statement

The replication code is available in the Harvard Dataverse at this link.

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Appendix: Additional Tables and Figures

Table A1: Summary statistics for the outstanding amount for instrument type, by size

	No.	p25	p50	p75	mean	Firms (%)
(a) Large firms						
Loans	25,955	186,928	1,443,768	8,833,740	14,938,787	60.91%
Credit lines	12,260	302,856	1,922,659	7,590,907	10,169,434	28.77%
Finance leases	11,995	46,783	140,676	628,126	1,340,983	28.15%
Trade receivables	17,114	78,458	336,782	1,816,110	3,260,926	40.17%
Revolving credit	28,317	2,633	30,788	1,119,077	3,436,898	66.46%
(b) Medium firms						
Loans	94,025	159,432	616,987	2,190,877	2,811,213	65.20%
Credit lines	42,754	175,131	618,966	2,000,000	2,224,224	29.65%
Finance leases	36,820	40,406	98,724	335,063	485,733	25.53%
Trade receivables	37,689	60,548	250,000	972,724	964,466	26.14%
Revolving credit	104,141	2,707	40,817	490,324	760,464	72.22%
(c) Small firms						
Loans	404,209	59,499	173,749	508,610	664,929	68.12%
Credit lines	147,593	62,500	196,139	612,168	735,565	24.88%
Finance leases	122,489	30,921	60,715	152,710	213,484	20.64%
Trade receivables	108,636	40,571	118,003	309,793	283,566	18.31%
Revolving credit	422,645	2,536	31,385	148,619	212,514	71.23%
(d) Micro firms						
Loans	1,422,992	35,117	82,186	205,651	258,776	72.70%
Credit lines	324,162	35,275	97,000	284,161	402,398	16.56%
Finance leases	189,723	26,681	40,551	84,072	136,127	9.69%
Trade receivables	164,889	13,690	34,219	79,750	89,858	8.42%
Revolving credit	1,090,505	2,055	14,679	45,202	80,301	55.71%

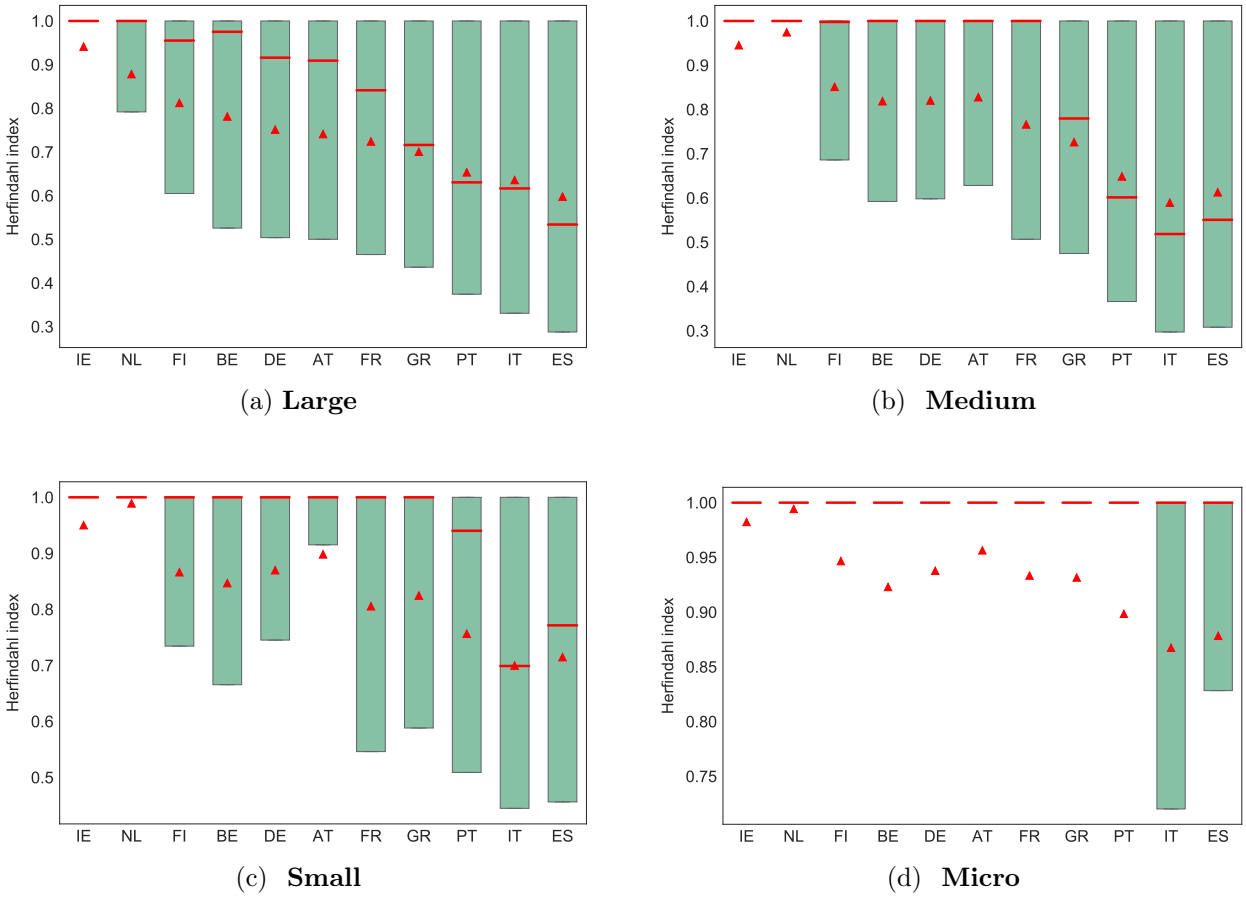
Note: The last column, Firms (%), shows the percentage of firms using the instrument. The total percentage per size class does not sum to 100% because one firm can use multiple instruments and is counted in each.

Table A2: Regression coefficients of the control variables

	(1) Number of relationships	(2) Main bank share of credit	(3) Maturity	(4) Interest rate
Bank size	-0.0156***	0.00259***	-0.215***	-0.000425***
	(0.000447)	(0.0000697)	(0.00244)	(0.00000610)
Bank concentration	-0.157***	0.0104***	0.354***	-0.00167***
	(0.0163)	(0.00254)	(0.0856)	(0.000214)
Bank specialization	0.0242***	0.0228***	2.230***	0.00110***
	(0.00488)	(0.000761)	(0.0252)	(0.0000629)
Micro	-2.012***	0.159***	0.665***	0.00765***
	(0.00547)	(0.000853)	(0.0320)	(0.0000799)
Small	-1.331***	0.0697***	-0.178***	0.00369***
	(0.00557)	(0.000869)	(0.0325)	(0.0000811)
Medium	-0.584***	0.0226***	-0.296***	0.000741***
	(0.00610)	(0.000952)	(0.0353)	(0.0000880)
Country coeff.	Yes	Yes	Yes	Yes
R^2	0.71	0.97	0.77	0.77
Observations	2,704,327	2,704,327	2,241,800	2,241,800

This table displays the results from estimating a regression on the four main variables of interest – number of relationships, main bank share, maturity, and interest rate. We present the coefficients of the control variables in the conditional specifications, while the estimated coefficients for each country are presented in Figures 3, 5, 9, and 11 of the main text. All regressions include sector dummies. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure A1: Credit concentration - Herfindahl index

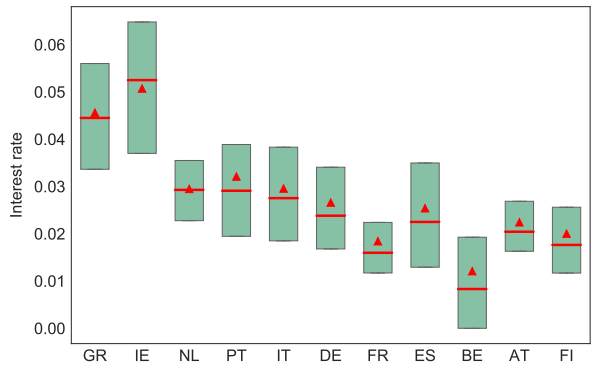


(a) **Large** (b) **Medium**

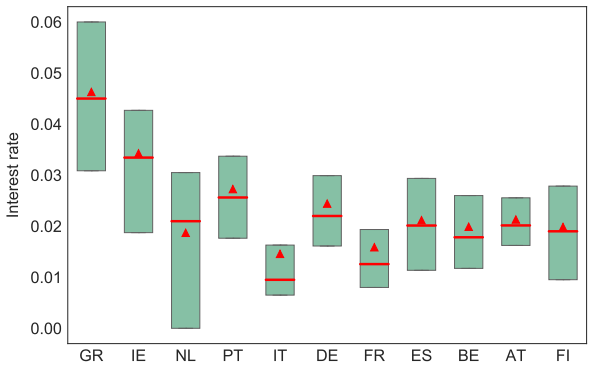
(c) **Small** (d) **Micro**

Note: The figure shows the Herfindahl-Hirschman index by debtor country and firm size. The index is computed at the firm level as specified in subsection 3.2. The box plot's bar represents the interquartile range, the red line indicates the median credit concentration and the red triangle represents the average credit concentration. For readability, upper and lower whiskers are omitted. Countries are ordered by descending average credit concentration of large firms. The sample period is December 2019.

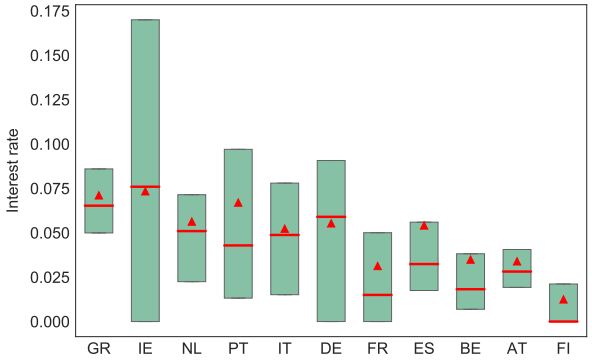
Figure A2: Interest rates by instrument type



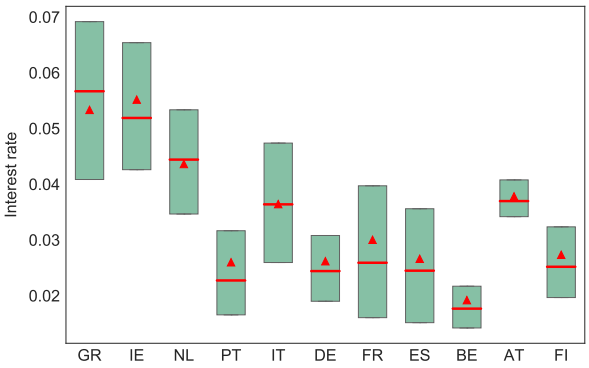
(a) **Loans**



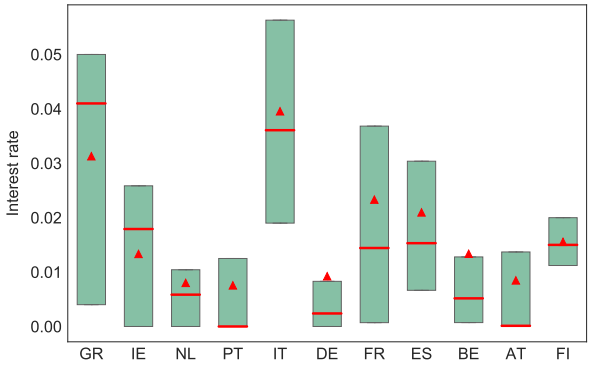
(b) **Credit lines**



(c) **Revolving credit**



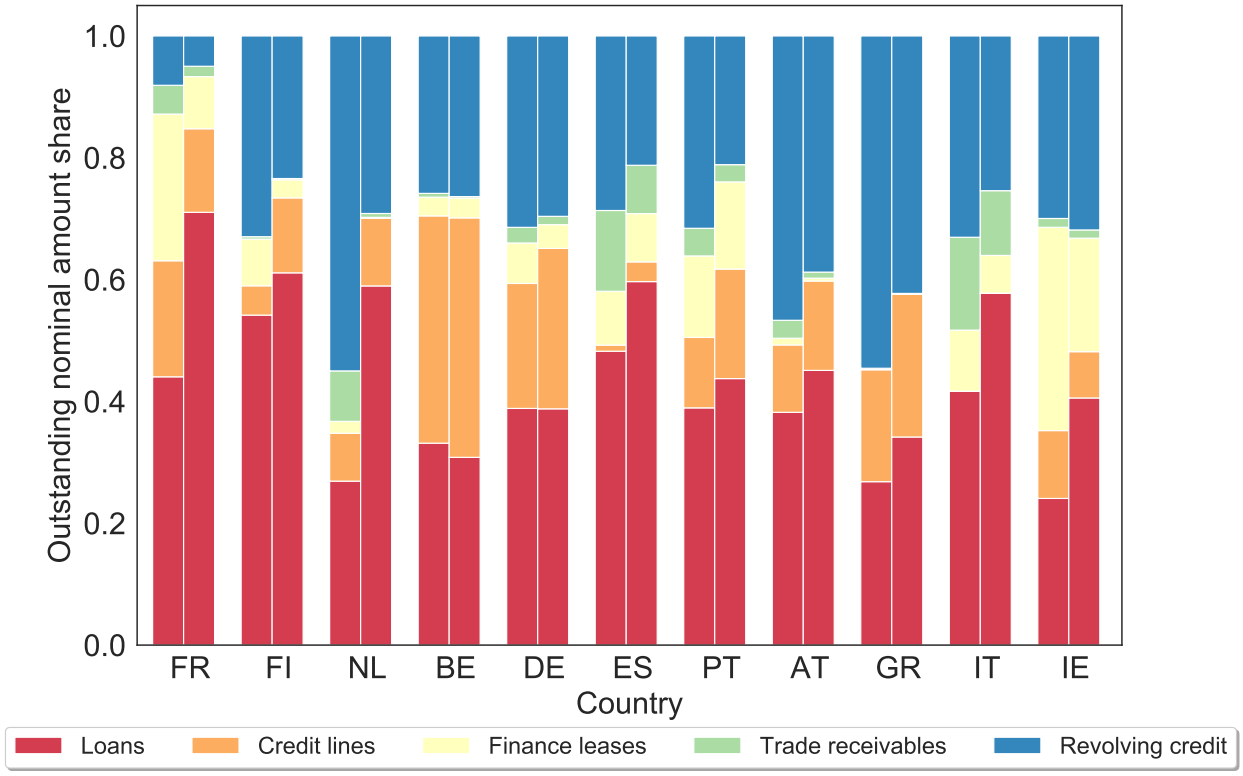
(d) **Finance leases**



(e) **Trade receivables**

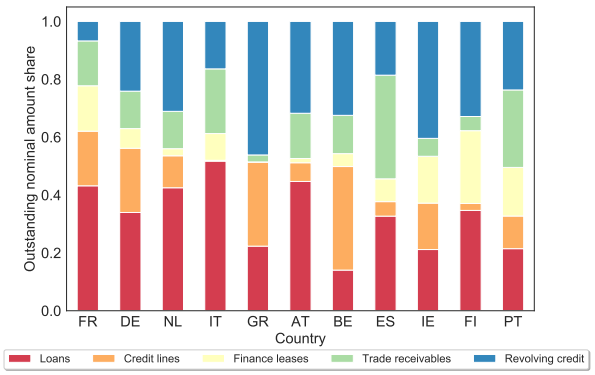
Note: The figure shows the distribution of interest rates on instrument type level. The box plot's bar represents the interquartile range, the red line indicates the median interest rate and the red triangle represents the average interest rate. For readability, upper and lower whiskers are omitted. The country order is that of large firms. The sample period is December 2019.

Figure A3: Instrument type shares for the main banks and all other banks

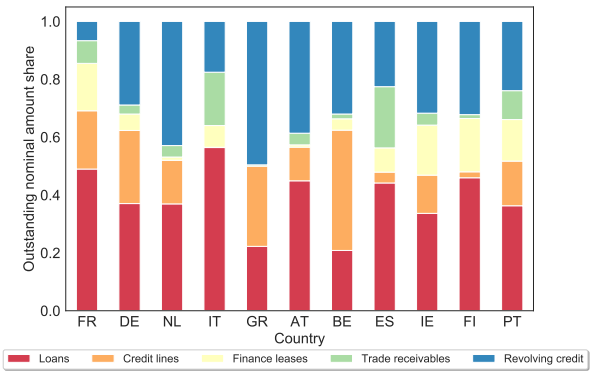


Note: The figure shows the shares of total outstanding amount by loan types. The first bar shows the amounts coming from all banks except the main bank. The second bar shows the amounts coming from the main bank only. The countries are ordered according to the combined shares of long-term instruments (loans and non revolving credit lines) from all banks in descending order.

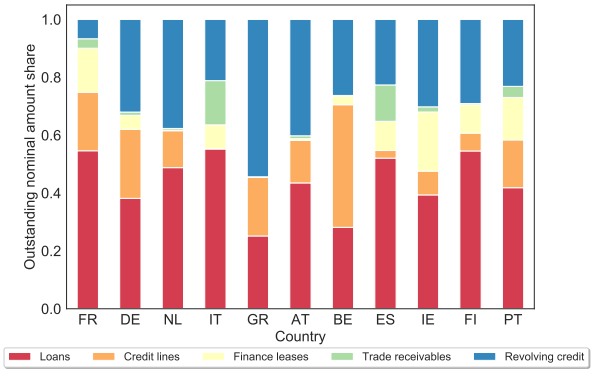
Figure A4: Instrument type shares by firm size



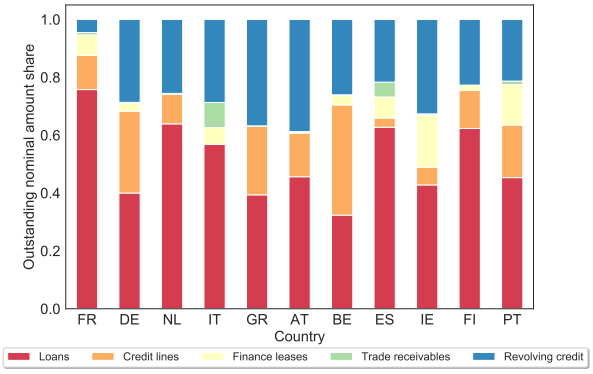
(a) **Large**



(b) **Medium**



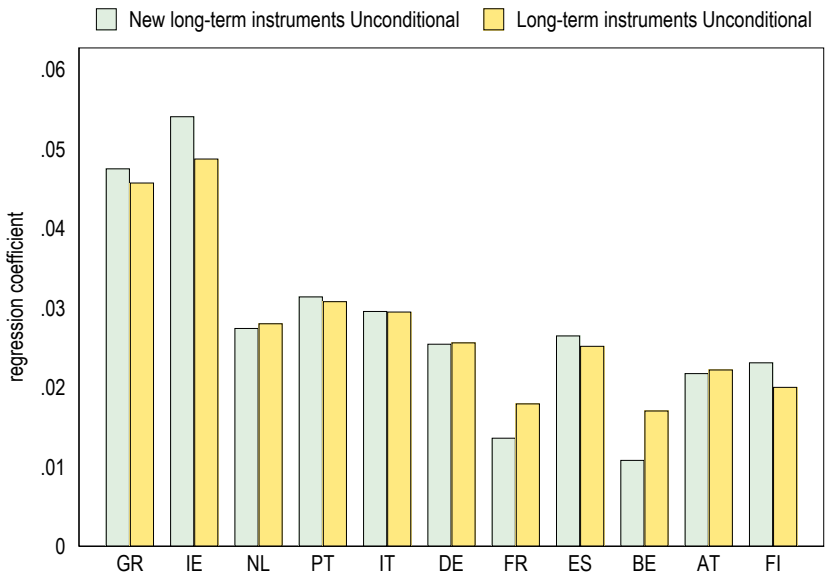
(c) **Small**



(d) **Micro**

Note: The figure shows the shares of total outstanding amount by loan types coming from all banks by firm size. The countries are ordered according to the combined shares of long-term instruments (loans and non revolving credit lines) in descending order for large firms.

Figure A5: New long-term instruments



Note: The figure shows two versions of the unconditional interest rate coefficients from the main analysis. The versions are based on the different restrictions which we apply to our sample. The first bar shows the coefficients when we restrict the sample to only long-term instruments. The second bar shows the coefficients when we apply also a restriction for new instruments, i.e. we restrict the sample to newly issued long-term instruments (the ones issued in 2019 only).