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Loan Guarantees, Bank Lending and Credit Risk Reallocation

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December 2023

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Abstract

Do banks extending government-guaranteed loans simultaneously reduce their risk exposure to firms? Using unique euro-area credit register data and the COVID-19 guarantee programs as a laboratory, we find that banks extending guaranteed loans reduced non-guaranteed credit by over 30% relative to other banks lending to the same firm. Substitution was highest for riskier and smaller firms in more affected sectors and for stronger banks. Nevertheless, banks offered cheaper credit and longer maturities to guaranteed loan recipients, especially more fragile ones. This improvement in lending terms is the flipside of credit substitution: the two correlate positively.

Keywords: loan guarantees, bank lending, COVID-19 pandemic, substitution, credit risk

JEL Classifications: G18, G21, E63, H12, H81

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1 Introduction

Loan guarantees are standard policy tools: governments rely on them to encourage bank lending by shouldering borrowers' default risk. Their typical rationale is to overcome frictions leading to the under-provision of credit to particular types of firms, especially during economic crises when default waves may propagate across debt chains interconnecting firms (Glode and Opp, 2021), leading even otherwise viable firms to be liquidated (Antill and Clayton, 2021). Loan guarantees provide the required backstop, insofar as transferring default risk to the government encourages banks to increase lending, even to hard-hit firms. They may also be a faster and more efficient way to support firms than direct government funding, as typically banks' screening technologies and established relationships endow them with better information than the government about the quality of each firm: by leveraging banks' knowledge, liquidity should more likely reach viable firms than if the government were to decide which firms should be saved and which ones liquidated (Philippon, 2021).

Thus, the efficiency of such programs rests on bank lending being highly responsive to public guarantees. This is not the case if the banks providing guaranteed loans simultaneously reduce their non-guaranteed loans or credit lines to the same debtors, so as to decrease their credit risk exposure towards them, by shifting it to the government. The main objective of this paper is to assess the extent to which banks engage in such "credit substitution", and thus reduce the loan guarantees' effectiveness in expanding credit. To this purpose, we exploit the COVID-19 guarantee programs as a laboratory. Bank loan guarantees were massively used as a stabilization tool in response to the pandemic shock and the resulting dry-up in firms' liquidity. The possibility of credit substitution was indeed on policymakers' minds when laying out eligibility guidelines for these programs, as we explain in Section 2,[1]

[1] Blanchard, Philippon and Pisani-Ferry (2020) describe this possible problem as follows: "The main danger is the transfer of pre-existing exposures. A bank with an exposure to a firm could ask it to use the guaranteed debt to repay its existing loans. This would be a transfer of risk to the state."

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and the media was also aware of such behavior.[2] In this respect, our setting can be regarded as a testing ground to study the effectiveness of a massive expansion of bank loan guarantees in the midst of a major recession. In this study we consider how loan guarantees affected the overall conditions at which banks offered credit: not only the amount of lending, but also the interest rates and the maturities at which it was made available, taking into account the trade-offs between these different dimensions of bank-client relationships.

At the aggregate level, net lending in the euro area grew less than one-for-one with the expansion of guaranteed loans between April and August 2020, i.e., during the first wave of the pandemic and the launch of loan guarantee programs, as shown by Figure 1. Of course, such a macro-level correlation is *per se* no evidence that credit substitution occurred upon the introduction of loan guarantee schemes. For this reason, in this paper we base the analysis on unique euro-area credit register data, drawn from the Anacredit database.

[Insert Figure 1: Guarantee loans and net lending: country-level data]

The granularity of our firm-bank matched data enables us to investigate various facets of the issue of substitution. First, data for firms with multiple lending relationships help us to address the issue of firms' selection into loan guarantee programs. Second, the data enable us to investigate how credit substitution varied across firms and banks, depending on their characteristics, while availability of data for the whole euro area allows us to test whether substitution differed significantly across countries adopting different loan guarantee programs. Finally, we are able to investigate whether loans covered by public guarantees

[2] For instance, the Financial Times drew attention to Greensill Bank AG using state-backed loans from three European governments to reduce its exposure to distressed companies owned by metal magnate Sanjeev Gupta (see "Greensill used taxpayer loans to cut exposure to Sanjeev Gupta", Financial Times, 4 July 2021); similarly, Italian and Spanish newspapers flagged the risk that loan guarantees may end up shielding banks more than firms hit by the pandemic shock (see "Lo scudo delle garanzie fiscali copre più le banche delle imprese", La Repubblica, 1 March 2021 and "Una parte de los créditos avalados por el ICO para rescatar a las pymes se queda en manos de la banca para cubrir deudas de los empresarios", El Diario, 13 May 2020).

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were also extended at lower interest rates and/or longer loan maturities, and whether such improvements in these loan contracts were related to credit substitution.

To guide our empirical analysis, we start from a simple model of the effect of public loan guarantees on banks' lending policies. The model shows that the availability of guarantees triggers an outward shift of the bank's credit supply curve, leading it to offer a more favorable menu of interest rates and loan amounts to eligible firms. The more risk-averse the bank (i.e., the lower its risk absorption capacity) and the riskier the borrower, the more valuable the insurance provided by the public guarantee; hence, the greater the outward shift in the bank's credit supply curve, implying a larger increase in lending and/or a greater drop in the interest rate. If banks with lower risk absorption capacity are those with more fragile balance sheets, then loan guarantees should be more effective in improving the credit conditions offered by these banks. If so, weaker banks are predicted to engage less in credit substitution than stronger ones.[3]

The model shows that changes in lending and in interest rates offered by the bank issuing the guaranteed loan are related: the bank can offer a deeper interest rate cut in exchange for a lower increase in lending, hence greater credit substitution. The extent to which the guarantee will translate into an interest rate cut or less credit substitution depends on the firm's demand for credit: firms with more inelastic loan demand will obtain a deeper interest rate cut at the cost of greater credit substitution. As small firms operating in sectors and countries more severely hit by the pandemic were more strapped for cash, this leads to the prediction that banks issuing guaranteed loans to such firms should have opted for more credit substitution and deeper cuts in interest rates. This conceptual framework helps us

[3] Several papers model banks with weaker balance sheets as less prone to take risk (Kim and Santomero, 1988; Rochet, 1992; Hellman, Murdock and Stiglitz, 2000). While another strand of the literature considers weaker banks to have a greater incentive to "gamble for resurrection" and thereby take risk, especially during crises, such incentive problems may be effectively offset by prudential regulation and supervision, coupled with the preservation of franchise value. This is in line with recent empirical evidence presented by Peydró et al. (2023).

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gain a new insight in the effects of loan guarantee programs relative to existing literature (for example, Bachas et al. (2021)): the focus on the impact on lending quantities, while important, may be incomplete. Instead we should analyze how loan guarantees affect the whole bank-firm relationship, i.e., the "menu" of credit conditions (including interest rates and maturities) that banks offer to firms, and investigate trade-offs between them.

To take these predictions to the data, we measure credit substitution as (the negative of) the change in non-guaranteed credit in the pandemic period relative to the pre-pandemic level. Our data allow us to use a methodology similar to that of Khwaja and Mian (2008): we compare the change in pre-existing exposures between banks extending non-guaranteed loans and other banks lending to the *same* firm. The granular nature of our data enables us to address several challenges. As the data are at bank-firm level, we can identify the lending flow within each bank-firm pair, exploiting the differences in the relationships that a firm may have with multiple banks. Exploiting within-firm variation enables us to address the counterfactual problem whether firms that received guaranteed loans and experienced substitution, would have anyway faced a credit cut. This is an important concern, especially for firms that were already financially weak before the pandemic and/or severely hit by the shock: if they had not received guaranteed loans, presumably these firms would have been more likely than others to face a credit cut, and even loan foreclosure.

In regressions that exploit within-firm variation in lending to firms with multiple bank relationships, we find that banks extending guaranteed loans reduced non-guaranteed lending more than other banks that lent to the same firm: banks providing the guaranteed loan cut pre-existing credit more than 30% relatively to other banks. Estimates also show that credit substitution was largest for guaranteed funding granted to riskier and smaller firms in more affected sectors, and borrowing from stronger banks, i.e., those with lower non-performing loans (NPLs). These results are in line with the model's predictions, as these are the firms

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expected to have less elastic demand for credit and the banks that benefit less from public loan guarantees, due to their lower risk absorption capacity. Banking relationships instead attenuated credit substitution. These regressions also include bank fixed effects to control for unobserved bank heterogeneity in the provision of credit during the pandemic.[4] These results are broadly consistent across the four largest euro-area countries, despite some differences in the design of national guarantee schemes, though the extent of substitution differs across them, being largest in Spain and lowest in France.

Nonetheless, these results are still potentially subject to a different kind of selection bias, as the bank issuing a guaranteed loan is not randomly assigned among the pre-existing lenders of a given firm. To sign the bias that our estimates may suffer from, we analyze the within-firm selection of the bank granting guaranteed credit, investigating the characteristics of the bank issuing a guaranteed loan relative to the other banks lending to the same firm. We find that banks that are better capitalized, larger and with a tighter relationship with the firm were more likely to extend guaranteed credit.[5] This evidence helps to sign the potential bias in the substitution estimates: "selected" banks are stronger, and with a tighter relationship with the firm, and therefore should be associated with a greater supply of credit at times of stress (Bolton et al., 2016, and Jimenez et al., 2012). This suggests that, if anything, our results under-estimate the extent of substitution by banks issuing guaranteed credit.

A potential concern with our estimates is that credit substitution by the bank providing guaranteed lending may not be due to its decision to cut credit, but simply to the fact that its previous loan just expired and was rolled over with the guaranteed loan. Several tests show that substitution cannot be ascribed to the expiration of pre-existing non-guaranteed

[4] For example, some banks may have lent more aggressively during the guarantee program because they had better information technology capabilities to handle the high number of applications (Core and De Marco, 2023).

[5] This confirms the importance of healthy balance sheets and relationship (consistently with U.S. evidence by Li and Strahan (2021)) as crucial mechanisms in the provision of liquidity at times of stress.

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credit. For external validity, we also enlarge the sample to include single-bank borrowers, obtaining very similar results.[6]

As our model predicts that the provision of loan guarantees should not only increase the availability of credit but also improve the other lending conditions offered to the firm, we then analyze the effect of loan guarantees on the interest rates and the loan maturity offered by the bank providing the guaranteed loan. In line with the model's setup, we consider how this bank modifies the interest rate and loan maturity that apply to its overall lending position to the firm, including its pre-existing credit. Using the same specification as in our lending regressions, we find that the bank providing guaranteed credit reduces the average interest rate and lengthens the average maturity of their loans to the firm relative to other banks lending to the same firm without a guarantee.

The drop in average interest rate and maturity is larger for weaker firms (i.e., those in more affected sectors and countries, and those featuring smaller size and/or a larger fraction of arrears). As predicted by our model, these are the same classes of firms for which the banks providing guaranteed loans engage in greater substitution: indeed, the banks granting guaranteed loans that offer larger interest rate cuts reduce more their non-guaranteed exposures vis-à-vis the corresponding firms, i.e., opt for more credit substitution. Hence, banks granting guaranteed loans provide a more generous interest rate cut to riskier, smaller and more severely hit firms in exchange for more credit substitution. Moreover, larger and better capitalized banks, which benefit less from the insurance of a public guarantee, provide a smaller interest rate cut, in line with the model's prediction of a smaller shift in their credit supply curve in response to the guarantee.

In the last part of the paper we ask whether the substitution we observe at bank-firm

[6] In these regressions we cannot include firm fixed effects as in the main specification, but we include industry-location-size fixed effects.

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level matters also at firm level. We focus on the firms that received a loan guarantee and taking into account differences across firms in the size of guaranteed loans and in fractional guarantees.[7] We find that larger guaranteed loans turn out to be associated with a smaller degree of substitution, €1 of additional loan guarantees being associated, on average, with a drop in non-guaranteed lending ranging between €0.13 and €0.30, depending on the specification. Also at firm level, substitution is confirmed to be greater in firms that are smaller, ex ante riskier, and operating in sectors and countries more severely hit by the pandemic. Again, results are similar across countries, with the magnitude of substitution being the highest in Spain and smallest in France.

The overall thrust of our results is that in the euro area government guarantees contributed to the continued extension of credit to relatively creditworthy firms hit by the pandemic, but also benefited the balance sheet of banks. Although loan guarantee programs were designed to mitigate it, they did trigger a moderate amount of credit substitution, and therefore to some extent merely transferred pre-existing credit risk from banks to taxpayers. However, this does not necessarily indicate a failure of the public credit schemes, for three reasons. First, absent such schemes, banks could have reduced their pre-existing credit exposures even more, possibly generating default waves that might have crippled even otherwise viable firms. Second, to the extent that banks used such schemes to de-risk their balance sheets, they may have preserved their lending capacity to better face the post-pandemic recovery period: hence, this implicit bank recapitalization may reduce the risk of a cliff-effect credit crunch when loan guarantee schemes and other support programs are terminated. Third, insofar as substitution moderated lending to the riskiest firms, these should exit the stress period with lower leverage than in a counterfactual world where no substitution occurred (Brunnermeier and Krishnamurthy, 2020).

[7] In these regressions since we do not exploit within-firm variation we include also single-bank firms.

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Our paper contributes to three recent strands of research. The first is the nascent literature on the effectiveness of government guarantee programs. Bachas et al. (2021) investigate the effectiveness of guarantees provided by the Small Business Agency in the U.S. and find significant bunching in the loan size distribution at thresholds where guarantee generosity decreases, showing that lenders prefer to issue loans when guarantee rates are higher. Subsequent to our work, other papers have focused on evidence from individual countries and on particular aspects of the pandemic loan guarantee programs in Europe.[8] Our contribution relative to this literature is to provide the first systematic investigation of the effects of these programs on the entire gamut of credit conditions in bank-firm relationships, exploring how these effects vary depending on firm and bank characteristics and taking into account the trade-off between credit substitution and cost of credit.[9] A further contribution is to show that our results are quite general, as they hold across countries with different program designs and institutional characteristics.

Our paper also contributes to the literature on the provision of bank liquidity across firm sizes at times of stress. Most of the literature focuses on large firms and documents that they raised liquidity by drawing down bank credit lines after the outbreak (Acharya and Steffen, 2020, and Li et al., 2020), which in turn led banks restricting credit to SMEs (Greenwald et al, 2020; Kapan and Minoiu, 2021). One paper that specifically investigates the effects of financial frictions on small firms is Chodorow-Reich et al. (2022). Our paper adds to this literature by showing that solely investigating the effect of such programs on lending to

[8] Cascarino et al. (2022) study their effectiveness in Italy by exploiting the different fractional guarantee offered by different programs, and find that programs with higher fractional guarantee triggered a greater expansion in credit. Jimenez et al. (2022) analyze the effect of relationship lending on guaranteed loans in Spain: they show that pre-existing relationships affect both the allocation of guaranteed loans and the substitution between guaranteed and non-guaranteed credit. Martin et al. (2023) develop a model that shows that banks have the incentive to allocate guarantees to captive and risky firms and test these predictions using Spanish credit register data.

[9] The firm-level evidence in Chodorow-Reich et al. (2022) suggests that the issue of substitution may also be relevant for the U.S., as SMEs that took PPP loans repaid significant non-PPP lending in the second quarter of 2020.

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small firms does not provide a complete picture: while we find that the provision of credit to weaker firms was more severely hampered by credit substitution, these firms obtained comparatively large interest rate reductions and loan maturity extensions.

Finally, our paper is related to the research on the effectiveness of policies aimed at counteracting the real effects of the pandemic. Our evidence contrasts with that available for the United States, where Granja et al. (2020) find that the funds of the Paycheck Protection Program (PPP) were not channeled to the worst-hit sectors, and Cororaton and Rosen (2021) document that PPP targeted mostly firms with higher leverage, less cash and worse business prospects.[10]

The paper is organized as follows. Section 2 describes the institutional framework of the euro-area loan guarantees and proposes a conceptual framework to guide the empirical analysis. Section 3 describes the data and the empirical specifications. Section 4 presents and discusses the results. Section 5 concludes.

2 Institutional and conceptual framework

As a preliminary step to our empirical analysis, this section provides information on the design of EU loan guarantee programs enacted in the wake of the COVID-19 outbreak (Section 2.1), as well as a simple conceptual framework to interpret how banks can be expected to redesign their loan contracts (loan amounts as well as interest rates and maturities) in response to the availability of loan guarantees (Section 2.2).

[10] There is evidence that the PPP scheme had significant real effects: Autor et al. (2020) and Bartik et al., (2020) document that it raised employment at eligible firms and increased firms' survival. Instead, our evidence for the euro area dovetails with that by Core and De Marco (2023) for Italy and Kozeniauskas, Moreira, and Santos (2020) for Portugal and broadly in line with the evidence by Gourinchas et al. (2020).

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2.1 The EU loan guarantee programs

The extent to which banks engage in credit substitution may be affected by the eligibility rules that determine the allocation of credit guarantees across firms, as these determine the selection of firms with guaranteed loans in our sample. Hence, we briefly review the design of EU loan guarantee programs: as we shall see, these were structured so as to exclude firms whose viability could not benefit from such guarantees, namely, both those already close to insolvency before the outbreak of the pandemic, and those that were not negatively affected by the pandemic. Hence, the eligibility rules were designed so as to exclude from loan guarantee programs both the lower and the upper tail of the firm distribution by credit risk.

The design of the loan guarantee schemes in European Union (EU) countries shares several common features defined by the EU Commission Regulation No. 651/2014, although some of their details are determined by national rules. Not all firms were eligible to benefit from loan guarantee programs in the EU. The Communication of the EU Commission about State aid during the pandemic (2020/C 91 I/01) stated: "The guarantee may be granted to undertakings that were not in difficulty ... on 31 December 2019", thus excluding firms already close to default before the start of the pandemic. The Commission's definition of an "undertaking in difficulty" is one for which at least one of the following circumstances occurs:

(a) limited liability companies (other than SMEs that existed for less than three years), where more than half of their subscribed share capital has disappeared as a result of accumulated losses,

(b) companies where at least some members have unlimited liability for the debt of the company (other than an SME that existed for less than three years), where more than half of their capital as shown in the company accounts has disappeared as a result of

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accumulated losses,

(c) firms subject to collective insolvency proceedings or fulfilling the criteria for being placed in collective insolvency proceedings at the request of their creditors,

(d) firms that have received rescue aid and have not yet reimbursed the loan or terminated the guarantee, or have received restructuring aid and are still subject to a restructuring plan,

(e) large firms, whose book debt to equity ratio exceeded 7.5 and EBITDA interest coverage ratio was below 1 for the previous two years.

At the same time, the EU Commission required aid to be targeted to firms "that faced difficulties or entered in difficulty thereafter as a result of the COVID-19 outbreak", hence excluding those firms unaffected by the pandemic or even benefiting from it.

Regarding credit substitution, national regulators appeared to tolerate it at most to a limited degree. For instance, French regulation subjected the guarantee to the bank evidencing that the loan granted led to an "increase in the bank's commitments to the borrower compared to commitments that existed as at 16 March 2020". In Italy, loans guaranteed by Fondo Nazionale di Garanzia and designed for refinancing of existing loans were required to involve at least 25% of new lending. The media also appeared acutely aware of the risk that loan guarantee programs might benefit banks more than the firms hit by the pandemic.

The EU Commission set minimum guarantee premia increasing in maturity and that were more stringent for large enterprises than for SMEs, as well as a ceiling of 6 years on the maturity for all loans. It also mandated limits to the size of guaranteed loans: these could not exceed twice the annual wage bill of the beneficiary for 2019, or 25% of total turnover of the beneficiary in 2019. Interestingly, it designed the guarantees so as to leave banks with enough "skin in the game" to remain sensitive to firms' creditworthiness when granting

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guaranteed loans: the guarantee could not exceed 90% of the loan principal if losses are sustained *pari passu* by the bank and the state, or 35% of the loan principal if the State is junior to the bank.

National governments introduced some differences in their respective programs: while they all designed schemes in which the guaranteed fraction of the loan decreases with firm size (hence, more generous with SMEs than with large firms), different governments chose different schedules for the relationship between guaranteed loan fraction and firm size, as shown in Table A1. The Italian and the German governments even provided 100% guaranteed loans: in the case of Italy, this applied to all loans up to €30,000 given to small firms, and in the case of Germany to firms whose loans were issued under the KfW-Schnellkredit program. But, as shown by the table, for most loans the guaranteed fraction ranges between 70% and 90%, with lower percentages applying to larger firms. The table also reveals that the Italian, German and Spanish schemes allowed public guarantees even for loans exceeding the 6-year maturity limit prescribed by the EU Commission's guidelines.

2.2 A simple model of loan guarantees and credit substitution

The availability of a public loan guarantee is a positive shock to the supply of loans by banks: insofar as the government takes upon itself part of the default risk of the new loan, the bank issuing it is more willing to extend credit to the firm, to an extent determined by its degree of credit substitution. Importantly, its decision regarding credit substitution, not only affects the quantity it lends to the firm, but also the other terms of its loan contracts with the firm, such as their interest rates and maturity.

A simple framework to think about this issue is the following. Consider bank j lending to a firm i that is eligible for a guarantee covering a fraction $1-\lambda$ of a loan of size L_i^G. Denote by L_{ij}^0 the bank's pre-existing stock of loans to the firm, and by L_{ij}^1 its lending to firm i after

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issuing the guaranteed loan. If the bank reduces its pre-existing loan by a fraction s, which measures the extent of its credit substitution, the new total loan of the bank is

$$L_{ij}^1 = L_{ij}^0(1-s) + L_i^G \tag{1}$$

Thus the loan guarantee program induces the bank to expand credit provision to firm i, if its degree of substitution is not too large, namely, if $s < L_i^G/L_{ij}^0$. The extent of substitution will be affected by the bank's new exposure to the risk of default by firm j, namely $\hat{L_{ij}^1} = L_{ij}^0(1-s) + \lambda L_i^G$: this is smaller than its loan L_{ij}^1 to firm i by $(1-\lambda)L_i^G$, which is the credit risk exposure transferred to the government owing to the guarantee.

The interest r_{ij}^t charged by bank j to firm i at date t will be the risk-free rate r_f plus a risk premium commensurate to the bank's risk exposure to the firm, which initially is L_{ij}^0 and becomes $\hat{L_{ij}^1}$ after the implementation of loan guarantee program. Hence, the rates charged by bank j to firm i before and after the implementation of the loan guarantee program are respectively

$$r_{ij}^0 = r_f + \rho_j(L_{ij}^0), \qquad r_{ij}^1 = r_f + \rho_j(\hat{L_{ij}^1}), \tag{2}$$

where the bank's risk premium $\rho_j(\cdot)$ is assumed to be an increasing function of its loan exposure, as well as of the firm's credit risk and the bank's risk aversion, which may capture constraints on its risk-absorption capacity (e.g., due to under-capitalization). Importantly, the interest rate r_{ij}^1 applies to the bank's overall lending L_{ij}^1 to the firm, and not only to the guaranteed loan L_i^G.

Figure 2 shows the two credit supply functions in (2): the availability of the loan guarantee triggers an outward shift of the (inverse) credit supply curve, pivoting on the intercept r_f. The figure plots the initial supply as a solid curve, and the final one as a dashed one. To see this, consider that if the loan supply to firm j were to stay unchanged ($L_{ij}^1 = L_{ij}^0$), then bank

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j's exposure to the firm's credit risk would drop ($\hat{L^1_{ij}} = L^1_{ij} - (1-\lambda)L^G_i = L^0_{ij} - (1-\lambda)L^G_i < L^0_{ij}$) and therefore, according to (2), the interest rate would decrease ($r^1_{ij} < r^0_{ij}$). Figure 2 also takes into account that the loan guarantee is introduced at a time in which there has been an increase in the demand for loans by firms, as a result of the pandemic shock: also in this case, the initial loan demand is plotted as a solid curve, and the final one as a dashed one.

The combined effect of the loan guarantee scheme and the increased demand for loans on the equilibrium outcome will be more lending by bank j ($L^1_{ij} > L^0_{ij}$), implying an upper bound on credit substitution ($s < L^G_i/L^0_{ij}$), and a lower interest rate ($r^1_{ij} < r^0_{ij}$). This implies that the degree of substitution chosen by bank j falls in the intermediate range $s \in (\lambda L^G_i/L^0_{ij}, L^G_i/L^0_{ij})$ where the bank expands its credit to the firm and reduces the interest rate it charges to it. If the degree of substitution is at its lowest ($s = \lambda L^G_i/L^0_{ij}$), the bank's incremental lending will equal the portion of the guaranteed loan covered by the guarantee ($L^1_{ij} - L^0_{ij} = (1-\lambda)L^G_i$), which in Figure 2 it is the magnitude of the outward shift of the loan supply curve for that interest rate. Such minimal degree of substitution is consistent with the equilibrium interest rate remaining at the initial level ($r^1_{ij} = r^0_{ij}$).

[Insert Figure 2: Change in lending and interest due to loan guarantees]

Interestingly, the more credit substitution bank j performs in equilibrium, the deeper the interest rate cut it will give to the firm:

$$\frac{\partial r^1_{ij}}{\partial s} = -\frac{\partial \rho_j}{\partial \hat{L^1_{ij}}} \cdot L^0_{ij} < 0. \tag{3}$$

Intuitively, credit substitution reduces the bank's exposure to the firm, thus leading it to require a lower credit risk premium, hence a lower interest rate. This negative trade-off is affected by the bank's pre-existing exposure L^0_{ij}, as shown by expression (3): a bank with greater initial exposure will be willing to give a deeper interest rate cut in exchange for more

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credit substitution s. The trade-off between credit substitution and the interest rate charged by the bank in (3) is also affected by the firm's credit risk and by the bank's risk aversion: the riskier the firm and the more risk-averse the bank, the deeper the interest rate cut the bank is willing to give to the firm in exchange for more credit substitution s. This is clearly seen by focusing on the special case of a bank with a mean-variance objective function, so that the interest rate it charges to firm i is the certainty equivalent of the interest paid by the firm:

$$r_{ij}^0 = r_f + \frac{\gamma_j}{2}\sigma_i^2 (L_{ij}^0)^2, \quad r_{ij} = r_f + \frac{\gamma_j}{2}\sigma_j^2 (\hat{L_{ij}^1})^2. \tag{4}$$

In this case, the trade-off between between credit substitution and the interest rate charged by the bank can be seen to be steeper the greater is the firm's risk σ_i^2 and bank j's risk aversion coefficient γ_j:

$$\frac{\partial r_{ij}^1}{\partial s} = -\gamma_j \sigma_i^2 \cdot \hat{L_{ij}^1} \cdot L_{ij}^0 < 0. \tag{5}$$

Graphically, the riskier the firm and the more risk averse the bank, the greater the clockwise rotation of the inverse supply curve in Figure 2, and therefore the more favorable the new menu of credit conditions that the bank will offer to the firm.[11] The intuition is simple: the more risk averse is the lender and the riskier the borrower, the greater the value of the insurance provided by the loan guarantee, increasing the bank's willingness to provide a concession to the borrower either in the form of an interest rate reduction or of an increase in lending, hence lower substitution.

The figure also indicates that the extent of credit substitution not only hinges on the bank's credit supply parameters, but also on the magnitude of the shift and on elasticity of the firm's demand for credit, which summarizes the firm's preferences between the quantity

[11] The magnitude of the rotation is measured by the drop in the interest rate required by bank j if its lending were to remain at the initial level, i.e., if $L_{ij}^1 = L_{ij}^0$. The resulting interest rate reduction would be $\gamma_j \sigma_i^2 [L_{ij}^0 - \frac{1-\lambda}{2} L_i^G](1-\lambda) L_i^G$, which is increasing in γ_j and σ_i^2, as well as in the size of the loan guarantee $(1-\lambda)L_i^G$, under the reasonable assumption that the guarantee is less than twice the initial loan size L_{ij}^0.

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and the price of credit. The figure assumes that the increase in loan supply triggered by the introduction of loan guarantees exceeds that in the demand for loans triggered by the pandemic, so that the equilibrium interest rate drops. However, the magnitude of the drop also depends on how inelastic the demand for loans is. A more inelastic firm's demand translates into a larger decrease in the interest rate and a lower increase of credit, hence greater substitution. At the limit, a firm with totally inelastic demand will opt for the maximal degree of substitution ($s = L_i^G/L_{ij}^0$) and will benefit from the guarantee mainly in the form of cheaper credit. At the opposite extreme, if the firm's demand for credit is perfectly elastic, it will receive no interest rate reduction, while the level of substitution will be at its lowest ($s = \lambda L_i^G/L_{ij}^0$).

It is reasonable to assume that the demand for credit by small and riskier firms and by firms severely hit by the pandemic was less interest-rate sensitive than that of other firms. If so, the model predicts that these firms should have faced more credit substitution and obtained larger interest rate reductions than other firms: paradoxically, those most strapped for cash at the outbreak of the pandemic are predicted to have faced the greatest credit substitution, other things being equal.

To summarize, the model predicts that in general credit substitution should be associated with a reduction in interest rates. The more risk-averse the lender, the greater the resulting interest rate reduction and/or the lower credit substitution. Moreover, other things equal, both the extent of credit substitution and the reduction in interest rate associated with it should be largest for firms with more inelastic demand for credit, which in our data are likely to be comparatively small and risky firms that were more severely hit by the pandemic.

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3 Data and methodology

3.1 Data

We draw loan-level information obtained from AnaCredit, a proprietary and confidential database of the ECB and the national central banks of the countries that have adopted the euro (the Eurosystem). AnaCredit is a very granular (transaction-level) database that reports 94 loan-level attributes on a monthly frequency in a harmonised way across all euro area countries. The reporting threshold for loans to firms is fixed at €25,000 for all countries participating in the database. This database enhances the level of information obtained from national credit registers that were already collected at country-level by several euro area members. This is because the common threshold ensures that cross-country studies, like ours, are not affected by sample selection bias possibly emerging from the different reporting threshold of the national credit registers. For example, while there is no threshold for credit exposure in Spain (any credit exposure is reported), the German credit register has a threshold of euro 1 million[12]. The results of a cross-country study based on national credit registers would be affected by the differences in the characteristics of the unit of observation.

AnaCredit covers a comprehensive set of credit instruments: overdrafts, revolving credit, credit lines, reverse repurchase agreements and other loans, including term loans[13]. Both the amount already drawn under a granted facility and the undrawn part are reported in AnaCredit: in our analysis we consider the sum of both, i.e. the total commitment of the bank to the debtor with respect to an instrument. AnaCredit also reports interest rates and maturities at loan level.

Importantly for our analysis, among the attributes of each loan, there is extensive infor-

[12] The reporting thresholds for the national credit register in France and Italy are €25,000 and €30,000, respectively.

[13] The complete list of instruments also includes credit card debt, trade receivables, financial leases as well as well as deposits other than reverse repurchase agreements.

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mation on the protection securing the bank's credit exposure. Financial guarantees are one of the types of protection considered and we concentrate on those provided by government entities.[14] While in some countries special identifiers were introduced to mark guarantees provided under specific COVID-19 related schemes, these are not consistently available for all four of the countries considered in our sample and therefore we use all guarantees provided by government entities. As a sanity check, we compare AnaCredit data for Italy with the publicly available list of government guaranteed loans from the Italian Fondo Nazionale di Garanzia (FNG). Applying the AnaCredit filter of loans above the 25,000 euro threshold to the FNG data, we find a very similar number of firms receiving guaranteed credit in both databases (around 358,000 firms)[15].

We supplement the data by drawing bank balance sheet information from the ECB supervisory data to measure, as of December 2019, the strength of the banks' capital position (i.e., their capital ratio and fraction of non-performing loans), liquidity (liquidity coverage ratio), and size (total assets).

Our sample from AnaCredit contains a total of 2,639,651 firms: 1,143,966 from France, 427,535 from Germany, 641,921 from Italy and 426,229 from Spain. These firms borrow from 838 banks in Germany, 106 in Spain, 104 in France and 158 in Italy. The number of firms that are recorded to have received guaranteed credit between March and August 2020 was a subset of the entire sample and stood at 601,952 firms. Recall that, while guaranteed credit can be of any euro size, AnaCredit records loans of at least €25,000. This means that many micro firms that likely obtained credit for less than this threshold do not appear in the credit register. This could be one reason why we see only about 23% of firms in AnaCredit

[14] The database also registers the guarantees provided by special entities including Instituto de Crédito Oficial in Spain, Kreditanstalt für Wiederaufbau in Germany, Ministere de l'Action et des Comptes Publics in France.

[15] The number of firms that obtain a loan guarantee is smaller in our tables since we only consider firms which are included in the AnaCredit database in December 2019.

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obtaining guaranteed credit.

As shown in Figures 3 and 4, the largest amount of guaranteed credit was granted in Spain and Italy, with France in third place and the smallest amount in Germany. The two figures also confirm that, as seen above, the loan guarantee schemes of all four countries were designed so as to channel funds preferentially to small and medium size firms: around 85% of the credit went to SMEs in each of the four countries (Figure 3), and the prevalence of small firms is even more extreme in terms of their number, especially in Italy (Figure 4). In terms of average size of guaranteed loans, German firms received the largest loans, and Italian firms received the smallest, the size of guaranteed loans in France and Spain being in the middle, as shown by Figure 5.

[Insert Figure 3. Guaranteed loans by firm size (million euro)]

[Insert Figure 4. Guaranteed loans by number of firms]

[Insert Figure 5. Amount of guaranteed loans (million euro)]

Table 1 reports the descriptive statistics for the variables used in our analysis. Panel A shows firm-level statistics for the full sample, Panel B shows those for the sample of firms that received a guaranteed loan, and Panel C presents bank-firm-level statistics for the subsample of firms that featured multiple bank relationships and received a guaranteed loan. Panel D reports the interest rate and maturity of the guaranteed loans. Average interest rates on the guaranteed loans are different in the four countries consistently with the different rules we report in Table A1. The average rate is 0.5% in France, 1.4% in Germany, 1.9% in Italy and 2.2% in Spain. The average maturity of a guaranteed loan is just below three years.[16] The Appendix reports descriptive statistics separately for each country (A7, A8, A9 and A10).

In Table A2 we also report evidence showing that guaranteed loans were distributed in line

[16] The reported number is the log of the number of months.

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with the EU Commission guidelines reported in the previous section. We find that guaranteed loans were allocated especially to small firms and those in the most heavily affected industries, but not to firms that were already close to distress before the pandemic. Seen from this perspective, the guaranteed credit programs in the euro area succeeded by targeting guaranteed credit to the most severely hit firms, while leveraging on banks' information to screen out the worst risks.

[Insert Table 1: Descriptive Statistics]

3.2 Empirical Methodology

The central question addressed in this paper is whether banks extending guaranteed loans reduce their pre-existing exposures towards them. Identifying credit substitution is challenging. The issue is the classical counterfactual problem: whether a firm that received a guaranteed loan and experienced substitution, would have faced a credit cut anyway. This is an important concern, especially for firms that were already weak before the pandemic and/or were severely hit by the shock: if they had not received guaranteed loans, presumably these firms would have been more likely than others to face a credit cut, and even loan foreclosure. Indeed, the evidence reported in Table A2 indicates that government guarantees were not blanketed across euro-area firms but carefully targeted to specific classes of firms. We are able to address this selection issue owing to the granularity of our data, which allows us to exploit within-firm variation. Since data are at bank-firm level, we can identify the lending flow within each bank-firm pair, exploiting the differences in the relationships that a firm may have with multiple banks. The methodology is similar to that of Khwaja and Mian (2008): we compare the change in non-guaranteed exposures between banks extending guaranteed loans and other banks lending to the *same* firm.

Specifically, we consider the change in non-guaranteed credit ($NGC_{i,j}$) extended to firm i

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by bank j, scaled by its initial credit exposure ($TC_{i,j}$):

$$y_{i,j} = \frac{NGC_{i,j,t} - NGC_{i,j,t-1}}{TC_{i,j,t-1}}$$

where t is August 2020 and $t-1$ is February 2020. We define credit substitution by the negative of $y_{i,j}$ denoted by $s_{i,j} \equiv -y_{i,j}$. We estimate a specification at bank-firm level, where variables vary across lending relationships between firm i and bank j:

$$s_{ij} = \beta_1 G_{ij} + \beta_2 G_{ij} \times \Delta VA_i + \beta_3 G_{ij} \times Size_i + \beta_4 G_{ij} \times Risk_i + \beta_5 G_{ij} \times BSize_j \quad (6)$$
$$\beta_6 G_{ij} \times Liq_j + \beta_7 G_{ij} \times Cap_j + \beta_8 G_{ij} \times NPL_j + \gamma_i + \eta_j + \varepsilon_{ij}$$

For banks that do not grant guaranteed credit to firm i, the variable s_{ij} coincides with the reduction in their total credit to the firm. Hence, if bank j grants guaranteed credit to firm i, s_{ij} measures bank j's substitution, while for other banks it measures the change in their total credit to firm i. The variable G_{ij} is a dummy variable that equals 1 if bank j grants guaranteed credit to firm i, and 0 otherwise. Since we include firm fixed effects, γ_i, the coefficient β_2 measures the magnitude of bank j's substitution benchmarked against the change in credit by other banks lending to firm i. Substitution occurs if non-guaranteed credit offered by the bank extending the guaranteed credit declines relative to the other banks lending to the same firm. The other coefficients measure whether the magnitude of bank j's substitution differs depending on firm, bank and firm-bank characteristics.

The firm characteristics that we consider are: (a) the change of the value added in firm i's industry during the sample period (ΔVA), (b) the log of firm i's total outstanding bank loans as of December 2019 ($Size$),[17] and (c) the firm's fraction of credit in arrears as of December 2019 ($Risk$). These characteristics are meant to capture the firms' ex-ante credit risk as well

[17] Owing to incomplete reporting of other metrics of firm size in the Anacredit database (such as total assets or number of employees), we use total banks loans as a proxy.

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as the extent to which they were exposed to the economic effects of the pandemic, hence arguably the willingness of banks to grant them credit during the pandemic. To reduce endogeneity concerns, the change of value added is measured at industry rather than at firm level. Since the same industry was differently affected by the pandemic in different countries, we measure the change in value added at the industry-country level. Finally, $Size$ and $Risk$ are included since smaller and riskier firms are typically subject to tighter financial constraints (Beck et al., 2005), especially at times of economic stress.

The regressions include four bank characteristics measured before the pandemic, aimed at investigating whether bank size and balance sheet strength mattered for credit substitution. Our specification includes three measures of the balance sheet strength of banks lending to firm i: liquidity (LIQ), capitalization (CAP), and non-performing loans as a fraction of total loans (NPL). Finally, in some specifications we also include controls at bank-firm level: the credit granted by bank j scaled by the total credit owed by the firm to all banks (as a proxy for relationship banking), the ratio between the drawn amount and credit granted, and the residual maturity of the loans issued by a bank to a given firm. All bank and bank-firm variables are calculated as of December 2019.

The specification also includes bank fixed effects (η_j) to control for any observed and unobserved bank heterogeneity in the provision of credit during the pandemic. Standard errors are clustered at the bank-firm level. Since the model in Section 2.2 provides predictions about the joint response of credit substitution and interest rates to the availability of loan guarantee, subsequently we estimate similar specifications where the dependent variables are interest rates and loan maturities.

While the main analysis is performed at the bank-firm level exploiting within-firm variation, it is also worth exploring whether credit substitution is relevant at the firm level. To minimize the impact of the selection issue discussed above, the analysis focuses only on firms that

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received such guarantees. We estimate the firm-level substitution associated with an increase in guaranteed lending, i.e., the drop in non-guaranteed loans to a given firm in response to an extra euro of guaranteed loans. To measure the credit substitution faced by firm i, similarly to what we have done before, we consider the change in non-guaranteed credit (NGC_i) extended to that firm, scaled by its initial total credit (TC_i):

$$y_i = \frac{NGC_{i,t} - NGC_{i,t-1}}{TC_{i,t-1}}$$

where t is August 2020 and $t-1$ is February 2020. Substitution occurs if non-guaranteed credit declines upon the firm being granted a guaranteed loan, i.e., if $y_i < 0$, dampening the growth in total credit by $-y_i$. Hence, we measure credit substitution by the negative of y_i, denoted by $s_i \equiv -y_i$. However, in principle non-guaranteed credit may increase, i.e., $y_i > 0$, in which case our measure of substitution s_i would turn negative. Figure 6 shows how the variable y_i is distributed across firms for each of the four countries: interestingly, it is negative for most firms, its median value being negative in all countries, and smaller in Italy and Spain than in France and Germany. In Italy and Spain, almost the whole distribution is in negative territory, the 84^{th} percentile being below zero. In contrast, in France and Germany y_i is positive for over a quarter of the firms in the sample. Hence, this simple unconditional statistic suggests that substitution was larger in Italy and Spain than in France and Germany. But this result may reflect cross-country differences in firm characteristics, as well as in the magnitude of the liquidity shock hitting them.

[Insert Figure 6. Distribution of the change in non-guaranteed credit scaled by total initial credit]

To account for such heterogeneity, we investigate how substitution is related to the size of the guarantee scaled by total initial credit, g_i, and to its interactions with firm and bank

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characteristics, for the subsample of firms that received a guaranteed loan:

$$s_i = \alpha + \beta_1 g_i + \beta_2 g_i \times \Delta VA_i + \beta_3 g_i \times Size_i + \beta_4 g_i \times Risk_i + \beta_5 g_i \times BSize_i + \beta_6 g_i \times Liq_i + \beta_7 g_i \times Cap_i + \beta_8 g_i \times NPL_i + \gamma_c + \varepsilon_i \quad (7)$$

where $g_i \equiv GC_i/TC_i$ is the guaranteed credit received by firm i as a fraction of its total initial credit. While firm variables are defined in the same way as in equation (1), the bank variables are calculated as weighted averages of the corresponding variables for the banks lending to firm i, with weights equal to their shares in the firm's total bank exposure as of December 2019. In estimating this specification, errors are clustered at the level of the main bank of the relevant firm.

4 Results

In this section we address the main issue of the paper, by assessing the extent to which guaranteed loans resulted in credit substitution, and investigating how it correlates with the firm and bank characteristics identified as potentially relevant in the model presented in Section 2.2. To take into account the possible selection bias resulting from systematic differences between firms that received and those that did not receive guaranteed credit, most of the analysis is carried out at within-firm level, comparing credit provided by lenders providing a guaranteed loan with that issued by other lenders catering to the same firm (Section 4.1). We also try to sign the possible remaining selection bias arising from the non-random choice of the lender providing the guaranteed loan among the firm's lenders (Section 4.2). Next, we consider how loan guarantees correlate with changes in the interest rate and the maturity offered by the bank providing the guaranteed loan, and whether these changes are correlated with credit substitution as predicted by our model (Section 4.3). Finally, we

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repeat the estimation on firm-level data, including firms borrowing from a single borrower in the sample, and test the robustness of the results obtained in the within-firm analysis (Section 4.4).

4.1 Within-firm level substitution

Figure 7 shows country-level averages of the degree of credit substitution for the subsample of firms that received a guaranteed loan and had multiple bank relationships: the figure plots the average country-level change in non guaranteed credit, scaled by its initial exposure, $y_{i,j}$, for the bank-firm relationships with a guaranteed loan and those without. In all four countries, the banks granting guaranteed loans reduced their non-guaranteed exposure much more than other banks lending to the same firm. On average, for the four largest euro area countries, banks that did not provide guaranteed loans reduced their exposure by 4% during the period under analysis, while banks that granted guaranteed loans reduced their non-guaranteed credit by 36% (Table A3).

Table 2 investigates whether the result that emerges from these descriptive statistics is confirmed by regression analysis. It reports within-firm estimates of substitution based on specification (6) presented in Section 3.2. As the specification shown in the table includes both firm and bank fixed effects to control for firm- and bank-level unobserved heterogeneity, its estimates enable testing whether banks that offer guaranteed loans cut their pre-existing exposures more than other banks lending to the same firm. The specification shown in the last column also controls for variables that vary at the bank-firm level (share of granted credit, ratio between drawn and granted credit, and residual maturity). The results confirm the evidence provided by the descriptive statistics, even in terms of economic magnitude: banks providing the guaranteed loan reduced non-guaranteed credit between 30% and 32% more than other banks, depending on the specification. The coefficient is statistically significant

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at the 1% level in all specifications.

When the dummy identifying the bank offering the guaranteed credit, G_{ij}, is interacted with the three main firm-level variables, i.e. industry-level growth in value added, size and risk, we find that substitution is larger for more fragile firms, namely, smaller and riskier ones, and those in sectors and countries more affected by the pandemic. This evidence is consistent with the prediction of the model in Section 2.2 if these firms can be taken to have a less elastic demand for credit than the others. Moreover, substitution is larger for banks with a lower amount of NPLs before the pandemic. This is consistent with the model's prediction that less risk-averse lenders should respond to credit guarantees with a smaller increase in lending (as they benefit less from the implied insurance provision), hence with less substitution. The coefficients of the interactions with other bank characteristics (size, liquidity and capital) are often not significant. The evidence suggests that larger banks and banks featuring greater liquidity seem to engage more in credit substitution upon issuing a guaranteed loan. Again, this is consistent with the model's predictions if these banks can be regarded as featuring lower risk aversion in their lending policies, hence respond less to public insurance provision via loan guarantees. Finally, when the dummy G_{ij} is interacted with bank-firm level variables, only the interaction with residual maturity, defined as the time to the expiration of existing credit, turns out to be significantly different from zero: substitution is higher the longer is the residual maturity in the bank-firm relationship.

[Insert Table 2. Substitution: firm-bank level analysis]

Table A4 presents the estimates for the most complete specification (shown in column 4 of Table 2) separately for each of the four countries. These results show that the results are similar in all four countries included in our analysis. This finding is far from obvious, in light of the different design of the programs, the different magnitude of the pandemic shocks, and the cross-country differences in the composition of the firm populations and

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banking structures. The dummy G_{ij} is positive and highly statistically significant in all four countries.

However, the magnitude of substitution varies across countries, being largest in Spain (61%) and smallest in France (15%). Moreover, in all four countries firm and bank characteristics appear to play a similar role in moderating the extent of substitution: this turns out to be larger for more fragile firms (i.e. smaller and riskier ones in more affected sectors and countries) and for banks with lower NPLs. In some cases the relevant coefficients are not statistically significant but their signs (and also economic magnitude in case of bank NPL) are consistent across countries.

A potential concern with these results is that the finding that the bank providing the guaranteed loan reduces non-guaranteed credit may not be due to an active decision but simply to its pre-existing loan contract with the firm expiring in the current period and not being rolled over upon issuing a guaranteed loan. The above result that substitution is larger for banks whose pre-existing loans had longer residual maturity mitigates this concern, as it suggests that substitution is unlikely to stem from the expiration of pre-existing non-guaranteed credit. However, to address this concern more directly, in Table 3 we re-estimate the main specifications of Table 2 excluding from the sample the bank-firm relationships with at least one loan maturing between March 2020 and August 2020 – a filter that removes around 15 per cent of the sample observations. The results remain very similar.

[Insert Table 3. Substitution: firm-bank level analysis, excluding relationships with maturing loans]

In the above analysis, the sample only contains the firms that received a guaranteed loan and have multiple bank relationships, to be able to include firm fixed effects and merely exploit within-firm variation. But this condition greatly reduces the sample, raising possible

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concerns about the external validity of the results. To address this issue, we estimate regressions that also include single-bank firms. Even though these specifications cannot include firm fixed effects, they include industry-location-size (ILS) fixed effects as in Degryse et al. (2019) and Acharya et al. (2019). Table 4 shows that the inclusion of single-bank firms in the sample does not affect the main coefficients of interest. The main difference relative to the previous tables is that the interaction of loan guarantees with bank capital rather than that with bank NPLs now appears with a positive and significant coefficient, but overall it appears that banks with stronger balance sheets, hence presumably lower risk-aversion, engage in greater substitution.

[Insert Table 4. Substitution: firm-bank level analysis, including single-bank firms]

4.2 Within-bank selection

While the within-firm estimates shown in Table 2 avoid selection on firms, they are not entirely immune from selection bias, as the banks issuing guaranteed loans are not randomly assigned to firms. To sign the potential resulting bias, we analyze the within-firm selection of the bank granting guaranteed credit: for the subsample of firms with multiple banking relationship, Table 5 investigates the characteristics of the banks granting guaranteed credit. The dependent variable is a dummy variable equal to 1 for banks granting guaranteed credit, and 0 otherwise.

[Insert Table 5. Within-firm selection of banks granting guaranteed credit]

The estimates in Table 5 show that the banks that provide guaranteed credit are larger (the coefficient estimate of their size being statistically significant at the 1% level in columns 1-3) and more capitalized (the relevant coefficient estimate being statistically significant at the 1% level in columns 1 and 3). Moreover, these banks are more likely to be the relevant firms'

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main banks, as they feature a significantly larger share of granted credit. Thus, relationship lending appears to have made it easier for firms to access government guaranteed credit, consistently with evidence by Li and Strahan (2021) that the bank supply of credit under the Paycheck Protection Program (PPP) was mostly done by relationship banks.

The results in Table 5 help us infer the sign of the potential bias in the substitution estimates of Table 2 arising from selection of the banks providing guaranteed credit: these "selected" banks are stronger, and more likely to engage in relationship lending with the relevant firms: hence, they are precisely the type of banks that according to the literature (Bolton et al., 2016, and Jimenez et al., 2012) should be associated with greater supply of credit during economic shocks. By extension, these banks should also be associated with lower credit substitution. Instead, our results indicate the opposite, so that – if anything – our estimates in Table 2 under-estimate the extent of substitution by the banks providing guaranteed loans.

Moreover, the results in Table 5 provide a further reassurance that our results are likely to stem from banks' decision to cut their non-guaranteed credit when issuing a guaranteed loan, rather than to casual concomitant expiration of pre-existing non-guaranteed loans. When residual maturity is included in the specifications of columns 4-6, its coefficient is positive and significant: the bank issuing the guaranteed loan tends to be the one whose credit to the firm had a longer residual maturity, confirming that the previous findings regarding substitution are not simply driven by expiring credit being rolled over in the form of guaranteed credit.

4.3 Change in interest rate and loan maturity

So far we investigated the impact of guaranteed loans on non-guaranteed lending. However, the model presented in Section 2.2 shows that public loan guarantees should simultaneously affect both the amount of non-guaranteed lending and the interest rate offered by the bank

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issuing the guaranteed loan, and that firm and bank characteristics should affect both of them. Indeed, the model predicts that the availability of the guarantee creates a trade-off between substitution and cost of credit to the firm: the bank can offer a deeper interest cut in exchange for more substitution, and both the trade-off itself and the point picked along the trade-off should vary with bank and firm characteristics. A similar trade-off can be expected to exist between substitution and loan maturity: the bank can lengthen the maturity of the firm's loans in exchange for more substitution.

To analyze how interest rates and loan maturities respond to the availability of loan guarantees in our data, and how such response varies depending on bank and firm characteristics, we adopt the same econometric specification used to assess the extent of credit substitution, namely, specification (6) from Section 3.2, replacing the dependent variable with the change in the interest rate or in the loan maturity of the relevant firm over the relevant period. In line with the model's setup, we consider how the bank providing the guaranteed loan modifies the interest rate and loan maturity that apply to its overall lending position to the firm, i.e., the respective weighted averages applying to all the loans and credit lines issued to the relevant firm.

In Table 6 the dependent variable is $\Delta InterestRate_{ij}$, i.e. the change between February 2020 and August 2020 in the weighted average interest rate charged by bank j to firm i. The estimates indicate that firms that receive a loan guarantee face a reduction in the interest rate charged on the loans extended to the firm by the bank issuing the guaranteed loan. The baseline estimate of the interest rate drop relative to that offered by other banks lending to the same firm ranges from 21 to 74 basis points depending on the specification. More fragile firms, i.e., smaller and riskier ones and those belonging to more affected sectors and countries, obtain a deeper interest rate cut, and larger and more capitalized banks offer a smaller cut upon providing the guaranteed loan.

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All of these results are in line with the predictions of the model presented in Section 2.2, which predicts that the downward tilt of the credit supply curve should be larger for riskier firms and smaller for less risk-averse lenders, and that firms with less elastic demand for credit end up taking a deeper cut in the interest rate (as opposed to a larger increase in lending) in response to provision of the guaranteed loan.

The specifications in columns 3 and 4 of Table 6, which also control for characteristics of the bank-firm relationship, indicate that the bank issuing the guaranteed loan gives a deeper cut to the firm if it supplies a large fraction of the firm's total credit: for firms that received most of their credit from this bank (so that the shared of granted is close to 1), the firm gets an additional interest rate reduction ranging between 35 and 40 basis points. This effect is also in line with the logic of our model: as a firm's main bank can be expected to have a larger pre-existing exposure towards it, it will benefit more from the availability of a loan guarantee and be ready to offer a deeper cut to the firm than a less exposed bank.

[Insert Table 6. Firm-bank level analysis of changes in interest rates]

Table 7 presents regressions whose dependent variable is the change in average residual maturity. The results are remarkably similar. The bank providing guaranteed credit increases the average residual maturity by about 19 months relative to other banks lending to the same firm and this increase in maturity, again, is larger for smaller and riskier firms and for more capitalized banks. However, in this case surprisingly the presence of a bank-firm relationship appears to reduce (or even offset) the positive effect of the availability of the loan guarantee: the estimated coefficient of the share of granted variable is positive and precisely estimated and even larger than the baseline estimated coefficient of the loan guarantee dummy. Moreover, banks issuing guaranteed loans appear to offer greater maturity extensions to firms that already have a longer residual maturity. The puzzle may be solved if relationship banks typically have longer maturity loans, so that in the estimates residual

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maturity acts as the most relevant measure of the strength of the bank-firm relationship.

[Insert Table 7. Firm-bank level analysis of changes in maturities]

Finally, we investigate how the reduction in interest rate correlates with credit substitution in the sample of bank-firm relationships where there is a guaranteed loan between August and February 2020, taking to the data the model's prediction that changes in interest rates and changes in loan amounts, hence credit substitution, are jointly affected by the provision of loan guarantees. We estimate a regression (not reported for brevity) in which the dependent variable is the change in the interest rate charged by the bank issuing the guaranteed loan and the explanatory variable is the degree of credit substitution. As in this exercise we do not include firm fixed effects, the sample also includes firms with a single bank relationship. We find that the coefficient of credit substitution is negative and precisely estimated, consistently with the model's prediction of a negative trade-off (see equation 3): the estimated coefficient (0.00169) implies that 100% credit substitution would be associated with an interest rate reduction of about 17 basis points.

4.4 Firm level results

In the last part of the paper, we ask whether the substitution we observe at bank-firm level matters also at a higher level of aggregation. At firm level, we investigate whether larger guarantees are indeed associated with a higher level of reduction in pre-existing credit exposure. Moreover, all the previous estimates regarding the extent of credit substitution do not take into account that in the EU loan guarantee programs there was considerable heterogeneity in the size of the guaranteed loans. So it is worth investigating whether the degree of credit substitution is related to the size of firm i's guaranteed loan scaled by its total initial credit, $g_i = L_j^G / L_{ij}^0$, and to its interactions with firm and bank characteristics. We perform this estimation at firm level rather than at bank-firm level, estimating the

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specification of equation 7 for the subsample of firms that received a guaranteed loan. This enables us to see whether the size of the firm-level guarantee affected the overall amount of credit received by firms included in EU guarantee programs.

The firm-level estimates are shown in Table 8 for the pooled sample of firms receiving guaranteed loans in all four countries, and in Table A5 separately in each country. We find that the amount of credit substitution is positively associated with the size of the firm-level guarantee. The coefficient of the *Guarantee* variable indicates that on average a €1 increase in firm-level guaranteed lending is associated with substitution ranging between €0.10 and €0.14 depending on the specification, which translates into an average increase in total lending ranging between €0.90 and €0.86. Even in this very different specification, firm and bank heterogeneity associated with credit substitution has similar implications for credit substitution as in previous tables. When the amount of the guaranteed loan is interacted with the three main firm-level variables, i.e industry-level growth in value added, size and risk, we find that the response of substitution to guarantees is larger for firms in more affected sectors and countries, and for smaller and riskier firms. These results, shown in column (1) for a specification that does not include bank-level variables, are all precisely estimated at the 1% confidence interval (except for the interaction between guarantee size and value-added growth, which is statistically significant at the 10% confidence level). Also in this firm-level specification, credit substitution turns out to be significantly greater for firms borrowing from stronger banks, i.e. those featuring fewer NPLs, larger size, liquidity and capitalization, confirming the results reported in previous tables.

[Insert Table 8. Substitution of guaranteed lending: firm-level analysis]

Table A5 presents the estimates for the most complete specification (shown in column 4 of Table 8) separately for each of the four countries. Larger guarantees are associated with a greater reduction in non-guaranteed credit in all four countries, but the magnitude

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of the reduction varies across countries, being again largest in Spain (0.24) and smallest in France (0.08). Also in this case firm and bank characteristics appear to play a similar role in moderating the extent of substitution: larger for weaker firms (i.e., smaller and riskier firms in more affected sectors and countries) borrowing from stronger banks (i.e., with fewer NPLs,larger, more capitalized and liquid banks). In some cases the relevant coefficients are not statistically significant but their signs are consistent across countries.

A possible concern regarding the regressions in Tables 8 and A5 is that they treat guaranteed loans as if they were homogeneous, whereas individual programs not only differed in loan sizes but also in their fractional guarantees, as explained in Section 3. Indeed, the model of Section 2.2 indicates that the magnitude of the rightward shift of the credit supply curve of bank j supplying guaranteed credit to firm i is given by the guaranteed lending $(1-\lambda)L_i^G$, where $(1-\lambda)$ is the guaranteed fraction of the loan L_i^G. To address this concern, Table A6 reports estimates where the amount of each guaranteed loan is replaced by the corresponding guaranteed amount, calculated as the value of the loan multiplied by its guaranteed fraction. The results are very similar: the average substitution is actually larger, as it rises from 0.13 (in column 4 of Table 8) to 0.30 (in column 4 of Table A6), and also the results about how substitution varies depending on firm and bank characteristics are qualitatively unchanged.

5 Conclusions

This paper investigates whether government credit guarantee schemes, used extensively after the onset of the COVID-19 pandemic to support bank lending by shifting default risk to governments, led to substitution of non-guaranteed with guaranteed credit. In principle, such substitution may be driven by banks exploiting public guarantees as an opportunity to reduce their pre-existing credit risk exposure. We provide a simple model of the effects of loan guarantees on banks' lending policies, showing that banks may engage more in credit

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substitution in exchange for a reduction in the cost of credit to eligible firms. This trade-off between credit substitution and cost of credit varies depending on the bank's risk aversion and on the firm's riskiness, while the point chosen along this trade-off depends on the elasticity of the firm's demand for credit.

We take these predictions to the data by exploiting a novel harmonized credit register dataset for the entire euro area, AnaCredit, matched with supervisory bank balance-sheet data, and focus on the four largest euro area countries. We find that guaranteed loans resulted in some substitution of pre-existing non-guaranteed debt with guaranteed loans. The value of this response varies across countries, being lowest in France and highest in Spain. For firms borrowing from multiple banks, the substitution arises from the lending behavior of the bank extending guaranteed loans, whose drop in non-guaranteed lending is significantly larger than for other banks lending to the same firm: the former reduced non-guaranteed credit between 30% and 32% more than the latter.

Credit substitution varied considerably across firms, being highest for guaranteed loans granted to riskier and smaller firms operating in more affected sectors. This is consistent with our model if these firms have less elastic demand for credit. Banking relationships attenuated credit substitution. Similar estimates, though varying in magnitude, are obtained for all countries analyzed. As predicted by the model, the evidence reveals a trade-off between the interest rate reduction offered to firms receiving guaranteed loans and credit substitution by the corresponding lenders: riskier and smaller firms operating in more affected sectors were given larger interest rate reductions upon receiving guaranteed loans.

Instead, banks with stronger balance sheets, i.e., with more liquidity and capital and/or fewer NPLs, featured both greater substitution and smaller interest rate reductions upon offering guaranteed loans. This is consistent with the model's predictions if these banks can be regarded as less risk-averse than others in their lending policies: benefiting less from the

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provision of public loan guarantees, these lenders are then less inclined both to expand credit and to improve credit conditions to recipients of guaranteed loans.

Overall, the evidence suggests that in the euro area loan guarantees contributed to the continued extension of credit to relatively creditworthy firms, but also benefited the balance sheet of banks, especially the comparatively stronger ones. It also highlights that the provision of credit to weaker firms was more severely hampered by credit substitution, although these firms obtained comparatively large interest rate cuts and loan maturity extensions.

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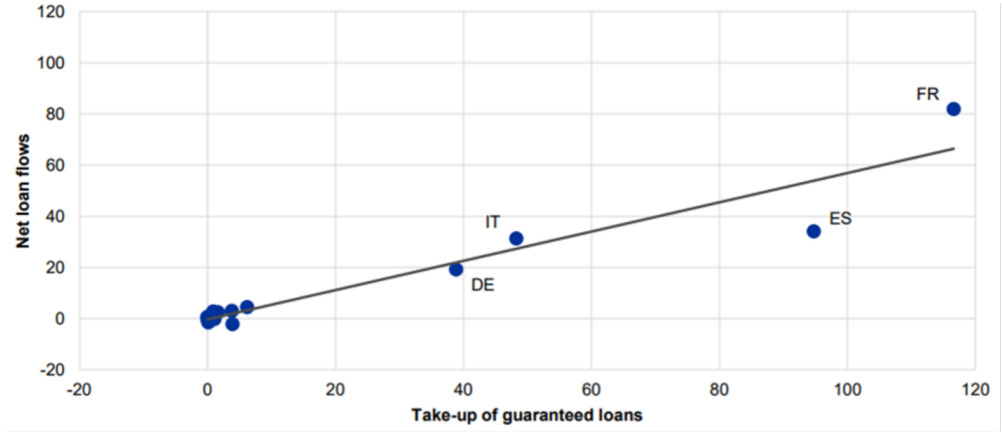
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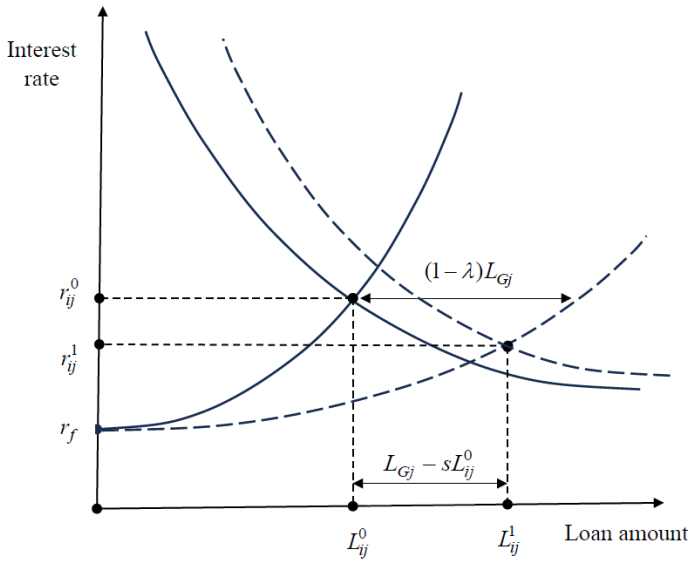
Figures and Tables

Figure 1. Guarantee loans and net lending: aggregate country-level data



Notes: This figure reports the relation between the amount of take-up of guaranteed loans and the net loan flows at a country level, over the period April-August 2020. Each blue dots refers to a country in the euro area. Data sources: Kreditanstalt für Wiederaufbau for Germany, Instituto de Crédito Oficial for Spain, Ministère de l'Économie etdes Finances for France, Ministero dell'Economia e delle Finanze and Banca d'Italia for Italy, various national authorities for other euro area countries, news sources, ECB and ECB calculations. A similar figure with data for the period April-July 2020 appears in the ECB Economic Bulletin, Issue 6/2020.

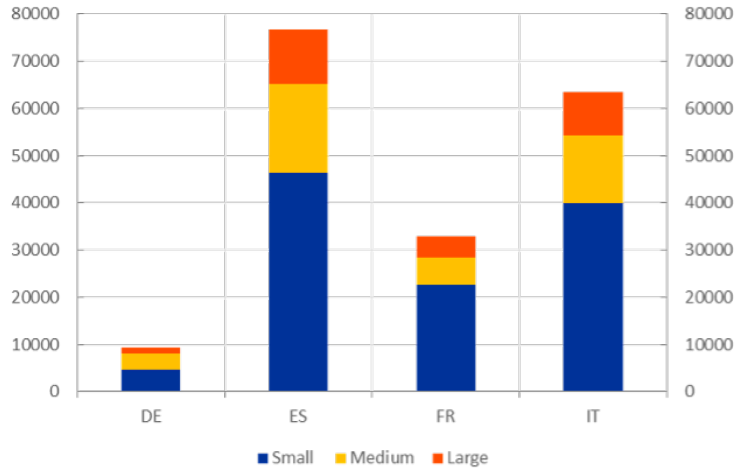
Figure 2. Change in lending and interest due to loan guarantees



Notes: This figure illustrates the predicted effects of the provision of a publicly guaranteed loan L_{Gj} to firm j by bank i, in the wake of an increased demand for loans. Initially the bank lends the amount L_{ij}^0 to the firm at the interest rate r_{ij}^0. The provision of the guaranteed loan modifies the credit supply function from the solid to the dashed upward-sloping curve. At the same time, the pandemic shock modifies firms' demand for loans from the solid to the dashed downward sloping curve, resulting in an increase in the equilibrium loan amount to L_{ij}^1, and a change in the equilibrium interest rate from r_{ij}^0 to r_{ij}^1. The change in the equilibrium loan amount, $L_{ij}^1 - L_{ij}^0$, equals the guaranteed loan minus the credit substitution, $L_{Gj} - sL_{ij}^0$. Hence the greater the degree s of credit substitution, the smaller the increase in credit and the larger the drop in the interest rate.

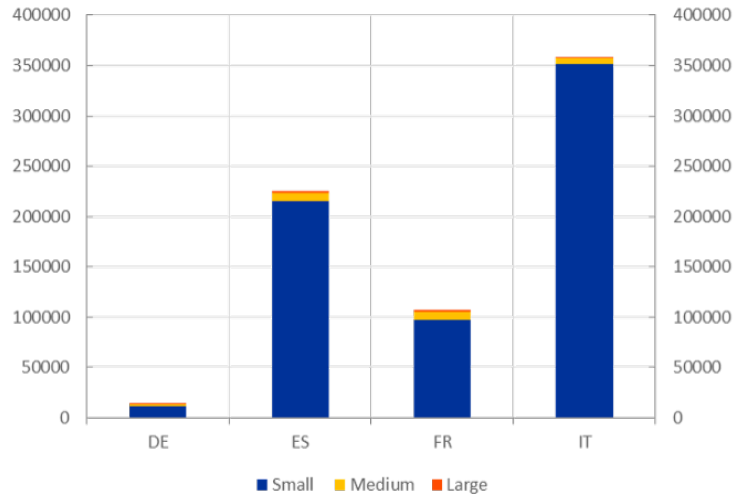
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Figure 3. Guaranteed loans by firm size (million Euro)



Notes: The figure shows the amount of guaranteed loans in million euro issued to firms in different size classes based on their employment (small firms being those with less than 50 employees, medium firms those with 50 to 250 employees, large firms as those with more than 250 employees). The sample includes firms present in the AnaCredit database as of December 2019 and considers guaranteed loans issued between March and August 2020.

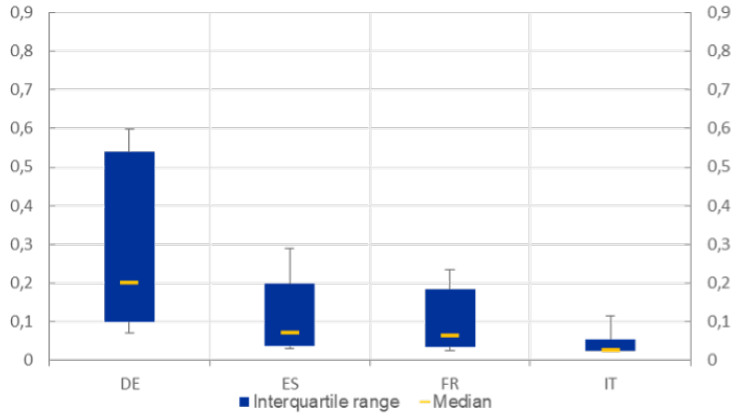
Figure 4. Guaranteed loans by number of firms



Notes: The figure shows the number of guaranteed loans issued firms in different size classes to their employment size (small firms being those with less than 50 employees, medium firms those with 50 to 250 employees, large firms as those with more than 250 employees). The sample includes firms present in the AnaCredit database as of December 2019 and considers guaranteed loans issued between March and August 2020.

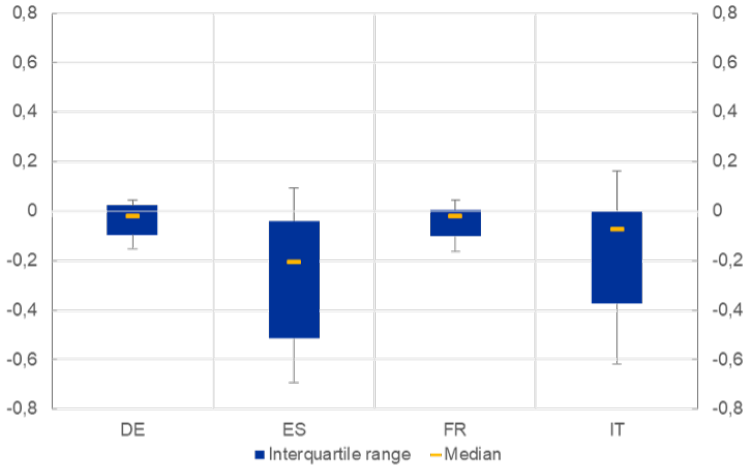
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Figure 5. Amount of guaranteed loans (million euro)



Notes: The figure reports the distribution of the size of guaranteed loans in million euro issued in different countries. We report the median, the interquartile range and the 16th and 84th percentile. The sample includes firms present in the Anacredit database as of December 2019 and considers guaranteed loans issued between March and August 2020.

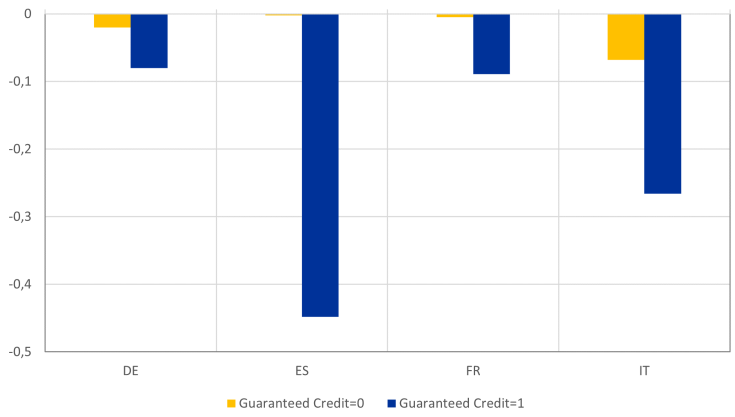
Figure 6. Distribution of the change in non-guaranteed credit (y_i)



Notes: The figure shows the country-level distribution of the firm-level change in non-guaranteed credit between February 2020 and August 2020, divided by total credit in February 2020 (y_i for firm i). Each box plot displays the median, the interquartile range and the 16th and 84th percentile. The sample includes firms present in the AnaCredit database as of December 2019 and that receive a guaranteed loan between March and August 2020.

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Figure 7. Change in non-guaranteed credit (y_{ij}) for bank-firm relationships with and without guaranteed credit.



Notes: This figure reports bank-firm level descriptive statistics of the variable y_{ij} , defined as the change in non-guaranteed credit granted by bank j to firm i between February 2020 and August 2020, divided by total initial credit granted by bank j to firm i in February 2020. We report the average value of y_{ij} for bank-firm relationships where there is a government guaranteed loan to firm i between March 2020 and August 2020, and 0 otherwise. We consider only firms which receive a government guaranteed loan and that have multiple bank relationships.

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Table 1. Descriptive Statistics

This table reports the descriptive statistics for the variables used in our analysis. We report the statistics at firm-level for the full sample in Panel A and for the sample of firms receiving a guaranteed loan in Panel B. In Panel C we report bank-firm-level statistics for the sample of firms with multiple bank relationships receiving a guaranteed loan. In Panel D we report loan-level statistics for the guaranteed loans. The dummy G_i equal to 1 if firm i receives a government guaranteed loan between March 2020 and August 2020, and 0 otherwise (at the bank-firm level, the dummy G_{ij} is equal to 1 if bank j gives a government guaranteed loan to firm i between March 2020 and August 2020, and 0 otherwise); Industry VA Growth is defined as the percentage change in Valued Added in the relevant industrial sector in each country between February 2020 and August 2020; Firm Size is proxied by the log of firm total debt; Firm Risk is proxied by the share of loans in arrears out of total loans; Bank Assets is defined as the log of total bank assets; Bank Liquidity is defined as the bank Liquidity Coverage Ratio; Bank Capital is defined as the Core Tier 1 Ratio; Bank NPL is defined as the share of NPL loans out of its total loans; Change in non-guaranteed credit (y_i) is defined as the change in non-guaranteed credit received by firm i between February 2020 and August 2020, divided by its total credit as of February 2020 (at the bank-firm level, y_{ij} is defined as the change in non-guaranteed credit granted by bank j to firm i between February 2020 and August 2020, divided by total initial credit granted by bank j to firm i in February 2020); Guarantee is defined as the amount of the government guaranteed loan received by the firm, divided by total credit in February 2020; GuarAmount is defined as the amount of the government guaranteed loan multiplied by the percentage of guarantee received by the firm, divided by total credit in February 2020; Share of granted is defined as the share of the bank j out of the total bank exposure of the firm i; Drawn/Granted is defined as the amount of credit drawn by firm i divided by the amount granted by bank j to firm i; Residual Maturity is defined as the log of the number of remaining months until the expiration or the repayment of the credit by bank j to firm i; Interest Rate is the rate charged on the guaranteed loan; Maturity is the log of the number of months of the maturity of the guaranteed loan. In Panel A and B the bank-level variables are calculated as a weighted average of the bank variable, where the weights are the shares of the bank exposure toward the firm out of total bank exposure of the firm as of December 2019. All variables, apart from Guarantee, Industry VA Growth, Interest rate and Maturity are calculated as of December 2019.

Variable	Observations	Mean	Std. Dev.	p25	p50	p75
Panel A: Firm-Level Statistics for Full Sample						
G_i	2534649	.201231	.4009204	0	0	0
Industry VA Growth	2534649	-.1851828	.13311538	-.2799991	-.212043	-.0381242
Firm Size	2534649	.4556356	1.032835	.06	.1394943	.355784
Firm Size (ln)	2534649	-1.841103	1.385576	-2.813411	-1.969731	-1.033432
Firm Risk	2534649	.0511766	.2035104	0	0	0
Bank Assets (ln)	2499952	10.96647	1.850156	9.752056	10.64261	12.60875
Bank Liquidity	1909643	1.609331	.4499768	1.374791	1.468671	1.656271
Bank Capital	2467193	.164408	.0373446	.1376	.1622	.1872
Bank NPL	2484676	.036722	.0251427	.0190742	.0295823	.0459807

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Variable	Observations	Mean	Std. Dev.	p25	p50	p75
Panel B: Firm-Level Statistics for Sample of Firms Receiving a Guaranteed Loan						
y_i	472206	-.1651976	.4351072	-.3588249	-.0884875	-6.61e-08
Guarantee	472206	.6610703	.6126491	.2130464	.4778608	.9133081
GuarAmount	472206	.56591	.803487	.181089	.406182	.776312
Industry VA Growth	472206	-.2696674	.1176344	-.2965012	-.2799991	-.2464528
Firm risk	472206	.009838	.0727509	0	0	0
Firm Size (ln)	472206	-1.825618	1.403241	-2.864704	-1.999964	-.9586785
Bank Assets (ln)	466779	11.78363	1.606472	10.93654	12.19957	12.93476
Bank Liquidity	429584	1.629307	.4063831	1.369273	1.524408	1.715151
Bank Capital	462361	.1580418	.0315707	.1376	.1538016	.17379
Bank NPL	465304	.0499914	.0251201	.0324722	.0389781	.0628809
Panel C: Bank-Firm-Level Statistics for Sample of Firms with Multiple Bank Relationships Receiving a Guaranteed Loan						
y_{ij}	463378	-.1934169	.4223604	-.4221086	-.0783115	0
G_{ij}	463378	.4813953	.4996543	0	0	1
Industry VA Growth	463378	-.2850879	.1164456	-.3217703	-.2694259	-.2464528
Firm Size	463378	2.442876	5.221862	.256848	.671932	2.067729
Firm Size (ln)	463378	-.2574106	1.474238	-1.359271	-.3975981	.7264507
Firm Risk	463378	.0106374	.0699585	0	0	.0000731
Bank Assets (ln)	463378	11.78151	1.55693	11.14689	12.09178	12.93476
Bank Liquidity	463378	1.714639	.4939096	1.324652	1.563804	1.79208
Bank Capital	463378	.1513137	.0310854	.12991	.14158	.16791
Bank NPL	455992	.0511682	.0245063	.0376693	.0395396	.0628809
Share of Granted$_{ij}$	463378	.3060326	.233435	.1158215	.2474143	.4525441
Drawn/Granted$_{ij}$	462308	.7910086	.2734942	.6614148	.9237205	1
Residual Maturity$_{ij}$ (ln)	423102	2.994799	1.502414	2.495956	3.476427	3.885073
Panel D: Loan-Level Statistics for Guaranteed Loans						
Interest Rate	504849	0.01717	0.01131	0.0103	0.0151	0.0242
Maturity (ln)	512498	3.563876	0.8980772	3.346398	4.021774	4.074142

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Table 2. Credit substitution: Firm-bank level analysis

This table reports bank-firm level estimates of an equation whose dependent variable is the credit substitution s_{ij}, defined as the negative of the change in non-guaranteed credit granted by bank j to firm i between February 2020 and August 2020, divided by total initial credit granted by bank j to firm i in February 2020. The main regressor is a dummy G_{ij} equal to 1 if bank j gives a government guaranteed loan to firm i between March 2020 and August 2020, and 0 otherwise. Other regressors are: Industry VA Growth, defined as the industrial sector change in Valued Added in each country between February 2020 and August 2020; Firm Size, proxied by the log of firm total debt; Firm Risk, proxied by the share of loans in arrears out of total loans; Bank Assets, defined as the log of total bank assets; Bank Liquidity, defined as the bank Liquidity Coverage Ratio; Bank Capital, defined as the Core Tier 1 Ratio and Bank NPL, defined as the share of NPL loans out of its total loans; Share of granted, defined as the share of the bank j out of the total bank exposure of the firm i; Drawn/Granted, defined as the amount of credit drawn by firm i divided by the amount granted by bank j to firm i; Residual maturity, defined as the log of the number of remaining months until the expiration or the repayment of the credit by bank j to firm i. All the regressors, apart from G_{ij} and Industry VA Growth are calculated as of December 2019. In all the specifications we include also the non-interacted variables but we do not report the coefficients for convenience. Standard errors clustered at the bank level, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Dependent variable:	Credit Substitution ($s_{i,j}$)			
	(1)	(2)	(3)	(4)
G_{ij}	0.318***	0.307***	0.305***	0.321***
	(0.0119)	(0.0174)	(0.0172)	(0.0322)
G_{ij} × Industry VA Growth	-0.112**	-0.125***	-0.131***	-0.166***
	(0.0481)	(0.0441)	(0.0414)	(0.0345)
G_{ij} × Firm Size	-0.00113	-0.00202	-0.00188	-0.0214**
	(0.00531)	(0.00522)	(0.00535)	(0.00838)
G_{ij} × Firm Risk	0.264***	0.271***	0.258***	0.223***
	(0.0389)	(0.0426)	(0.0417)	(0.0651)
G_{ij} × Bank Assets	0.000677	0.00379	0.00560	0.0168**
	(0.00668)	(0.00690)	(0.00687)	(0.00677)
G_{ij} × Bank Liquidity	0.000595***	0.000470*	0.000439*	0.000280
	(0.000219)	(0.000246)	(0.000237)	(0.000228)
G_{ij} × Bank Capital	0.267		0.381	0.318
	(0.396)		(0.349)	(0.376)
G_{ij} × Bank NPL		-0.287***	-0.390***	-0.157***
		(0.0486)	(0.0498)	(0.0449)
G_{ij} × Share of Granted				-0.0467
				(0.0383)
G_{ij} × Drawn/Granted				-0.227
				(0.305)
G_{ij} × Residual Maturity				0.0680***
				(0.00980)
Firm FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Non-interacted variables	Yes	Yes	Yes	Yes
R^2	0.479	0.479	0.480	0.552
N	463378	460084	453694	452065

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Table 3. Credit substitution: firm-bank level analysis, excluding relationships with maturing loans

This table reports bank-firm level estimates of an equation whose dependent variable is the credit substitution s_{ij}, defined as the negative of the change in non-guaranteed credit granted by bank j to firm i between February 2020 and August 2020, divided by total initial credit granted by bank j to firm i in February 2020. In this table we exclude from the sample bank-firm relationships where there is at least one loan which is maturing between March 2020 and August 2020. The main regressor is a dummy G_{ij} equal to 1 if bank j gives a government guaranteed loan to firm i between March 2020 and August 2020, and 0 otherwise. Other regressors are: Industry VA Growth, defined as the industrial sector change in Valued Added in each country between February 2020 and August 2020; Firm Size, proxied by the log of firm total debt; Firm Risk, proxied by the share of loans in arrears out of total loans; Bank Assets, defined as the log of total bank assets; Bank Liquidity, defined as the bank Liquidity Coverage Ratio; Bank Capital, defined as the Core Tier 1 Ratio and Bank NPL, defined as the share of NPL loans out of its total loans; Share of granted, defined as the share of the bank j out of the total bank exposure of the firm i; Drawn/Granted, defined as the amount of credit drawn by firm i divided by the amount granted by bank j to firm i; Residual Maturity is defined as the log of the number of remaining months until the expiration or the repayment of the credit by bank j to firm i. All the regressors, apart from G_{ij} and Industry VA Growth are calculated as of December 2019. In all the specifications we include also the non-interacted variables but we do not report the coefficients for convenience. Standard errors clustered at the bank level, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Dependent variable:	Credit Substitution ($s_{i,j}$)			
	(1)	(2)	(3)	(4)
G_{ij}	0.321***	0.311***	0.309***	0.294***
	(0.0121)	(0.0175)	(0.0173)	(0.0339)
G_{ij} × Industry VA Growth	-0.127***	-0.141***	-0.145***	-0.172***
	(0.0486)	(0.0434)	(0.0411)	(0.0333)
G_{ij} × Firm Size	-0.000607	-0.00139	-0.00141	-0.0224***
	(0.00528)	(0.00530)	(0.00543)	(0.00818)
G_{ij} × Firm Risk	0.271***	0.267***	0.258***	0.213***
	(0.0380)	(0.0408)	(0.0404)	(0.0672)
G_{ij} × Bank Assets	0.000975	0.00371	0.00536	0.0168**
	(0.00660)	(0.00689)	(0.00696)	(0.00671)
G_{ij} × Bank Liquidity	0.000590***	0.000472*	0.000438*	0.000269
	(0.000222)	(0.000245)	(0.000238)	(0.000233)
G_{ij} × Bank Capital	0.352		0.251	0.235
	(0.265)		(0.351)	(0.373)
G_{ij} × Bank NPL		-0.241***	-0.327***	-0.162***
		(0.0482)	(0.0497)	(0.0446)
G_{ij} × Share of Granted				-0.0639*
				(0.0382)
G_{ij} × Drawn/Granted				-0.132***
				(0.0331)
G_{ij} × Residual Maturity				0.0728***
				(0.0103)
Firm FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Non-interacted variables	Yes	Yes	Yes	Yes
R^2	0.487	0.487	0.488	0.558
N	401214	401102	394269	385090

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Table 4. Substitution: Firm-bank level analysis, including single-bank firms

This table reports bank-firm level estimates of an equation whose dependent variable is the credit substitution s_{ij}, defined as the negative of the change in non-guaranteed credit granted by bank j to firm i between February 2020 and August 2020, divided by total initial credit granted by bank j to firm i in February 2020. The main regressor is a dummy G_{ij} equal to 1 if bank j gives a government guaranteed loan to firm i between March 2020 and August 2020, and 0 otherwise. Other regressors are: Industry VA Growth, defined as the industrial sector change in Valued Added in each country between February 2020 and August 2020; Firm Size, proxied by the log of firm total debt; Firm Risk, proxied by the share of loans in arrears out of total loans; Bank Assets, defined as the log of total bank assets; Bank Liquidity, defined as the bank Liquidity Coverage Ratio; Bank Capital, defined as the Core Tier 1 Ratio and Bank NPL, defined as the share of NPL loans out of its total loans; Share of granted, defined as the share of the bank j out of the total bank exposure of the firm i; Drawn/Granted, defined as the amount of credit drawn by firm i divided by the amount granted by bank j to firm i; Residual maturity, defined as the log of the number of remaining months until the expiration or the repayment of the credit by bank j to firm i. All the regressors, apart from G_{ij} and Industry VA Growth are calculated as of December 2019.In all the specifications we include also the non-interacted variables but we do not report the coefficients for convenience. Standard errors clustered at the bank level, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Dependent variable:	Credit substitution ($s_{i,j}$)			
	(1)	(2)	(3)	(4)
G_{ij}	0.304***	0.307***	0.294***	0.2875**
	(0.0141)	(0.0160)	(0.0159)	(0.0406)
G_{ij} × Industry VA Growth	-0.166**	-0.158**	-0.178***	-0.144**
	(0.0719)	(0.0781)	(0.0680)	(0.0580)
G_{ij} × Firm Size	-0.00831*	-0.00563	-0.00740*	-0.0246***
	(0.00460)	(0.00428)	(0.00443)	(0.00828)
G_{ij} × Firm Risk	0.353***	0.360***	0.347***	0.412***
	(0.0363)	(0.0403)	(0.0371)	(0.0456)
G_{ij} × Bank Assets	0.0054	0.000267	0.0098	0.0111
	(0.0117)	(0.0144)	(0.0110)	(0.00963)
G_{ij} × Bank Liquidity	0.000704***	0.000742***	0.000545***	0.000582***
	((0.000207)	(0.000247)	(0.000210)	(0.000197)
G_{ij} × Bank Capital	0.947**		1.123**	1.052**
	(0.471)		(0.484)	(0.487)
G_{ij} × Bank NPL		-0.167	-0.637	-0.861
		(0.474)	(0.572)	(0.558)
G_{ij} × Share of Granted				0.258***
				(0.0353)
G_{ij} × Drawn/Granted				-0.187***
				(0.0411)
G_{ij} × Residual Maturity				0.0823***
				(0.00995)
Industry-Location_Size FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Non-interacted variables	Yes	Yes	Yes	Yes
R^2	0.159	0.158	0.159	0.208
N	2489230	2497833	2449371	2026042

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Table 5. Characteristics of banks providing guaranteed loans

The table reports bank-firm level estimates of a regression whose dependent variable is a dummy G_{ij} equal to 1 if bank j gives a government guaranteed loan to firm i between March 2020 and August 2020, and 0 otherwise. The regressors are bank and firm characteristics. The bank variables are: Bank Assets, defined as the log of total bank assets; Bank Liquidity, defined as the bank Liquidity Coverage Ratio; Bank Capital, defined as the Core Tier 1 Ratio and Bank NPL, defined as the share of NPL loans out of total loans. The bank-firm variables are: Share of granted, defined as the share of the bank j out of the total bank exposure of the firm i; Drawn/Granted, defined as the amount of credit drawn by firm i divided by the amount granted by bank j to firm i; Residual Maturity is defined as the log of the number of remaining months until the expiration or the repayment of the credit by bank j to firm i. All the regressors, are calculated as of December 2019. Standard errors clustered at the bank level, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Dependent Variable:	Guaranteed Loan ($G_{i,j}$)					
	(1)	(2)	(3)	(4)	(5)	(6)
Bank Assets	0.0686***	0.0779**	0.0695***	0.0805***	0.0925***	0.0806***
	(0.0206)	(0.0307)	(0.0214)	(0.0204)	(0.0328)	(0.0212)
Bank Liquidity	0.0559	0.0371	0.0536	0.0742	0.0534	0.0739
	(0.0753)	(0.0885)	(0.0720)	(0.0701)	(0.0870)	(0.0677)
Bank Capital	0.331***		0.332***	0.407***		0.407***
	(0.0654)		(0.0640)	(0.0798)		(0.0780)
Bank NPL		-0.868	-0.616		-0.612	-0.0616
		(1.752)	(1.271)		(2.156)	(1.525)
Share of Granted	0.887***	0.914***	0.883***	0.636***	0.684***	0.635***
	(0.0460)	(0.0508)	(0.0473)	(0.0432)	(0.0496)	(0.0434)
Drawn/Granted	0.151*	0.121*	0.153**	0.151**	0.173***	0.151**
	(0.0800)	(0.0663)	(0.0780)	(0.0610)	(0.0540)	(0.0593)
Residual Maturity				0.114***	0.107***	0.114***
				(0.0185)	(0.0231)	(0.0184)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.447	0.418	0.447	0.493	0.453	0.493
N	452065	452065	452065	399002	399002	399002

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Table 6. Firm-bank level analysis of changes in interest rates

This table reports bank-firm level estimates of an equation whose dependent variable is the $\Delta InterestRate_{ij}$ charged by bank j to firm i between February 2020 and August 2020. The main regressor is a dummy G_{ij} equal to 1 if bank j gives a government guaranteed loan to firm i between March 2020 and August 2020, and 0 otherwise. Other regressors are: Industry VA Growth, defined as the industrial sector change in Valued Added in each country between February 2020 and August 2020; Firm Size, proxied by the log of firm total debt; Firm Risk, proxied by the share of loans in arrears out of total loans; Bank Assets, defined as the log of total bank assets; Bank Liquidity, defined as the bank Liquidity Coverage Ratio; Bank Capital, defined as the Core Tier 1 Ratio and Bank NPL, defined as the share of NPL loans out of its total loans; Share of granted, defined as the share of the bank j out of the total bank exposure of the firm i; Drawn/Granted, defined as the amount of credit drawn by firm i divided by the amount granted by bank j to firm i; Residual maturity, defined as the log of the number of remaining months until the expiration or the repayment of the credit by bank j to firm i. All the regressors, apart from G_{ij} and Industry VA Growth are calculated as of December 2019. In all the specifications we include also the non-interacted variables but we do not report the coefficients for convenience. Standard errors clustered at the bank level, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Dependent variable:	$\Delta InterestRate_{ij}$				
	(1)	(2)	(3)	(4)	(5)
G_{ij}	-0.00277***	-0.00243***	-0.00251***	-0.00215**	-0.00737***
	(0.000277)	(0.000414)	(0.000396)	(0.00103)	(0.00140)
G_{ij} × Industry VA Growth	0.00101	0.00130*	0.00132*	0.00150**	0.00163***
	(0.000710)	(0.000695)	(0.000672)	(0.000666)	(0.000658)
G_{ij} × Firm Size	0.000622***	0.000627***	0.000626***	0.000282	0.000240*
	(0.000149)	(0.000147)	(0.000151)	(0.000213)	(0.000143)
G_{ij} × Firm Risk	-0.00380***	-0.00396***	-0.00398***	-0.00515	-0.00169
	(0.00134)	(0.00127)	(0.00134)	(0.00428)	(0.00114)
G_{ij} × Bank Assets	0.000058	0.000169*	0.000145	0.000208*	0.000137
	(0.000099)	(0.000102)	(0.000101)	(0.000116)	(0.000144)
G_{ij} × Bank Liquidity	0.000005	0.000001	0.000003	0.000004	0.000003
	(0.000004)	(0.000005)	(0.000004)	(0.000004)	(0.000002)
G_{ij} × Bank Capital	0.00529		0.00524	0.0128**	0.0373***
	(0.00636)		(0.00639)	(0.00548)	(0.00786)
G_{ij} × Bank NPL		-0.0120	-0.0111	-0.0128	-0.0114
		(0.00839)	(0.00858)	(0.00850)	(0.00944)
G_{ij} × Share of Granted				-0.00397***	-0.00352***
				(0.00152)	(0.00115)
G_{ij} × Drawn/Granted				0.000001	0.000001
				(0.000001)	(0.000001)
G_{ij} × Residual Maturity				-0.000168	-0.00116***
				(0.000281)	(0.000148)
G_{ij} × Interest Rate					-0.244***
					(0.0337)
Firm FE	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
Non-interacted variables	Yes	Yes	Yes	Yes	Yes
R^2	0.405	0.405	0.406	0.413	0.732
N	463894	464112	454008	449568	449568

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Table 7. Firm-bank level analysis of changes in loan maturities

This table reports bank-firm level estimates of an equation whose dependent variable is the $\Delta Maturity_{ij}$ in the bank-firm relationship between bank j and firm i between February 2020 and August 2020. The main regressor is a dummy G_{ij} equal to 1 if bank j gives a government guaranteed loan to firm i between March 2020 and August 2020, and 0 otherwise. Other regressors are: Industry VA Growth, defined as the industrial sector change in Valued Added in each country between February 2020 and August 2020; Firm Size, proxied by the log of firm total debt; Firm Risk, proxied by the share of loans in arrears out of total loans; Bank Assets, defined as the log of total bank assets; Bank Liquidity, defined as the bank Liquidity Coverage Ratio; Bank Capital, defined as the Core Tier 1 Ratio and Bank NPL, defined as the share of NPL loans out of its total loans; Share of granted, defined as the share of the bank j out of the total bank exposure of the firm i; Drawn/Granted, defined as the amount of credit drawn by firm i divided by the amount granted by bank j to firm i; Residual maturity, defined as the log of the number of remaining months until the expiration or the repayment of the credit by bank j to firm i. All the regressors, apart from G_{ij} and Industry VA Growth are calculated as of December 2019. In all the specifications we include also the non-interacted variables but we do not report the coefficients for convenience. Standard errors clustered at the bank level, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Dependent variable:	$\Delta Maturity_{ij}$			
	(1)	(2)	(3)	(4)
G_{ij}	19.49***	19.50***	19.28***	18.48***
	(1.043)	(1.677)	(1.689)	(4.448)
G_{ij} × Industry VA Growth	-6.503	-7.515	-6.669	-2.501
	(5.434)	(5.670)	(5.453)	(5.849)
G_{ij} × Firm Size	-3.444***	-3.366***	-3.431***	-4.443***
	(0.276)	(0.276)	(0.274)	(0.448)
G_{ij} × Firm Risk	17.65***	17.79***	17.95***	10.07**
	(1.679)	(1.571)	(1.633)	(4.562)
G_{ij} × Bank Assets	0.428	0.539	0.445	1.313**
	(0.628)	(0.610)	(0.645)	(0.589)
G_{ij} × Bank Liquidity	0.00805	0.00763	0.00885	0.0267**
	(0.0141)	(0.0163)	(0.0170)	(0.0120)
G_{ij} × Bank Capital	-66.24**		-69.45***	-58.64***
	(25.86)		(26.73)	(26.54)
G_{ij} × Bank NPL		16.95	9.624	3.576
		(39.67)	(40.49)	(32.05)
G_{ij} × Share of Granted				-22.36***
				(4.465)
G_{ij} × Drawn/Granted				-0.00752***
				(0.00186)
G_{ij} × Residual Maturity				2.635**
				(1.120)
Firm FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Non-interacted variables	Yes	Yes	Yes	Yes
R^2	0.371	0.371	0.371	0.390
N	463894	464112	454008	449568

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Table 8. Credit substitution: Firm-level analysis

The table reports firm-level estimates of a regression whose dependent variable is the credit substitution s_i, defined as the negative of the change in non-guaranteed credit received by firm i between February 2020 and August 2020, divided by its total credit as of February 2020. The variable Guarantee is defined as the amount of the government guaranteed loan received by the firm, divided by total credit in February 2020. Other regressors are: Industry VA Growth, defined as the industrial sector change in Valued Added in each country between February 2020 and August 2020; Firm Size, proxied by the log of firm total debt; Firm Risk, proxied by the share of loans in arrears out of total loans; Bank Assets, defined as the log of total bank assets; Bank Liquidity, defined as the bank Liquidity Coverage Ratio; Bank Capital, defined as the Core Tier 1 Ratio and Bank NPL, defined as the share of NPL loans out of its total loans. Each of the bank related variables is calculated as a weighted average of the corresponding bank-level variable, where the weights are the shares of the banks' exposure toward the firm out of total bank exposure of the firm at December 2019. All the regressors, apart from Guarantee and Industry VA Growth are calculated as of December 2019. In all the specifications we include also the non-interacted variables but we do not report the coefficients for convenience. Standard errors clustered at the main bank level, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Dependent Variable:	Substitution (s_i)			
	(1)	(2)	(3)	(4)
Guarantee	0.108***	0.137***	0.102***	0.128**
	(0.0241)	(0.0149)	(0.0153)	(0.0150)
Guarantee × Industry VA Growth	-0.0659***	-0.0901***	-0.0908***	-0.0910***
	(0.0263)	(0.0227)	(0.0222)	(0.0212)
Guarantee × Firm Size	-0.0611***	-0.0981***	-0.0768***	-0.0651***
	(0.00514)	(0.00635)	(0.00580)	(0.00626)
Guarantee × Firm Risk	0.171***	0.180***	0.189***	0.163***
	(0.0306)	(0.0312)	(0.0309)	(0.0312)
Guarantee × Bank Assets		0.0355***	0.0192*	0.0354***
		(0.00956)	(0.00996)	(0.00923)
Guarantee × Bank Liquidity		0.0730**	0.0946**	0.0588*
		(0.0325)	(0.0436)	(0.0330)
Guarantee × Bank Capital		0.161***		0173***
		(0.0577)		(0.0549)
Guarantee × Bank NPL			-0.141*	-0.166**
			(0.0778)	(0.0645)
Country FE	Yes	Yes	Yes	Yes
Non-interacted variables	Yes	Yes	Yes	Yes
R^2	0.0661	0.0864	0.0737	0.0885
N	472206	427911	427691	426636

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Appendix

Table A1. Institutional details about loan guarantee programs in the euro area

	Size of the programme	Beneficiaries	Share of loan guaranteed	Maximum amount per borrower	Maturity	End of programme	*Lending rates*
Germany	€365 bn (Kreditanstalt für Wiederaufbau – "KfW")	Firms and sole proprietors	• **100%** for firms with more than 10 employees under the KfW-Schnellkredit programme • **90%** for SMEs and sole proprietors • **80%** for large firms	€1 bn, and in any case not above: (i) 25% of revenues in 2019 or (ii) twice the wage bill in 2019; or €0.5 (0.8) bn for firms with more than 10(50) employees under the KfW-Schnellkredit programme	up to 10 years	31 December 2020	> 1% and <1.46% for SMEs > 2% and <2.12% for large firms. Uniform 3% of interest margin for Schnellkredit programme
	€400 bn (Wirtschaftsstabilisierungs fonds "WSF" - Economic Stabilisation Fund)	Firms with at least two of the following conditions: turnover above €43 million, sales above €50 million, more than 249 employees	Scheme approved by the EC (individual Lufthansa plan approved by the EC on 25 June 2020, including €3 bn guaranteed loan provided by KfW)		up to 5 years	31 December 2020	
France	€300 bn (Ministry of Economy and Finance, via Bpifrance Financement SA)	Firms and sole proprietors	• **90%** of the loan to firms with less than 5,000 employees and EUR 1.5 billion turnover; • **80%** of the loan to firms with more than 5,000 employees and less than EUR 5.0 billion turnover; • **70%** of the loan to firms with more than 5,000 employees and more than EUR 5.0 billion turnover;	The maximum guaranteed amount for each SME is €5 million. Not above 25% of revenues in 2019	up to 5 years	31 December 2020	Banks have to grant guaranteed loans "at cost". The rate for the borrower is the so-called resource rate of the bank, currently close to 0% for the first year, plus the guarantee premium.
Italy	€100 bn (Central Guarantee Fund)	Firms with < 500 employees and sole proprietors	• 100% for loans up to €30000 • 90% for loans > €30000 and < €5 million • up to 100% for loans between €30000 and €800000 requested by firms with turnover up to €3.2 million	Not above: (i) 25% of revenues in 2019 or (ii) twice the wage bill in 2019	up to 10 years	31 December 2020	For loans <€30000: The interest rate cannot exceed the Rendistato index plus 20 bps For loans >€30000: bank-client agreement
	€200 bn (SACE Guarantee)	Firms with more than 499 employees, but also smaller firms and sole proprietors that have already fully benefitted from Fondo di Garanzia	• 90% for firms with < 5000 employees and €1.5 bn turnover • 80% for firms with > 5000 employees or turnover between €1.5 bn and €5 bn • 70% for firms with turnover above €5 bn	Not above: (i) 25% of revenues in 2019 or (ii) twice the wage bill in 2019	up to 6 years	31 December 2020	Must be lower than the cost requested with the same characteristics but without the guarantee.
Spain	€140 bn (Instituto de Crédito Oficial - ICO)	Firms and sole proprietors	• **80%** of new loans and *renewals* of transactions requested by the self-employed and SMEs. • For other companies, the guarantee will cover **70%** of the new loan granted • and **60%** of the *renewals*	Not above: (i) 25% of revenues in 2019 or (ii) twice the wage bill in 2019	up to 8 years	1 December 2020	Banks have to ensure that the cost for the borrower is in line with that charged before the COVID-19 crisis.

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Table A2. Which firms received guaranteed loans? Were eligibility rules respected?

This table reports firm-level estimates of an equation in which the dependent variable is a dummy G_i equal to 1 if firm i receives a government guaranteed loan between March 2020 and August 2020, and 0 otherwise. The regressors are: Industry VA Growth, defined as the percentage change in Valued Added in the relevant industrial sector in each country between February 2020 and August 2020; Firm Size, proxied by the log of firm total debt; Firm Risk, proxied by the share of loans in arrears out of total loans. All the regressors, apart from Industry VA Growth are calculated as of December 2019. Standard errors, clustered at the main bank level, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Dependent Variable:	G_i	
	(1)	(2)
Industry VA Growth	-3.982***	-2.840***
	(0.165)	(0.279)
Firm Size	-0.0330***	-0.0391**
	(0.0124)	(0.0189)
Firm Risk	-1.277***	-1.639***
	(0.153)	(0.130)
Country FE	No	Yes
R^2	0.129	0.226
N	2585334	2585334

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Table A3. Credit substitution: firm-bank descriptive statistics

This table reports bank-firm level descriptive statistics of the variable $y_{i,j}$, defined as the change in non-guaranteed credit granted by bank j to firm i between February 2020 and August 2020, divided by total initial credit granted by bank j to firm i in February 2020. We report the average value of $y_{i,j}$ for different values of the dummy G which is equal to 1 if bank j gives a government guaranteed loan to firm i between March 2020 and August 2020, and 0 otherwise. We consider only firms which receive a government guaranteed loan and that have multiple bank relationships.

	G_{ij}	$y_{i,j}$	Number of observations
Four largest Euro Area countries	0	-0.038	240,310
	1	-0.361	223,068
Germany	0	-0.020	4,967
	1	-0.080	2,213
Spain	0	-0.002	98,006
	1	-0.448	127,234
France	0	-0.005	5,914
	1	-0.089	7,891
Italy	0	-0.068	131,423
	1	-0.266	85,730

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Table A4. Credit substitution: firm-bank level analysis, by country

This table reports bank-firm level estimates of an equation in which the dependent variable is the change in non-guaranteed credit between February 2020 and August 2020 from bank j to firm i, divided by total credit from bank j to firm i in February 2020 (multiplied by -1), as a function of a dummy equal to 1 if bank j gives a government guaranteed loan to firm i between March 2020 and August 2020. Other regressors are: Industry VA Growth, defined as the industrial sector change in Valued Added in each country between February 2020 and August 2020; Firm Size, proxied by the log of firm total debt; Firm Risk, proxied by the share of loans in arrears out of total loans; Bank Assets, defined as the log of total bank assets; Bank Liquidity, defined as the bank Liquidity Coverage Ratio; Bank Capital, defined as the Core Tier 1 Ratio and Bank NPL, defined as the share of NPL loans out of total loans; Share of granted, defined as the share of the bank j out of the total bank exposure of firm i; Drawn/Granted, defined as the amount of credit drawn by firm i divided by the amount granted by bank j to firm i; Residual Maturity is defined as the log of the number of remaining months until the expiration or the repayment of the credit by bank j to firm i. All the regressors (except G_{ij} and Industry VA Growth) are calculated as of December 2019. In all the specifications we include also the non-interacted variables but we do not report the coefficients for convenience. Standard errors clustered at the bank level, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Dependent variable:	Credit Substitution ($s_{i,j}$)			
	Germany	Spain	France	Italy
	(1)	(2)	(3)	(4)
G_{ij}	0.295***	0.612***	0.153***	0.215**
	(0.113)	(0.129)	(0.0187)	(0.0393)
G_{ij} × Industry VA Growth	-0.131	-0.219***	-0.236**	-0.0623
	(0.218)	(0.0226)	(0.0961)	(0.0491)
G_{ij} × Firm Size	-0.0231**	-0.0478***	-0.0242***	-0.00258
	(0.0104)	(0.00513)	(0.00750)	(0.00529)
G_{ij} × Firm Risk	0.856*	0.0836	0.0241	0.273***
	(0.462)	(0.111)	(0.112)	(0.0745)
G_{ij} × Bank Assets	0.0212	0.0323	0.0111	0.00311
	(0.0193)	(0.0207)	(0.0808)	(0.0187)
G_{ij} × Bank Liquidity	0.0573	0.0977***	0.102	0.0471
	(0.502)	(0.000340)	(0.127)	(0.0567)
G_{ij} × Bank Capital	0.821	0.287**	0.257	0.0971
	(0.814)	(0.030)	(0.455)	(0.317)
G_{ij} × Bank NPL	-0.140	-0.171	-0.164***	-0.158***
	(0.120)	(0.1443)	(0.0651)	(0.0426)
G_{ij} × Share of Granted	-0.233*	-0.0443	-0.110	-0.00170
	(0.127)	(0.0697)	(0.110)	(0.0275)
G_{ij} × Drawn/Granted	-0.128**	-0.0746*	-0.277***	-0.0885**
	(0.0501)	(0.0400)	(0.0836)	(0.0361)
G_{ij} × Residual Maturity	0.0216	0.139***	0.00275	0.0594***
	(0.0200)	(0.0327)	(0.0156)	(0.00652)
Firm FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Non-interacted variables	Yes	Yes	Yes	Yes
R^2	0.548	0.550	0.614	0.552
N	9186	203306	17288	231137

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Table A5. Credit substitution: firm-level analysis, by country

The table reports firm-level estimates of a regression whose dependent variable is the credit substitution s_i, defined as the negative of the change in non-guaranteed credit received by firm i between February 2020 and August 2020, divided by its total credit as of February 2020. The variable Guarantee is defined as the amount of the government guaranteed loan received by the firm, divided by total credit in February 2020. Other regressors are: Industry VA Growth, defined as the industrial sector change in Valued Added in each country between February 2020 and August 2020; Firm Size, proxied by the log of firm total debt; Firm Risk, proxied by the share of loans in arrears out of total loans; Bank Assets, defined as the log of total bank assets; Bank Liquidity, defined as the bank Liquidity Coverage Ratio; Bank Capital, defined as the Core Tier 1 Ratio and Bank NPL, defined as the share of NPL loans out of its total loans. Each of the bank related variables is calculated as a weighted average of the corresponding bank-level variable, where the weights are the shares of the banks' exposure toward the firm out of total bank exposure of the firm at December 2019. All the regressors, apart from Guarantee and Industry VA Growth are calculated as of December 2019. In all the specifications we include also the non-interacted variables but we do not report the coefficients for convenience. Standard errors clustered at the main bank level, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Dependent Variable:	Credit Substitution (s_i)			
	Germany	Spain	France	Italy
	(1)	(2)	(3)	(4)
Guarantee	0.196***	0.238***	0.0753***	0.109***
	(0.0674)	(0.0497)	(0.0146)	(0.0405)
Guarantee × Industry VA Growth	-0.103	-0.196***	-0.225***	-0.192***
	(0.145)	(0.0499)	(0.0538)	(0.0429)
Guarantee × Firm Size	-0.00452	-0.0125*	-0.0380***	-0.0258***
	(0.00772)	(0.00712)	(0.00807)	(0.00492)
Guarantee × Firm Risk	0.163	0.288***	0.0962***	0.107*
	(0.246)	(0.0319)	(0.0346)	(0.0585)
Guarantee × Bank Assets	0.0195***	0.0408	0.00836***	0.0586***
	(0.00459)	(0.0293)	(0.00303)	(0.0152)
Guarantee × Bank Liquidity	0.0559***	0.0716	0.0417	0.246***
	(0.0155)	(0.0571)	(0.0278)	(0.0474)
Guarantee × Bank Capital	0.463	0.304***	0.0793	0.262***
	(0.417)	(0.0963)	(0.164)	(0.0758)
Guarantee × Bank NPL	-0.349*	-0.0697*	-0.514	-0.868***
	(0.181)	(0.0370)	(0.659)	(0.0780)
Non-interacted variables	Yes	Yes	Yes	Yes
R^2	0.0298	0.0918	0.0336	0.0514
N	7569	156629	70057	192381

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Table A6. Credit substitution: firm-level analysis, considering actual guaranteed amount instead of total guaranteed loan

The table reports firm-level estimates of a regression whose dependent variable is the credit substitution s_i, defined as the negative of the change in non-guaranteed credit received by firm i between February 2020 and August 2020, divided by its total credit as of February 2020. The variable GuarAmount is defined as the government guaranteed loan received by the firm multiplied by the percentage of government guarantee, divided by total credit in February 2020. Other regressors are: Industry VA Growth, defined as the industrial sector change in Valued Added in each country between February 2020 and August 2020; Firm Size, proxied by the log of firm total debt; Firm Risk, proxied by the share of loans in arrears out of total loans; Bank Assets, defined as the log of total bank assets; Bank Liquidity, defined as the bank Liquidity Coverage Ratio; Bank Capital, defined as the Core Tier 1 Ratio and Bank NPL, defined as the share of NPL loans out of its total loans. Each of the bank related variables is calculated as a weighted average of the corresponding bank-level variable, where the weights are the shares of the banks' exposure toward the firm out of total bank exposure of the firm at December 2019. All the regressors, apart from GuarAmount and Industry VA Growth are calculated as of December 2019. In all the specifications we include also the non-interacted variables but we do not report the coefficients for convenience. Standard errors clustered at the main bank level, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Dependent Variable:	Credit Substitution (s_i)			
	(1)	(2)	(3)	(4)
GuarAmount	0.337***	0.304***	0.291***	0.295***
	(0.0303)	(0.0238)	(0.0258)	(0.0255)
GuarAmount × Industry VA Growth	-0.178***	-0.132*	-0.151*	-0.143*
	(0.0688)	(0.0776)	(0.0818)	(0.0793)
GuarAmount × Firm Size	-0.161***	-0.161***	-0.159***	-0.159***
	(0.0135)	(0.0123)	(0.0140)	(0.0125)
GuarAmount × Firm Risk	0.101	0.186***	0.189***	0.192*
	(0.0677)	(0.0698)	(0.0680)	(0.0995)
GuarAmount × Bank Assets		0.0607***	0.0524***	0.0646***
		(0.0120)	(0.0133)	(0.0117)
GuarAmount × Bank Liquidity		0.000533**	0.000600**	0.000652**
		(0.000251)	(0.000256)	(0.000259)
GuarAmunt × Bank Capital		0.578***		0.469***
		(0.183)		(0.192)
GuarAmount × Bank NPL			-0.344***	-0.335***
			(0.105)	(0.149)
Country FE	Yes	Yes	Yes	Yes
Non-interacted variables	Yes	Yes	Yes	Yes
R^2	0.0756	0.0762	0.0760	0.0763
N	452354	410415	414211	411668

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Table A7. Descriptive statistics - Germany

Variable	Obs	Mean	Std. Dev.	p25	p50	p75
Panel A: Firm level Statistics for Full Sample						
G_i	252763	.0334938	.1799225	0	0	0
Industry VA Growth	252763	-.1723949	.0797266	-.2661097	-.1771516	-.1547713
Firm Size	252763	.8775824	1.643657	.0681629	.2021068	.8025328
Firm Size (ln)	252763	-1.388775	1.59761	-2.685854	-1.598959	-.2199826
Firm Risk	252763	.0213029	.1296524	0	0	0
Bank Assets (ln)	252763	9.443304	1.787251	8.135693	8.907613	10.40325
Bank Liquidity	252763	1.856293	.6667611	1.422	1.640416	1.98
Bank Capital	252763	.158222	.036538	.13405	.1487321	.1702026
Bank NPL	252763	.0152443	.0084284	.0096545	.0132664	.0188115
Panel B: Firm level Statistics for Sample of Firms Receiving a Guaranteed Loan						
y_i	7569	.0294492	.3780803	-.0978405	-.0262189	.0287692
Guarantee	7569	.8268862	.7054036	.3033639	.5978996	1.142409
GuarAmount	7569	.702853	1.164165	.257859	.508215	.971048
Industry VA Growth	7569	-.2026501	.0671072	-.2661097	-.1771516	-.1717442
Firm risk	7569	.0062343	.0465336	0	0	0
Firm Size (ln)	7569	-.7729988	1.421277	-1.82136	-.8665873	.2922885
Bank Assets (ln)	7569	9.608208	1.728739	8.260328	9.112977	10.74894
Bank Liquidity	7569	1.831977	.5921204	1.450858	1.65606	1.96
Bank Capital	7569	.1571572	.0307537	.1366	.1509183	.1716056
Bank NPL	7569	.0151103	.007928	.009443	.0135438	.0186106
Panel C: Bank-Firm-Level Statistics for Sample of Firms with Multiple Bank Relationships Receiving a Guaranteed Loan						
y_{ij}	7180	-.0546116	.3026088	-.1257962	-.0371246	.0000536
G_{ij}	7180	.3082173	.461789	0	0	1
Industry VA Growth	7180	-.2017557	.0671072	-.2661097	-.1771516	-.1717442
Firm Size	7180	4.438901	7.466265	.4552568	1.44547	4.725804
Firm Size (ln)	7180	.3975731	1.550213	-.7868945	.3684348	1.553038
Firm Risk	7180	.0066486	.0429471	0	0	0
Bank Assets (ln)	7180	9.835563	2.039088	8.22227	9.239208	10.74894
Bank Liquidity	7180	1.858152	.8052462	1.3842	1.56	1.854
Bank Capital	7180	.1581544	.0458491	.13405	.1443	.1653
Bank NPL	6870	.0152644	.0101312	.0082218	.0120831	.0192994
Share of Granted$_{ij}$	7180	.3155976	.2941007	.0699746	.2050615	.5192737
Drawn/Granted$_{ij}$	7104	.739222	.3292369	.5811453	.8893858	1
Residual Maturity (ln)	5828	3.341155	1.236191	2.968	3.614558	4.044233
Panel D: Loan-Level Statistics for Guaranteed Loans						
Interest Rate	6973	.013573	.007186	.0100	.0103	.0146
Maturity (ln)	6063	4.154056	.5404104	4.074142	4.074142	4.55738

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Table A8. Descriptive statistics - Spain

Variable	Obs	Mean	Std. Dev.	p25	p50	p75
Panel A: Firm level Statistics for Full Sample						
G_i	375621	.4418177	.4966039	0	0	1
Industry VA Growth	375621	-.2969653	.163576	-.4681712	-.3217703	-.2464528
Firm Size	375621	.4586029	1.04863	.058948	.131419	.353341
Firm Size (ln)	375621	-1.83766	1.343044	-2.8311	-2.029365	-1.040322
Firm Risk	375621	.0809921	.2491405	0	0	0
Bank Assets (ln)	375621	12.30366	.9762803	12.09178	12.60875	12.92058
Bank Liquidity	375621	1.75237	.4387194	1.468671	1.715151	1.79208
Bank Capital	375621	.150723	.0189058	.1376	.1465739	.1642
Bank NPL	375621	.0355724	.0061506	.032242	.0376693	.0385449
Panel B: Firm level Statistics for Sample of Firms Receiving a Guaranteed Loan						
y_i	156629	-.2466819	.4467807	-.5034692	-.210755	-.0444445
Guarantee	156629	.8387386	.6296211	.3636584	.6846501	1.139307
GuarAmount	156629	.645829	.752324	.280017	.527181	.877266
Industry VA Growth	156629	-.3287885	.1531424	-.4681712	-.3217703	-.2464528
Firm risk	156629	.0060816	.0374007	0	0	0
Firm Size (ln)	156629	-1.650195	1.334841	-2.697099	-1.825848	-.787814
Bank Assets (ln)	156629	12.45248	.8059398	12.09178	12.60875	12.92058
Bank Liquidity	156629	1.694113	.3661199	1.468671	1.655102	1.79208
Bank Capital	156629	.1533933	.0164927	.1408	.1528847	.1642
Bank NPL	156629	.0363205	.0053262	.0337309	.0376693	.0385449
Panel C: Bank-Firm-Level Statistics for Sample of Firms with Multiple Bank Relationships Receiving a Guaranteed Loan						
y_{ij}	225240	-.2523438	.46773	-.5872993	-.1731535	-.0049942
G_{ij}	225240	.5648819	.4957736	0	1	1
Industry VA Growth	225240	-.333356	.1450901	-.4681712	-.3217703	-.2464528
Firm Size	225240	2.191604	4.936068	.255182	.635966	1.807278
Firm Size (ln)	225240	-.316911	1.404574	-1.365778	-.4526102	.5918216
Firm Risk	225240	.006571	.032135	0	0	.0000686
Bank Assets (ln)	225240	12.17307	1.133703	11.31643	12.60875	12.92058
Bank Liquidity	225240	1.755414	.476793	1.468671	1.715151	1.79208
Bank Capital	225240	.1477338	.0217962	.1376	.1408	.1642
Bank NPL	224823	.0353647	.0069246	.032242	.0378145	.0385449
Share of Granted$_{ij}$	225240	.2904998	.2216841	.1098441	.2320705	.4279795
Drawn/Granted$_{ij}$	225225	.8061504	.2752201	.7066761	.9487358	1
Residual Maturity (ln)	220844	3.346354	1.093645	3.162481	3.652388	3.936499
Panel D: Loan-Level Statistics for Guaranteed Loans						
Interest Rate	181415	.022483	.008102	.0151	.0202	.0278
Maturity (ln)	196841	3.904012	.2882294	3.814977	4.025947	4.041881

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Table A9. Descriptive statistics - France

Variable	Obs	Mean	Std. Dev.	p25	p50	p75
Panel A: Firm level Statistics for Full Sample						
G_i	684494	.1161267	.320377	0	0	0
Industry VA Growth	684494	-.1197729	.1209537	-.2132464	-.0381242	-.0381242
Firm Size	684494	.3349425	.7107675	.0714347	.1494142	.3147322
Firm Size (ln)	684494	-1.844603	1.15251	-2.638971	-1.901033	-1.156033
Firm Risk	684494	.0185658	.1160795	0	0	0
Bank Assets (ln)	684494	11.28889	1.924782	9.846801	10.24894	13.30939
Bank Liquidity	684494	1.380974	.0894697	1.374791	1.374791	1.374791
Bank Capital	684494	.1823708	.0410711	.1611	.1817674	.213
Bank NPL	684494	.0233848	.0071877	.0190077	.0228226	.0278255
Panel B: Firm level Statistics for Sample of Firms Receiving a Guaranteed Loan						
y_i	70057	.0166524	.3779251	-.0983517	-.0219887	.0001161
Guarantee	70057	.8515676	.7060015	.3124042	.628859	1.190626
GuarAmount	70057	.698285	1.057002	.256171	.515664	.976313
Industry VA Growth	70057	-.2406818	.0978567	-.2799991	-.2799991	-.1771614
Firm risk	70057	.007501	.056014	0	0	0
Firm Size (ln)	70057	-1.983821	1.17061	-2.892727	-2.162197	-1.285001
Bank Assets (ln)	70057	11.72877	2.05215	9.953729	10.64365	13.7904
Bank Liquidity	70057	1.368989	.0915093	1.252571	1.374791	1.374791
Bank Capital	70057	.1753219	.040206	.1282192	.1728	.2058538
Bank NPL	70057	.024303	.0069923	.019403	.024107	.0324722
Panel C: Bank-Firm-Level Statistics for Sample of Firms with Multiple Bank Relationships Receiving a Guaranteed Loan						
y_{ij}	13805	-.0528667	.3597715	-.1342179	-.0214879	0.000000
G_{ij}	13805	.5716045	.4948642	0	1	1
Industry VA Growth	13805	-.2250968	.0973038	-.2799991	-.279991	-.1771614
Firm Size	13805	2.289138	5.526091	.2065514	.516942	1.624874
Firm Size (ln)	13805	-.4528852	1.494116	-1.577206	-.6598246	.4854306
Firm Risk	13805	.0153264	.0709034	0	0	0
Bank Assets (ln)	13805	11.7303	2.068436	9.972784	11.02524	14.46817
Bank Liquidity	13805	1.373128	.1064993	1.252571	1.374791	1.374791
Bank Capital	13805	.1593656	.0460885	.1223	.1649	.1949
Bank NPL	13805	.026805	.0106861	.0194926	.024107	.0324722
Share of Granted$_{ij}$	13805	.3885271	.2728432	.1563274	.3440479	.5884315
Drawn/Granted$_{ij}$	13797	.857278	.2434742	.8039736	1	1
Residual Maturity (ln)	13228	2.863787	1.086195	2.22282	2.926998	3.630618
Panel D: Loan-Level Statistics for Guaranteed Loans						
Interest Rate	96482	.004689	.007796	.000	.000	.008
Maturity (ln)	99677	2.533774	.7548663	2.0836	2.167147	2.538974

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Table A10. Descriptive statistics - Italy

Variable	Obs	Mean	Std. Dev.	p25	p50	p75
Panel A: Firm level Statistics for Full Sample						
G_i	540786	.3744032	.4839689	0	0	1
Industry VA Growth	540786	-.2302419	.084342	-.2965012	-.2498426	-.212043
Firm Size	540786	.5462619	1.157741	.054727	.147751	.46073
Firm Size (ln)	540786	-1.8341	1.657658	-2.905398	-1.912227	-.7749431
Firm Risk	540786	.1191722	.3041008	0	0	.0002384
Bank Assets (ln)	540786	11.67339	1.591469	11.14689	12.00496	12.93476
Bank Liquidity	540786	1.663658	.4699299	1.324652	1.524408	1.656271
Bank Capital	540786	.1522374	.0351854	.12093	.14192	.16791
Bank NPL	540786	.07239	.0210451	.0611005	.0643629	.084597
Panel B: Firm level Statistics for Sample of Firms Receiving a Guaranteed Loan						
y_i	192381	-.179156	.408887	-.3506369	-.0737196	0
Guarantee	192381	.421235	.4469445	.120829	.2818322	.5758379
GuarAmount	192381	.379112	.636945	.108746	.253649	.518254
Industry VA Growth	192381	-.2452776	.0727322	-.2965012	-.2694259	-.2498426
Firm risk	192381	.0138388	.0954151	0	0	0
Firm Size (ln)	192381	-1.82296	1.532356	-2.899641	-1.965085	-.865928
Bank Assets (ln)	192381	11.77314	1.465838	11.24238	12.00496	12.93476
Bank Liquidity	192381	1.656124	.4491092	1.324652	1.524408	1.656271
Bank Capital	192381	.1562764	.0342632	.132	.1471	.1735922
Bank NPL	192381	.0713465	.0190964	.0611005	.065682	.0823266
Panel C: Bank-Firm-Level Statistics for Sample of Firms with Multiple Bank Relationships Receiving a Guaranteed Loan						
y_{ij}	217153	-.1458202	.36705	-.2499992	-.0152744	0.000000
G_{ij}	217153	.3947908	.4888068	0	0	1
Industry VA Growth	217153	-.2503433	.063021	-.2965012	-.2498426	-.2498426
Firm Size	217153	2.647283	5.374904	.259999	.711619	2.353162
Firm Size (ln)	217153	-.2049241	1.532004	-1.347077	-.3402126	.85576
Firm Risk	217153	.0146889	.0946387	0	0	.000094
Bank Assets (ln)	217153	11.44297	1.74098	10.57639	11.74067	12.93476
Bank Liquidity	217153	1.689311	.5021324	1.324652	1.563804	1.656271
Bank Capital	217153	.1542888	.0365633	.11874	.14192	.16791
Bank NPL	210494	.0708171	.0224744	.0546911	.0628809	.084597
Share of Granted$_{ij}$	217153	.3165832	.2385714	.1228859	.2599145	.467759
Drawn/Granted$_{ij}$	216182	.7727057	.2697362	.6148636	.8830958	1
Residual Maturity (ln)	183202	2.569453	1.817286	1.955389	3.067037	3.748751
Panel D: Loan-Level Statistics for Guaranteed Loans						
Interest Rate	219979	.018538	.010776	.012	.015	.023891
Maturity (ln)	209917	3.717016	.9932165	3.507674	4.10006	4.248019

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