Banks vs. Firms: Who Benefits from Credit Guarantees?

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Abstract

Many countries implemented large-scale programs to guarantee private credit in response to the outbreak of COVID-19. Yet the role of banks in allocating guarantees – and thus in shaping their effects – is not well understood. We study this role in an economy where entrepreneurial effort is crucial for efficiency but it is not contractible, giving rise to a debt overhang problem. In such an environment, credit guarantees increase efficiency to the extent that they allow firms to reduce their repayment obligations. We show that banks follow a pecking order when allocating guarantees, prioritizing riskier, highly indebted, firms, from whom they can extract more surplus. The competitive equilibrium is constrained inefficient: all else equal, the planner would tilt the allocation of guarantees towards more productive, safer firms, and would fully pass-through the benefits of guarantees to firms in the form of lower repayments. We confirm the model's main predictions on the universe of all credit guarantees granted in Spain following the outbreak of COVID.

JEL Codes:

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1 Introduction

The outbreak of COVID-19 in 2020, and the economic disruptions that it entailed, led to some of the largest policy interventions in recent decades. Authorities resorted to fiscal, monetary and financial measures to mitigate the economic fallout of the pandemic on firms and households. In the euro area, some of the largest interventions were in the form of public programs to support and guarantee private credit. By April 2020, for instance, the three largest economies in the currency union – Germany, France, and Italy – had respectively announced plans to publicly guarantee up to €820 billion, €300 billion, and €750 billion of private credit. A common feature of these plans is that they relied heavily on private banks to allocate guarantees across borrowers.

The adoption of such major guarantee schemes raises many questions. First, what are the incentives of banks in allocating guarantees? Second, how is the surplus generated by guarantees divided between banks and the firms that receive them? And third, is the allocation of guarantees chosen by banks socially efficient? In this paper, we develop a model to address these questions and test its main predictions on the universe of all credit guarantees granted in Spain in the year following the outbreak of COVID.

We study a canonical economy populated by entrepreneurs and banks. Entrepreneurs operate projects with heterogeneous productivities, which require an investment to prevent liquidation. They are also endowed with some cash flows and have pre-existing debts with banks. The main friction we consider is that entrepreneurial effort, which increases the probability of project success, is not contractible. This gives rise to a debt overhang problem: namely, debt reduces entrepreneurial effort and thus economic efficiency, leading to a decline in output and to the inefficient liquidation of projects. In this context, we think of the advent of COVID as a "cash-flow shock" that aggravates these problems by increasing entrepreneurs' need for credit.

Entrepreneurs fall into one of three categories in equilibrium, depending on their productivity and level of pre-existing debt: *solvent*, *captive*, or *insolvent*. An entrepreneur is *solvent* when she can obtain enough credit to repay her pre-existing debt in full and to continue her project. An entrepreneur is *captive* when she must renegotiate her pre-existing debt downward with her bank in order to obtain new credit to continue her project. Finally, an entrepreneur is *insolvent* when her project is liquidated. We show that a negative cash-flow shock results in (i) more liquidations, (ii) more captive entrepreneurs, and (iii) lower entrepreneurial effort, with all three forces reducing aggregate output.

In this environment, credit guarantees may alleviate the debt overhang problem. We assume that the government responds to the cash-flow shock by distributing a fixed number of guarantees across all banks, who in turn decide how to allocate them to entrepreneurs. The effect of guarantees on efficiency depends on which entrepreneurs receive them and on how they affect entrepreneurial effort. Importantly, if the debt burden of entrepreneurs does not change when they receive a guarantee, i.e., the benefits of guarantees are fully appropriated by banks, then there is no effect on entrepreneurial effort or output. Instead, if payments from guarantees are passed on to entrepreneurs through a lower cost of funds, entrepreneurial effort and thus output increase.

We show that banks follow a pecking order when allocating credit guarantees. In equilibrium, all entrepreneurs whose risk exceeds a certain threshold receive guarantees. Within this group, moreover, guarantees are allocated first to captive entrepreneurs. The intuition behind this pecking order is as follows. The expected benefits of guarantees are increasing in entrepreneurial risk, because projects that are more likely to fail are also more likely to receive guarantee payments from the government. For a given level of risk, moreover, banks gain more by allocating guarantees to their captive entrepreneurs. The reason is that banks hold a strong bargaining position vis-à-vis these entrepreneurs, who can only avoid liquidation if their pre-existing debt is renegotiated. Thus, banks are able to capture much of the surplus from guarantees allocated to these entrepreneurs. Solvent entrepreneurs can instead choose which bank to borrow from, and are therefore in a better position to benefit from guarantees in the form of lower interest rates.

We explore the efficiency properties of the allocation of credit guarantees in the competitive equilibrium. To do so, we solve the problem of a planner who allocates guaranteed credit among entrepreneurs, subject to a participation constraint of banks. The planner's solution highlights two distortions present in the competitive equilibrium. First, as effort is unobservable, optimizing entrepreneurs set the private marginal benefit of effort to zero in the competitive equilibrium, whereas its social marginal benefit remains positive. Thus, the planner values the effect of guarantees on effort whereas the market does not. Second, banks have an incentive to maximize expected guarantee payments from the government in equilibrium, while these payments are only transfers for the planner. As a result, the planner tilts the allocation of guarantees towards more productive, safer entrepreneurs, and it fully passes on to them the benefits of guarantees through lower repayments.

We test the predictions of the model by studying the large credit guarantee program Spain implemented in 2020 (ICO program), which was endowed with €140 billion in funds. Guarantees, which were distributed among banks to then be allocated to firms, could cover up to 80%

of the financing losses on credit to the self-employed and SMEs and up to 70% of the losses on credit extended to non-SME's (60% if the credit was to rollover pre-existing debt). The program had a sizable effect on the Spanish credit market. By mid 2022, €107 billion of guarantees had been issued, more than 80% of which was extended during 2020. Approximately 40% of the credit granted between March and June of 2020 – the worst months of the COVID-lockdown – was guaranteed by the program and, even by mid-2022, guaranteed credit represented 18% of all outstanding credit to non-financial corporations.

Our main data source is the Banco de España Central Credit Registry (CCR), which contains the universe of loans granted by the financial institutions operating in Spain. Our sample consists of all loans granted between March 2020 and February 2021 (i.e., in the year following the outbreak of COVID). We focus on this period because it is when most public guarantees were granted. The CCR includes multiple variables on each loan, such as the type of contract, its size, the contractual interest rate, the origination and maturity dates, and the existence of guarantees. We merge this loan-level data with firm balance-sheet information from the quasi-census of non-financial firms included in the Central Balance Sheet Data Office Survey (CBSDO). This dataset is derived from the accounts filed with the Spanish Commercial Register and it contains information on firms' balance sheets, their profit and loss accounts, and other non-financial characteristics such as industry, year of incorporation, and demographic status.

The first testable prediction of our model is that credit guarantees are more likely to be allocated to riskier borrowers. The reason is that banks have an incentive to maximize expected guarantee payments from the government, which increase with the probability of firm failure. To test this, we evaluate how different firm-level measures of risk relate to the ratio of ICO-guaranteed loans (henceforth, ICO loans) to total credit received between March of 2020 and February of 2021. We find that, consistent with our model, the share of ICO loans received during this period is significantly higher for borrowers with a higher probability of default, that operate in COVID-affected sectors, or that have higher liquidity needs.[1]

The second testable prediction is that, conditional on firms' level of risk, banks are more likely to extend credit guarantees to their captive borrowers. The reason is that banks can extract more benefits when they extend guarantees to firms against which they have a higher bargaining power. To test this prediction, we say that a firm is captive to a given bank if it is considered ex-ante risky (in our preferred specification, if the firm has a high probability of default as of December 2019) and has a previous credit relationship with the bank. In line with

[1]The measures of default risk and liquidity needs are computed internally at the Banco de España, and are as of December 2019. We refer the reader to Section 6 for a detailed description of how each measure of risk is constructed.

the theory, we find that the share of ICO to total loans obtained between February 2020 and March 2021 is significantly higher for captive than for non-captive firms. This result is even stronger when we condition the sample to firms that operate in COVID-affected sectors, and they are robust to alternative measures of risk and of captivity.

Finally, a novel prediction of our model is that the pass-through of credit guarantees to firms in the form of lower interest rates should be weaker for captive borrowers. The reason is that captive firms have less barging power vis-à-vis their bank, and thus are less able to benefit from guarantees than non-captive firms. To test for this prediction, we measure the pass-through of guarantees to the contractual interest rates of ICO-loans, and analyze how this pass-through differs for captive and non-captive firms. We find that ICO loans entailed a significant interest-rate discount relative to non-ICO loans for non-captive borrowers (around 36 basis points on average), but they entailed no significant discount for captive borrowers. These findings are robust to different specifications of risk and captivity.

Our paper relates to the literature that studies the effects of loan guarantees in the presence of information and/or credit frictions. When credit markets are prone to adverse selection, e.g. Stiglitz and Weiss (1981), loan guarantees have been shown to improve the allocation of credit (Gale, 1990), to be welfare-improving (Smith and Stutzer, 1989), and to conform the optimal public intervention to increase investment while minimizing the cost of policy for taxpayers (Philippon and Skreta, 2012). Other modelling strategies that have been used to rationalize the use of loan guarantees include models with credit-constrained banks and firms (Elenev et al., 2020), debt overhang (Philippon and Schnabl, 2013), and strategic debt renegotiation in chain-like environments (Glode and Opp, 2021). More in line with our paper, Segura and Villacorta (2020) study the relative benefit of alternative government interventions in the presence of liquidity needs and debt overhang problems. Our contribution to this literature is to study banks' incentives to allocate government guarantees across heterogeneous borrowers, and the terms at which they do so.

Our paper is also related to the empirical literature that studies the effects of loan guarantees on credit markets and, more generally, on the real economy. One of the normative implications of our model is that loan guarantees can increase output as long as banks do not absorb all the benefits of guarantees. Bachas et al. (2021) estimate the elasticity of loan volumes to loan guarantees using US SBA data, and find that a 1% increase in the generosity of the guaranteed principal causes an average increase of $19,000 in loan volumes. Other papers have directly established a link between loan guarantees and aggregate real variables. For example, US SBA guaranteed loans have been found to have a positive effect on employment rates (Brown and

Earle, 2017) and on economic growth rates (Hancock et al., 2007; Lelarge et al., 2010)

Perhaps closest to us are the recent empirical studies on the effects of credit-guarantee programs in Europe following the outbreak of COVID-19. These focus mainly on the extent to which guaranteed credit substitutes non-guaranteed credit. Laeven et al. (2022), for instance, find evidence that the Spanish ICO program entailed some credit substitution for risky firms to which banks were heavily exposed, and that this substitution was stronger for weakly capitalized banks. Altavilla et al. (2021) report a similar finding using data from multiple countries within the Euro Area, whereas Sette et al. (2022) document that, in Italy, credit substitution appears to have been higher for guaranteed loans that had the highest coverage ratio. These empirical observations are broadly consistent with our findings, but we complement them by focusing on the terms at which different firms accessed credit guarantees as a way to capture the division of surplus between firms and banks. To our knowledge, we are the first to provide evidence on this division and to study how it correlates with firm characteristics.

Finally, our paper contributes to the vast literature that analyzes economic policies in post-COVID economies. Gourinchas et al. (2020) assesses the fiscal measures adopted in several advanced and emerging economies, and argue that SME failures would have increase by 6.15 percentage point in the absence of government interventions. Guerrieri et al. (2022) discusses both fiscal and monetary policies in a multi-sector economy and show that a supply shock to a given sector, e.g. due to COVID, can result in an even larger demand shock that drives activity below potential. Closer to our paper, Brunnermeier and Krishnamurthy (2020) analyze several interventions in the credit market to help mitigate the impact of the pandemic, while Blanchard et al. (2020) recommends the use of partial guarantees to face the COVID-shock. We contribute to this literature by studying the effect of loan guarantees that are allocated through banks, and by assessing their effects both theoretically and empirically using data from the large-scale guarantee program in Spain.

2 The Spanish ICO program: an overview

In 2020 the Spanish Government approved two public guarantee schemes for loans to firms and the self-employed. These schemes were aimed at facilitating access to finance for those firms that were most affected by the COVID-19 crisis.[2] Jointly considered, their size amounted to

[2]Royal Decree-Law (RDL) 8/2020 of 17 March 2020 approved a first public guarantee scheme for firms and the self-employed of up to €100 billion. The aim of the program was to cover the liquidity needs generated by COVID-related restrictions. RDL 25/2020 activated a second guarantee facility, of up to €40 billion, to meet funding needs linked to investment.

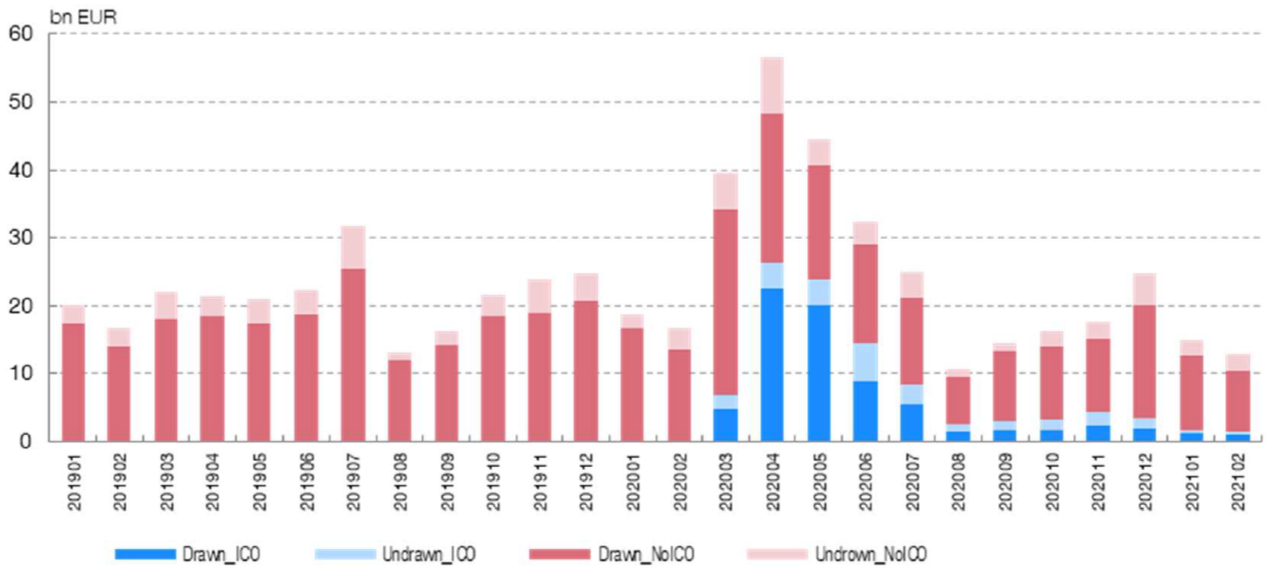


Figure 1: **Evolution of new credit operations to non-financial corporations (NFCs)**. This figure shows the evolution of new credit, drawn and undrawn, to NFCs from January 2019 to February 2021, distinguishing the portion arranged through the ICO facility.

€140 billion, and they have been managed by the Official Credit Institute (ICO, by its Spanish abbreviation).

ICO guarantees cover up to 80% of the potential losses on bank finance extended to the self-employed and SMEs, and up to 70% or 60% of financing losses extended to non-SMEs depending on whether this financing is composed of new loans or rollovers. All loans granted to firms domiciled in Spain after March 17, 2020 were eligible for the program, excepting firms that were in a delinquency situation at CIRBE[3] as of December 31, 2019, firms that were subject to bankruptcy proceedings, and firms that were deemed to be in distress. In addition, it was required that neither the financing operation nor any other financing granted by the bank to that firm be in arrears. One important feature of the program is that banks were allocated a share of total guarantees depending on their market share, and they decided in turn whether and how to grant these guarantees to firms.

By all accounts, the ICO program played an important role in sustaining credit during the most acute period of the COVID crisis. By mid-2022, a total of €107 billion of guarantees had been granted, with almost 85% of it extended during 2020. Figure 1 shows the evolution of new credit, drawn and undrawn, extended to non-financial corporations between January 2019 and February 2021. The figure shows that ICO loans made up a significant share of total credit both during the COVID crisis and in its aftermath. Of the €170 billion of new credit

[3]A central risk database in Spain.

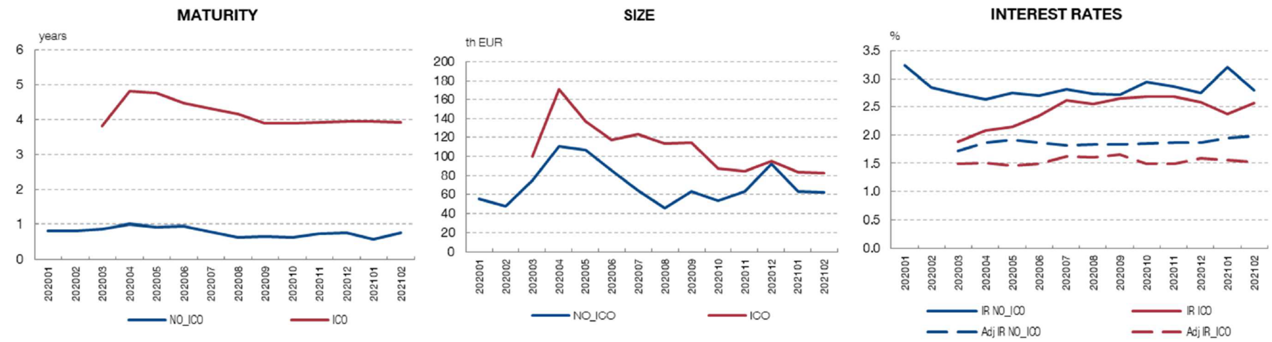


Figure 2: **Conditions of new loans with and without public guarantees.** Panels A and B of this figure show the average maturity and size, respectively, of ICO and non-ICO loans. Panel C shows the average interest rate (without fees) of both types of loans. The solid lines correspond to the average nominal rates whereas dashed lines correspond to the average nominal rates adjusted by type of loan, the maturity, the reference rate (fixed or floating), and the existence of other real or personal guarantees or a floor clause.

granted between March and June of 2020, approximately 40% was guaranteed by the ICO program. By mid-2022, ICO guaranteed credit still represented 18% of total outstanding credit to non-financial corporations.

The extent and conditions of access to ICO loans varied substantially across firms. Coverage of ICO loans was significantly higher for firms facing greater difficulties in accessing bank financing, such as those in sectors severely affected by the pandemic, SMEs, and firms with higher risk levels (see box 4.3 in Informe Anual Banco de España (2019)). Moreover, ICO and non-ICO loans were granted under very different terms. As Figure 2 shows, ICO loans had on average a longer maturity (Panel A), a larger size (Panel B), and lower nominal interest rates when adjusting for other loan conditions (Panel C) than non-ICO loans. This suggests that the ICO program contributed to mitigate rollover risk in a context of high uncertainty. However, not all firms benefited to the same extent from the more favorable financing conditions of guaranteed loans. As shown in Figure 3, the interest rate dispersion on ICO loans was substantial and comparable to the one observed on non-ICO loans.

To rationalize these facts and to better understand the drivers of firms' differential access to ICO loans, we develop next a model of credit guarantees and use it to study banks' incentives to allocate them across heterogeneous borrowers.

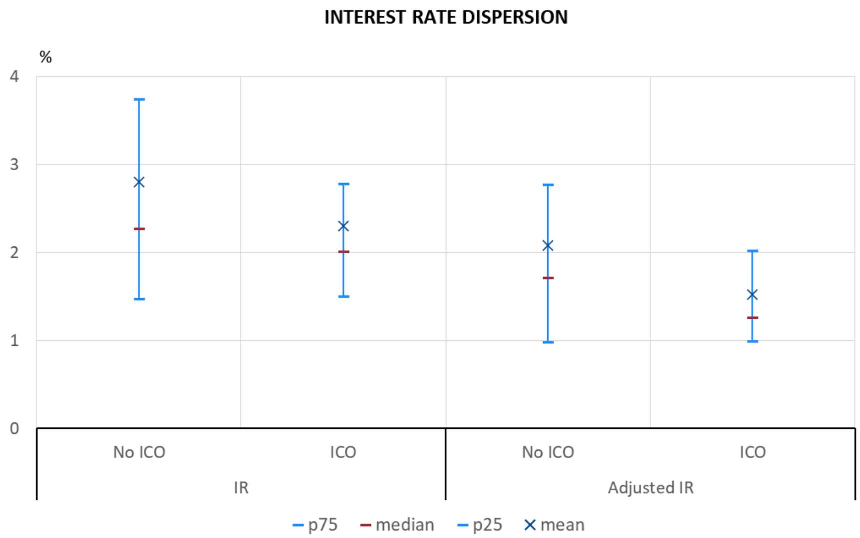


Figure 3: **Dispersion in the interest rates of new loans with and without public guarantees.** This figure reports the mean, median and the 25th and 75th percentiles of interest rates.

3 A model of credit guarantees

We study an economy in which heterogeneous entrepreneurs must obtain credit from banks in order to pay off pre-existing debts and to carry out their investment projects. The key friction in this economy is that the return to investment depends directly on entrepreneurial effort, which is not contractible. This gives rise to a debt overhang problem, which will reduce output relative to the efficient benchmark.

3.1 Setup

The economy lasts for two periods, $t = \{0, 1\}$. It is populated by a continuum of entrepreneurs, uniformly distributed in the unit interval and indexed by $i \in [0, 1]$, and by a continuum of bankers. The objective of all agents in the economy is to maximize expected $t = 1$ consumption of the economy's only good, net of any costs of effort exerted (more on this below).

At $t = 0$, each entrepreneur is endowed with an investment project that requires k units of investment, which yields A_i units of the consumption good at $t = 1$ in the event of success and nothing otherwise. We assume throughout that $A_i \sim^{iid} F(A)$, with full support in $\left[0, \bar{A}\right]$. If it is not continued, the project is liquidated in exchange for $\lambda > 0$ units of the consumption good.

Entrepreneur i's probability of success, which we denote by p_i, is determined by her effort, which entails a non-pecuniary cost $C(p_i)$, with $C(0) = 0$, $C' > 0$, $C'' > 0$. Crucially, it is assumed that p_i is not contractible.

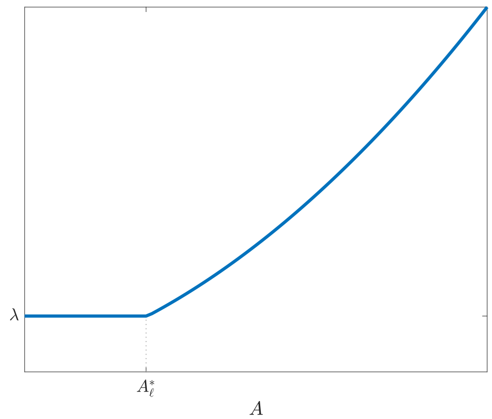


Figure 4: First-best total surplus of entrepreneur with productivity A.

Bankers have deep pockets and lend competitively to entrepreneurs in the credit market. We suppose that entrepreneur i enters period $t = 0$ with a pre-existing debt obligation B_i. For simplicity, we suppose that an entrepreneur's pre-existing debt is owed to only one bank, and that these debts are equally distributed across all banks. In the event that entrepreneur i's project is liquidated, her creditor bank obtains the liquidation value λ. Finally, all agents have access to a storage technology that yields a gross return of one.

3.2 First-best allocation

We begin by characterizing the first-best allocation. Letting

$$p^*_A = \arg\max_p p \cdot A - C(p), \tag{1}$$

denote the efficient effort level of entrepreneur i, it follows that project $i \in [0, 1]$ is socially profitable if and only if

$$p^*_A \cdot A - C(p^*_A) - k \geq \lambda \iff A \geq A^*_\ell.$$

Thus, there exists a threshold A^*_ℓ such that it is socially efficient to carry out all projects with productivity weakly above this threshold. Projects with productivity below A^*_ℓ should instead be liquidated.

The social surplus generated by a project with productivity A under the efficient effort level is given by

$$Y_A^* = \begin{cases} p_A^* \cdot A - C\left(p_A^*\right) - k & \text{if } A \geq A_\ell^* \\ \lambda & \text{otherwise} \end{cases}$$

and the total social surplus thus equals

$$Y^* = \underbrace{\lambda \cdot F(A_\ell^*)}_{\text{Liquidations}} + \underbrace{\int_{A_\ell^*}^{\bar{A}} \left(p_A^* \cdot A - C\left(p_A^*\right) - k\right) dF(A)}_{\text{Continued projects}} \tag{2}$$

Figure 1 depicts the social surplus generated by projects in the efficient allocation as a function of their productivity. As the figure shows, all projects with a productivity below A_ℓ^* are liquidated and generate a surplus of λ. Projects with a productivity above this threshold are continued, and the surplus that they generate is increasing in their productivity.

3.3 Competitive equilibrium

To simplify the exposition, in what follows we make two assumptions. First, we suppose that all entrepreneurs have the same pre-existing debt, i.e., $B_i = B, \forall i$. This allows us to index entrepreneurs by A, as all entrepreneurs with the same productivity are now identical to one another. Second, we suppose that pre-existing debts are high, i.e., $B > \lambda$. This gives rise to the possibility of debt renegotiation between banks and entrepreneurs, which would not arise if liquidation values exceeded debt obligations. We analyze the model with heterogeneous levels of debt, i.e., $B_i \sim^{iid} G(B)$, in Appendix C.

Recall that entrepreneurs must obtain credit from banks both to repay their pre-existing debts and to continue their projects. Since effort p_A is assumed to be non-contractible, credit contracts can only be contingent on a project's outcome. Specifically, the equilibrium contract obtained by an entrepreneur with productivity A is a pair $\{b_A, B_{1,A}\}$, where b_A denotes the amount of credit that the entrepreneur receives at $t = 0$ and $B_{1,A}$ denotes her repayment at $t = 1$ in the event of success. In any equilibrium, bank competition coupled with the existence of a storage technology implies that the contract $\{b_A, B_{1,A}\}$ must satisfy the bank's zero profit condition:

$$p_A(B_{1,A}) \cdot B_{1,A} = b_A \tag{3}$$

where $p_A(B_{1,A})$ is the effort level that is incentive compatible for entrepreneur i given the equilibrium contract, i.e.:

$$A - B_{1,A} = C'(p_A) \tag{4}$$

Equation (3) says that, given the entrepreneur's effort level, a credit contract extended to her must yield an expected return of one to the bank. Equation (4) ensures that, given the repayment stipulated by the contract and the entrepreneur's productivity, the effort exerted by the entrepreneur is incentive compatible. It implies, moreover, that the equilibrium level of effort is suboptimal relative to the efficient level characterized in Equation (1). The reason is that, as long as $B_{1,A} > 0$, the entrepreneur does not fully internalize the return to her effort because part of it accrues to the creditor bank.

There are three possibilities for an entrepreneur. We say that an entrepreneur is *solvent* if she is able to obtain enough credit to repay her existing debt and to continue her project, i.e., $b_A \geq B + k$. We say that an entrepreneur is *captive* if she is only able to obtain enough credit to continue her project after successfully renegotiating her pre-existing debt with her creditor bank. We say that an entrepreneur is *insolvent* if she cannot obtain credit to continue and thus her project is liquidated. We assume throughout that, in the event of renegotiation, the creditor bank has all the bargaining power. In particular, an entrepreneur's original creditor makes a take-it-or-leave-it (TIOLI) offer that the entrepreneur can accept or reject. In the event that the entrepreneur rejects this offer and is unable to pay the original debt in full, her project is liquidated.

3.3.1 Equilibrium contracts

To characterize equilibrium contracts, it is useful to define an entrepreneur's debt capacity.

Definition 1 *The debt capacity of an entrepreneur with productivity A, denoted by $\bar{B}_A$, is the repayment entailed by the contract that maximizes the bank's expected revenues subject to the entrepreneur's incentive and participation constraints. Formally,*

$$\bar{B}_A = \arg \max_B p_A \cdot B$$

$$s.t. \quad A - B = C'(p_A) \tag{5}$$

$$0 \leq p_A \cdot (A - B) - C(p_A) \tag{6}$$

Constraint (5) says that the effort exerted by the entrepreneur must be incentive compatible, whereas constraint (6) ensures that the payoff to the entrepreneur is non-negative. If the latter is slack, debt capacity maximizes $p_A \cdot (A - C'(p_A))$: even though the entrepreneur obtains a positive surplus from operating the project, the bank is unable to extract any higher repayments in an incentive-compatible manner. If instead the participation constraint (6) binds, the debt capacity extracts all of the entrepreneur's surplus.

We henceforth use $\bar{p}_A \equiv p_A(\bar{B}_A) = C'^{-1}\left(A - \bar{B}_A\right)$ to denote the effort level associated to the debt capacity. Given Definition 1, the following proposition characterizes equilibrium contracts.

Proposition 3.1 *For an entrepreneur with productivity A there are three possibilities in equilibrium:*

1. $\bar{p}_A \cdot \bar{B}_A - k \geq B$*: the entrepreneur is solvent and she accepts contract*

$$\{b_A, B_{1,A}\} = \left\{B + k, \frac{B + k}{p_A(B_{1,A})}\right\} \tag{7}$$

in the credit market to continue her project.

2. $\bar{p}_A \cdot \bar{B}_A - k \in [\lambda, B)$*: the entrepreneur is captive, her original debt is renegotiated down to $\bar{p}_A \cdot \bar{B}_A - k$ and she obtains contract*

$$\{b_A, B_{1,A}\} = \left\{\bar{p}_A \cdot \bar{B}_A, \bar{B}_A\right\}$$

in the credit market to continue her project.

3. $\bar{p}_A \cdot \bar{B}_A - k < \lambda$*: the entrepreneur is insolvent and her project is liquidated.*

Proposition 3.1 characterizes the equilibrium levels of credit and investment for each entrepreneur as a function of her debt capacity. In order to interpret the equilibrium allocation, however, it is useful to express them in terms entrepreneurial productivity.

Proposition 3.2 *There exist thresholds A_ℓ and A_h, with $A_\ell^* < A_\ell < A_h$ such that entrepreneurs with:*

1. $A \geq A_h$ *are solvent, pay back their original debt and continue their projects.*
2. $A \in [A_\ell, A_h)$ *are captive, renegotiate their original debts and continue their projects.*
3. $A < A_\ell$ *are insolvent and their projects are liquidated.*

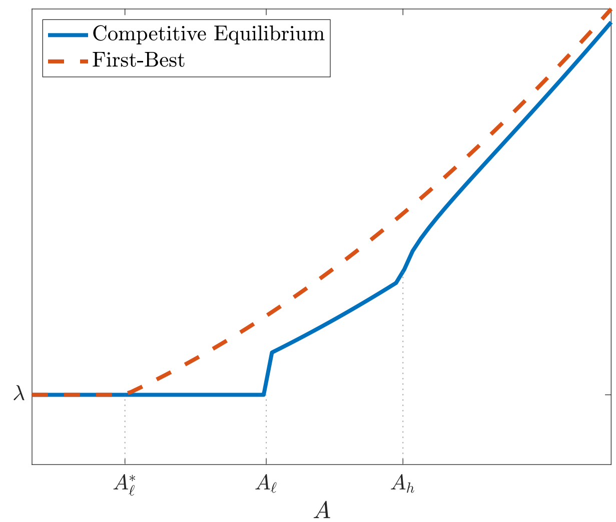


Figure 5: First-Best vs. Competitive Equilibrium Surplus.

In equilibrium, there is a threshold level of productivity A_ℓ below which projects are liquidated. This threshold is given by the productivity for which the bank's maximum profits from lending equals the benefit of liquidation, i.e.

$$\bar{p}_{A_\ell} \cdot \bar{B}_{A_\ell} - k = \lambda \tag{8}$$

As the expected repayment received by the bank in case of renegotiation, $\bar{p}_A \cdot \bar{B}_A$, increases in A, all entrepreneurs with productivity above A_ℓ obtain credit and continue their projects. However, entrepreneurs with $\bar{p}_A \cdot \bar{B}_A - k < B$ must renegotiate their pre-existing debts in order to continue, while entrepreneurs with $\bar{p}_A \cdot \bar{B}_A - k \geq B$ can fully repay their pre-existing debts and continue their projects by borrowing competitively in the credit market. The latter happens once $A \geq A_h$, where A_h is implicitly defined as,

$$\bar{p}_{A_h} \cdot \bar{B}_{A_h} - k = B \tag{9}$$

3.3.2 Properties of equilibrium

Proposition (3.2) implies that the social surplus in the competitive equilibrium is given by

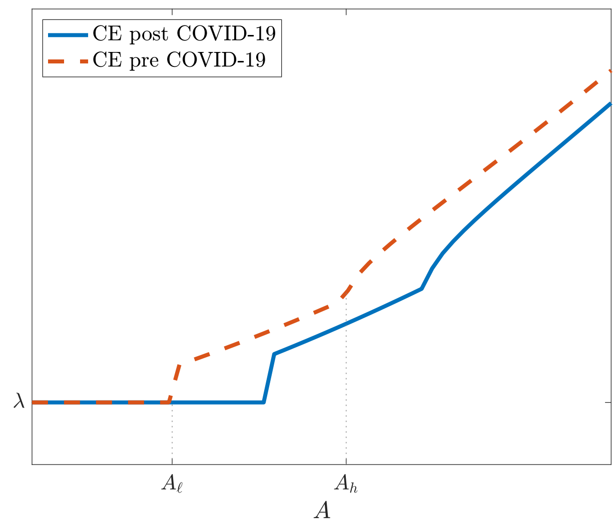


Figure 6: **COVID-19 Shock.** Effect on social surplus of an increase in entrepreneurs' financing needs.

$$Y = \underbrace{\lambda \cdot F\left(A_\ell\right))}_{\text{Insolvent E.}} + \underbrace{\int_{A_\ell}^{A_h} \left(\bar{p}_A \cdot A - C\left(\bar{p}_A\right) - k\right) \cdot dF\left(A\right)}_{\text{Captive Entrepreneurs}} + \underbrace{\int_{A_h}^{\bar{A}} \left(p_A \cdot A - C\left(p_A\right) - k\right) \cdot dF\left(A\right)}_{\text{Solvent Entrepreneurs}} \tag{10}$$

Figure 5 illustrates this surplus (solid line) relative to the first best (dashed line). As the Figure shows, the competitive equilibrium features a lower surplus than the first-best allocation, both along the extensive and intensive margins. First, some entrepreneurs who should continue with their projects if their effort was optimal are liquidated in equilibrium, i.e., $A_\ell > A_\ell^*$. Second, even those entrepreneurs who continue with their projects exert a suboptimal level of effort, i.e., $p_A < p_A^*$ for all $A \geq A_\ell$. Note, moreover, that there is a discontinuous jump in surplus at A_ℓ in the competitive equilibrium. This is because, in our parametrization, the participation constraint (6) is slack at A_ℓ and liquidations are thus inefficient even in a second-best sense. Essentially, there are projects that are liquidated not because they yield a negative surplus, but because banks are unable to extract this surplus without inducing a substantial fall in effort.[4]

We can use the model to interpret the effects of a COVID-like shock on equilibrium. Under the most benevolent interpretation, the onset of COVID temporarily reduced firm revenues without affecting their ultimate prospects. In other words, the pandemic increased the financing needed

[4]For the figures we suppose that $C(p) = \frac{p^2}{2}$ and it is straight-forward to show that with this cost function constraint (6) never binds: that is, liquidations are always inefficient at the margin. This need not be the case, however, for other cost functions.

by firms to avoid liquidation. Figure 6 illustrates the effects of such a shock by depicting the change in surplus induced by an increase in entrepreneurs' borrowing needs from $k-\omega$ to k, where $\omega>0$ denotes internal resources the firms had available for investment before COVID.[5] As the figure shows, an increase in financing needs destroys social surplus both by prompting liquidation and by reducing the output of continuing projects. This is clearly inefficient, as the first-best allocation is independent of financing needs, characterized by ω. Can credit-guarantee schemes help mitigate this destruction of surplus? We turn to this question next.

4 The effect of credit guarantees

We modify the model by assuming that the government grants a total of $\bar{X}$ units of guarantees, which are distributed equally across banks. Banks then allocate these guarantees at will across entrepreneurs. We first characterize the optimal allocation of guarantees from the perspective of an individual bank and then solve for the symmetric equilibrium.

4.1 Equilibrium

In the presence of guarantees, the credit contract obtained by entrepreneurs with productivity A becomes a triple $\left\{b_A^g, B_{1,A}^g, x_A\right\}$, where x_A denotes the units of guarantees assigned to the contract. Each unit of guarantee implies that the government backs a unit of the loan's capital in the event that the entrepreneur fails. Formally, a credit contract with $x_A \leq k$ units of guarantees offered to an entrepreneur with productivity A generates an expected revenue of $p_A^g \cdot B_{1,A}^g + (1-p_A^g)\cdot x_A$ for the bank, of which $(1-p_A^g)\cdot x_A$ are expected transfers from the government. The assumption that x_A cannot exceed k reflects the rules of the ICO program, which stipulated that guarantees could not be used to back pre-existing debt.

To understand the incentives faced by banks it is useful to define the shadow value of granting a guarantee, which we denote by ρ. This shadow value measures the opportunity cost that a bank faces when allocating guarantees to an entrepreneur. Although ρ is taken as given by each individual bank, it is an equilibrium object that we endogenize below. It follows that the bank will optimally allocate guarantees to entrepreneurs with productivity A whenever $1-p_A^g>\rho$. Moreover, when it does so, it will assign a full guarantee to maximize the transfer from the government. Thus, we have that $x_A \in \{0, k\}$.[6].

[5] This aims to capture the idea that the pandemic reduces entrepreneurial resources thereby increasing the part of investment that needs to be financed with external borrowing.

[6] We show this formally in the proof of Proposition 4.1 in Appendix B

The following definition extends the concept of debt capacity to the case where the entrepreneur receives a full guarantee, i.e. $x = k$.

Definition 2 *The debt capacity with guarantees of an entrepreneur with productivity A, denoted by $\bar{B}^g_A$, is the repayment entailed by the credit contract with $x_A = k$ that maximizes the bank's expected revenues subject to the entrepreneur's incentive and participation constraints. Formally*

$$\bar{B}^g_A = \arg \max_B p_A \cdot B + (1 - p_A) \cdot k \tag{11}$$
$$s.t. \quad (5) \quad and \quad (6)$$

Definition 2 implies that the introduction of guarantees changes the debt capacity of entrepreneurs. The reason is that, from the bank's perspective, the marginal benefit of promoting entrepreneurial effort falls from B to $B - k$. As a consequence, the choice of repayment that maximizes the contract's expected revenues for the bank increases, i.e., $\bar{B}^g_A > \bar{B}_A$, at the expense of lower effort, i.e., $\bar{p}^g_A < \bar{p}_A$, where $\bar{p}^g_A \equiv p_A(\bar{B}^g_A) = C'^{-1}\left(A - \bar{B}^g_A\right)$.

As in the economy without guarantees, the equilibrium is characterized by two productivity thresholds: $A_\ell(\rho)$, which denotes the productivity below which projects are liquidated, and $A_h(\rho)$, which denotes the productivity above which entrepreneurs are solvent. The main innovation is that these thresholds are now weakly increasing in the shadow price of guarantees, ρ. Indeed, $\lim_{\rho \to 1} A_\ell(\rho) = A_\ell$ and $\lim_{\rho \to 1} A_h(\rho) = A_h$, for A_ℓ and A_h as defined in Proposition 3.2.

Relative to the economy with no guarantees, productivity threshold $A_\ell(\rho)$ for which the bank is indifferent between liquidating or continuing a project is now implicitly defined by the productivity level for which

$$\bar{p}^g_A \cdot \bar{B}^g_A - k + (1 - \bar{p}^g_A - \rho) \cdot k = \lambda. \tag{12}$$

Equation (12) takes into account that, in equilibrium, entrepreneurs with productivity A_ℓ always receive guarantees and therefore the bank gets k from the government in the event of entrepreneurial failure. An immediate implication is that credit guarantees reduce liquidations, as $A_\ell(\rho) < A_\ell$.

Consistent with the discussion above, productivity threshold $A_h(\rho)$ is implicitly defined by

$$\max\{\bar{p}_A \cdot \bar{B}_A - k \ , \ \bar{p}^g_A \cdot \bar{B}^g_A - k + (1 - \bar{p}^g_A - \rho) \cdot k\} = B. \tag{13}$$

Naturally, A_h changes only if entrepreneurs at this threshold receive guarantees: $x_{A_h(\rho)} = x_{A_h} = k$. If they do, it means that guarantees are helping some captive entrepreneurs become solvent, as $A_h(\rho) \leq A_h$.

This discussion is formalized in the following Proposition, which extends Proposition 3.2 to incorporate the effect of credit guarantees.

Proposition 4.1 *Given a shadow price of guarantees ρ, there exist thresholds $A_\ell(\rho)$ and $A_h(\rho)$ such that $A_\ell(\rho) < A_h(\rho)$ and entrepreneurs with:*

1. *$A \geq A_h(\rho)$ are solvent, accept contract*

$$\left\{b_A^g, B_{1,A}^g, x_A\right\} = \begin{cases} \left\{k+B, \frac{k+B-(1-p_A^g(B_{1,A}^g)-\rho)\cdot k}{p_A^g(B_{1,A}^g)}, k\right\} & \text{if} \quad \rho \leq 1 - p_A(B_{1,A}^g) \\ \left\{k+B, \frac{k+B}{p_A(B_{1,A}^g)}, 0\right\} & o.w. \end{cases} \tag{14}$$

2. *$A \in [A_\ell(\rho), A_h(\rho))$ are captive, renegotiate their original debts down, and accept contract*

$$\left\{b_A^g, B_{1,A}^g, x_A\right\} = \begin{cases} \left\{\bar{p}_A^g \cdot \bar{B}_A^g + (1-\bar{p}_A^g)\cdot k, \bar{B}_A^g, k\right\} & \text{if} \quad \rho \leq 1 - \bar{p}_A^g \\ \left\{\bar{p}_A \cdot \bar{B}_A, \bar{B}_A, 0\right\} & o.w. \end{cases} \tag{15}$$

   and continue their projects.

3. *$A < A_\ell(\rho)$ are insolvent and their projects are liquidated.*

Corollary 1 *In equilibrium, entrepreneurs with productivity A receive guarantees if and only if $A \in [A_\ell(\rho), A(\rho)]$, where*

$$A(\rho) : 1 - p_A\left(B_{1,A}^g\right) \geq \rho.$$

Proposition 4.1 implies that banks follow a pecking order in allocating guarantees, granting them first to captive entrepreneurs and only then to solvent ones. Banks' incentives are depicted in Figure 7, which illustrates - for a given level of ρ - the extra revenues that banks obtain in equilibrium from granting guaranteed credit contracts. As the figure shows, this gain is non-monotonic in productivity A, and it is maximized at A_ℓ: the reason is that these are the riskiest projects from which the bank can fully extract the benefits of guarantees. Since entrepreneurs with productivities below this threshold would be liquidated in the absence of guarantees, banks must partially share with them the benefits of guarantees in order to induce effort and prevent liquidation. As for captive entrepreneurs with productivities above A_ℓ, banks can fully extract from them the benefits of guarantees but these fall alongside the probability of project failure

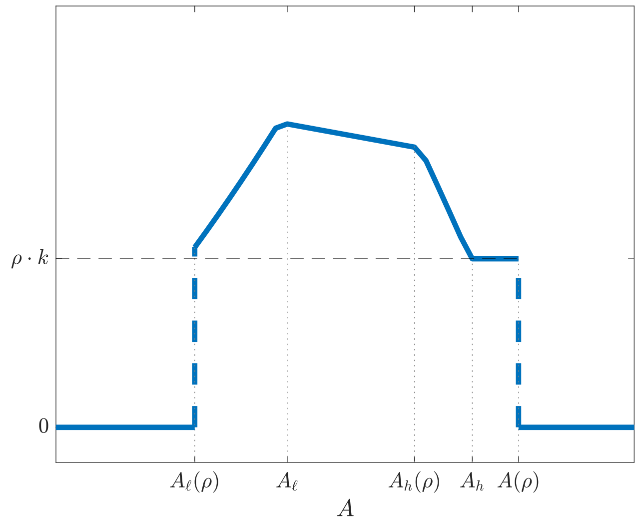


Figure 7: **Banks' extra revenues from granting guaranteed credit in equilibrium.** This figure plots the extra revenues that banks obtain from granting guaranteed credit contracts in equilibrium, as a function of entrepreneurial productivity A.

as A increases. Finally, extra revenues are lowest for solvent entrepreneurs, from which the bank can only obtain an additional income of $\rho \cdot k$.

To complete the characterization of equilibrium, we are left to find the value of ρ that clears the market, i.e., which ensures that banks allocate all available guarantees to entrepreneurs;

$$k \cdot [G(A(\rho)) - G(A_\ell(\rho))] = \bar{X}. \tag{16}$$

The left-hand side of Equation (16) denotes the total guarantees allocated by banks as a function of ρ: it is weakly decreasing because $A_\ell(\rho)$ increases while $A(\rho)$ decreases in ρ. The right-hand side is the total amount of guarantees that banks have available to distribute among entrepreneurs, which is independent of ρ. It follows that there is a unique value, ρ^*, that satisfies Equation (16), as depicted in Figure 8. It is immediate that ρ^* is decreasing in the supply of guarantees, and that it is strictly positive as long as guarantees are scarce, that is, if $\bar{X} < k \cdot (1 - G(A_\ell(0)))$.

4.2 Discussion

Intuitively, guarantees should reduce entrepreneurs' debt burden thereby increasing the efficiency of the competitive equilibrium. However, Proposition 4.1 shows that their effect on efficiency is ambiguous, as banks do not necessarily transfer the benefits of guarantees to en-

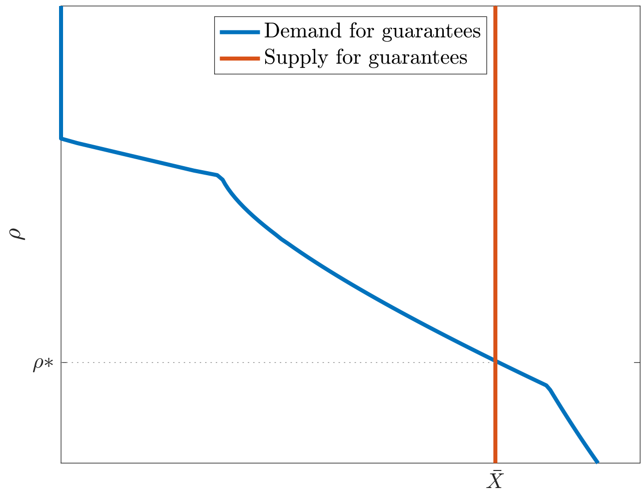


Figure 8: **Supply and Demand of Guarantees**

trepreneurs.

On the one hand, guarantees allocated to entrepreneurs with $A \geq A_h$ always enhance efficiency. These are solvent entrepreneurs that continue to receive credit $k + B$ but, due to bank competition, benefit through a fall in expected repayment of $(1 - p_A - \rho^*) \cdot k$ and this increases their effort and thus efficiency. Even these entrepreneurs capture the benefits of guarantees only partially, however, as the bank appropriates $\rho^* \cdot k$.[7] In contrast, guarantees allocated to entrepreneurs with $A \in [A_\ell, A_h(\rho))$ always reduce efficiency. These are captive entrepreneur who now receive more credit, $\bar{p}_A^g \cdot \bar{B}_A^g + (1 - \bar{p}_A^g) \cdot k > \bar{p}_A \cdot \bar{B}_A$, but the benefits of guarantees are fully appropriated by the creditor bank through a higher renegotiation of the pre-existing debt. As a result, expected repayment increases with guarantees, and entrepreneurial effort and efficiency consequently fall.

The effect of guarantees on the efficiency of other entrepreneurs is ambiguous, and depends on the degree to which banks pass on the benefits of guarantees to entrepreneurs in the form of lower repayments. These results are reflected in Figure 9, which compares the social surplus in the competitive equilibrium with and without guarantees. In this example, guarantees increase efficiency for solvent entrepreneurs, for captive entrepreneurs that become solvent, and for those entrepreneurs that were at the margin of being liquidated and can now continue their projects. In contrast, guarantees decrease efficiency for captive entrepreneur that remain captive and for negative-NPV projects that should be liquidated but are instead continued only to cash-in the

[7] A full pass-through of credit guarantees to entrepreneurs entails a reduction in repayments of $(1 - p_A) \cdot k$.

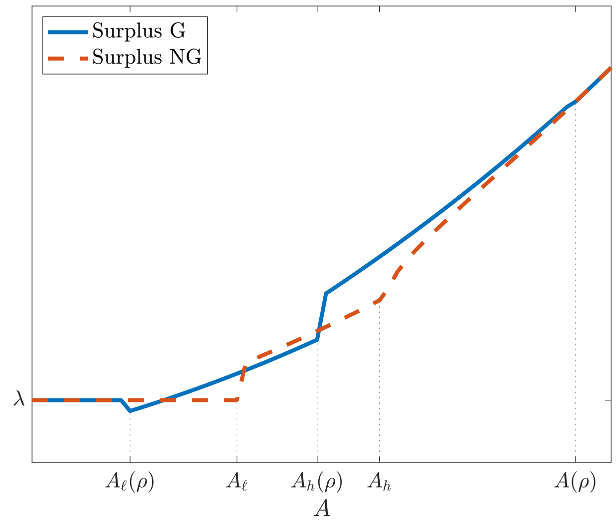


Figure 9: Social surplus of entrepreneurs with productivity A, with and without credit guarantees.

guarantees. It is immediate that this allocation of guarantees cannot be socially optimal, and we show this formally in the next section.

We conclude this section by discussing how our findings would be affected by relaxing the assumptions of (i) full bank barging power in debt renegotiations (through TIOLI offers to entrepreneurs), and (ii) homogeneous pre-exiting debt levels. First, the assumption that banks have full bargaining power in debt renegotiation implies that they extract all of the gains from credit guarantees, i.e. there is zero-pass-through to captive entrepreneurs. While this is a stark result, any renegotiation protocol that leaves some surplus for banks (e.g. Nash bargaining) would lead to a similar finding, i.e., there would be a limited pass-trough of credit guarantees to captive entrepreneurs. Second, we have assumed that the pre-existing level of debt B was equal for all entrepreneurs. In Appendix C, we show that the main predictions regarding the allocation and effect of credit guarantees remain unchanged when we extend the model to allow for heterogeneity in B. The only difference is that effort levels now depend on both productivity and pre-exiting debt, $p(A, B)$, and thus thresholds A_h and $A_h(\rho)$ from Propositions 3.2 and 4.1 also depend on B.

5 Constrained-Optimal Allocation of Guarantees

We now explore the efficiency properties of the allocation of credit guarantees in the competitive equilibrium. To do so, we solve the problem of a planner who chooses how to allocate $\bar{X}$ guarantees among entrepreneurs, subject to their incentive constraints and banks' participation constraints. In particular, the planner chooses contracts $\{b^p_A, B^p_A, x^p_A\}_A$ to maximize total surplus, where b^p_A is the credit granted at $t = 0$, B^p_A the repayment requested at $t = 1$, and $x^p_A \in [0, k]$ the amount guaranteed. Letting $\{\widehat{b}_A, \widehat{B}_A, \widehat{p}_A\}_A$ denote the allocations in the competitive equilibrium without credit guarantees, where we define $\widehat{p}_A \cdot \widehat{B}_A \equiv \lambda + k$ for $A \leq A_\ell$, the planner's problem can be formally stated as follows:

$$\max_{\{b_A, B_A, x_A\}_A} \int_0^{\bar{A}} \left[(p_A \cdot A - C(p_A) - k) \cdot \mathcal{I}_{\{b_A \geq k\}} + \lambda \cdot \mathcal{I}_{\{b_A = 0\}}\right] \cdot dF(A) \tag{17}$$

$$s.t. \qquad A - B_A = C'(p_A), \quad \forall A \tag{18}$$

$$(p_A \cdot B_A + (1 - p_A) \cdot x_A - k) \cdot \mathcal{I}_{\{b_A \geq k\}} + \lambda \cdot \mathcal{I}_{\{b_A = 0\}} \geq \widehat{p}_A \cdot \widehat{B}_A - k, \quad \forall A \tag{19}$$

$$\int_0^{\bar{A}} x_A \cdot dF(A) = \bar{X}. \tag{20}$$

where (18) represents entrepreneurs' incentive compatibility constraints, (19) represents banks' participation constraints, and (20) is the feasibility constraint faced by the planner. It is immediate that the banks' participation constraints always bind, as a lower repayment B_A always increases the objective by implementing higher entrepreneurial effort. Thus, for the case of $b_A \geq k$, we combine constraints (18) and (19) to obtain

$$A - \underbrace{\frac{\widehat{p}_A \cdot \widehat{B}_A - (1 - p_A) \cdot x_A}{p_A}}_{= B_A} = C'(p_A). \tag{21}$$

This implies that, in contrast to the competitive equilibrium, entrepreneurs in the planner allocation receive a full pass-through of the benefits of credit guarantees.

Taking this into account, the social marginal benefit of granting guarantee x_A to entrepreneurs with $b_A \geq k$ is

$$MB_A(x_A) \equiv f(A) \cdot (A - C'(p_A)) \cdot \underbrace{\frac{p_A \cdot (1 - p_A)}{C''(p_A) \cdot p_A^2 + x_A - \widehat{p}_A \cdot \widehat{B}_A}}_{= \frac{dp_A}{dx_A}}. \tag{22}$$

where $\frac{dp_A}{dx_A} > 0$ is obtained from (21). Equation (22) is intuitive, as it shows that the planner cares both about the beneficial effect of guarantees on effort, which is derived from (21), and about the social marginal benefit that this higher effort entails, $A - C'(A)$.

In turn, the social marginal cost of granting a guarantee is given by the multiplier of the feasibility constraint (20), which we denote by $\nu \geq 0$. The following result characterizes the planner's allocation of guarantees among entrepreneurs.

Proposition 5.1 *The planner allocates credit and guarantees as follows,*

$$\{b_A^p, B_A^p, x_A^p\} = \begin{cases} \{\widehat{p}_A \cdot \widehat{B}_A, B_A^p(\nu^*), x_A^p(\nu^*)\} & \text{if} \quad p_A(\nu^*) \cdot A - C(p_A(\nu^*)) - k \geq \lambda \quad \text{and} \\ & \text{if} \quad p_A(\nu^*) \cdot B_A^p(\nu^*) + (1 - p_A(\nu^*)) \cdot x_A^p(\nu^*) - k \geq \lambda \\ \{0, 0, 0\} & o.w. \end{cases} \tag{23}$$

where $B_A^p(\nu^*)$ and $p_A^p(\nu^*)$ are given by (21), and where

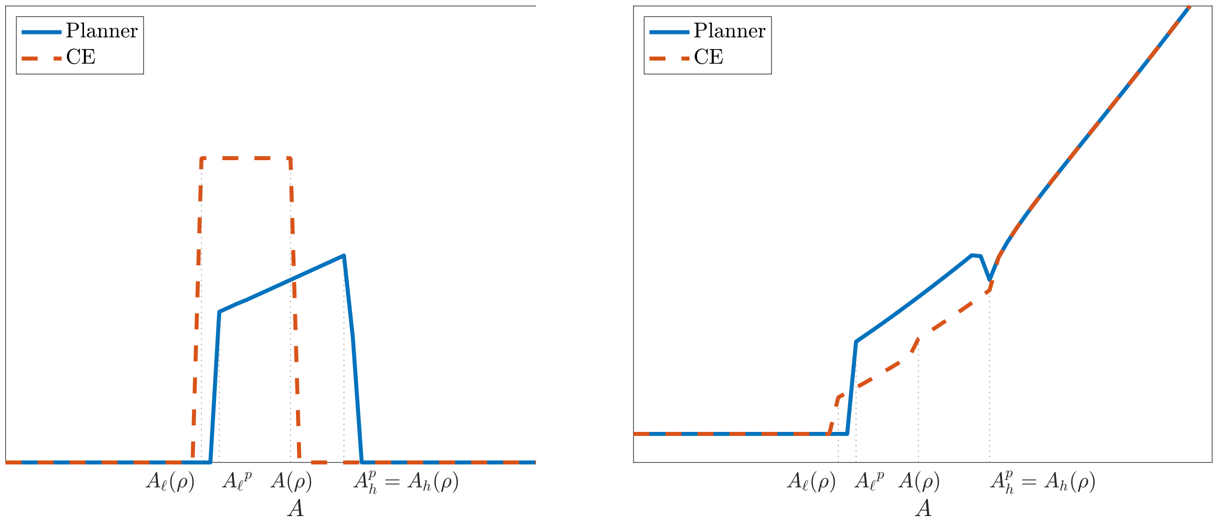
$$x_A^p(\nu^*) = \begin{cases} k & \text{if} \quad MB_A(k) \geq \nu^* \\ 0 & \text{if} \quad MB_A(0) < \nu^* \\ x : MB_A(x) = \nu^* & o.w. \end{cases} \tag{24}$$

Finally, ν^* ensures that the feasibility constraint (20) holds.

The planner's solution highlights two distortions present in the competitive equilibrium with guarantees. First, entrepreneurs' marginal benefit of effort $A - B_A - C'(A)$ is zero in equilibrium, whereas the social benefit of effort $A - C'(A)$ is positive. As a result, the planner values the effect of guarantees on effort whereas the market does not. Second, the incentive of banks and entrepreneurs in equilibrium is to maximize expected guarantee payments from the government $(1 - p_A) \cdot x$, while this is just a transfer for the planner.

Formally, these differences can be seen from comparing results in Proposition 5.1 from those obtained in Section 4.1. While Corollary 1 implies that banks grant guarantees to all entrepreneurs with $1 - p$ above a certain threshold, Equation (24) implies that the planner grants guarantees to all entrepreneurs for whom the marginal impact of guarantees on social surplus is above a certain threshold. Second, the planner requires that all financed projects generate positive social surplus, as stated in the first condition of Equation (23), while banks in the competitive equilibrium only require that they make non-negative profits.

Figure 10 illustrates how the allocation and effects of guarantees by the planner differ from that of banks. Panel (a) shows that, relative to banks, the planner tilts the allocation of guarantees towards safer, more productive entrepreneurs, both along the intensive and extensive margins. This is because the social marginal benefit to effort, $A - C'(A)$, increases with repayment and is thus maximized at $A_h(\rho)$. Panel (b) shows that the improved allocation of guarantees by the planner combined with the full pass-through of their benefits to entrepreneurs results in a higher increase in social surplus relative to the competitive equilibrium.



(a) Allocation of guarantees

(b) Total surplus

Figure 10: **Planner vs. Competitive Equilibrium**.

6 Empirical analysis

The model developed in the previous sections yields a set of predictions regarding the allocation of public guarantees in the competitive equilibrium. First, banks should allocate guarantees to riskier firms. Second, for a given level of risk, banks should allocate guarantees to their captive entrepreneurs first, as this enables them to appropriate a larger share of the surplus. This leads to the third key prediction of the theory: namely, the terms at which captive firms have access to ICO loans should be less favorable than those at which non-captive firms access the same type of loans.

We now analyze whether these predictions are borne in the data, which we describe before turning to our main results.

6.1 Data

Our main data source is the Banco de España Central Credit Registry (CCR), which contains the universe of loans granted by the financial institutions operating in Spain. Our sample consists of all loans granted between March 2020 and February 2021 (i.e., the year after the beginning of the ICO guarantees program). Our sample spans up to February 2021 because most public guarantees were granted before that date, €92 billion out of €107 billion. The CCR contains information on the type of loan contract, the loan size, the interest rate applied, the origination and maturity dates, the reference rate, the existence of a floor clause, and the existence of guarantees, either public – such as the ICO guarantees – or those given by the firm itself or its managers.

We merge the loan-level data with the balance sheets of the quasi-census of non-financial firms included in the Central Balance Sheet Data Office Survey (CBSDO). This dataset is derived from the accounts filed with the Spanish Commercial Register. It contains the balance sheets and profit and loss accounts, as well as other non-financial characteristics such as industry, year of incorporation, and demographic status, among others, for an average of more than 750,000 non-financial corporations with an adequate reporting quality per year. We apply several filters to the CBSDO data to define our final sample. We exclude firms with financial ratios that may not be comparable with those of the rest of firms, as their goal is not profit maximization, such as state-owned companies, local corporations, non-profit organizations, membership organizations, associations and foundations and religious congregations. We also remove holding companies because their financial information may not be comparable with those of the rest of firms. Our sample does not include foreign companies and permanent establishments of entities that do not reside in the country because they cannot be matched with the CCR. Financial firms and companies that do not belong to the market economy are also excluded according to the NACE industry classification.[8] Given that the public guarantees program was approved in March 2020 we use firms' balance-sheets as of December 2019.

Our analyses are performed on several samples. To study firms' access to guaranteed loans, we use a sample that consists of 209,941 firms that received new bank financing of any type between March 2020 and February 2021. We restrict the sample to those firms that were eligible to receive public guarantees according to the institutional framework section. Panel A of Table 1 summarizes the main characteristics of firms in this sample. ICO credit represents 65% of the new credit obtained by firms in our sample, the vast majority of them SMEs. Around 25.9% of these firms exhibit a default probability higher than 1% based on the information available as of December 2019. Moreover, 21.6% of firms in our sample operate in sectors that were severely affected by the COVID-19 pandemic (i.e., sectors in which sales fell by more than 15%). On the positive side, the average firm in our sample exhibited a good solvency ratio, a positive profitability and relatively high liquidity buffers before the pandemic. Another interesting feature of the data is that only 20.7% of firms that did not have bank debt as of December 2019 obtained credit between March 2020 and February 2021. This is telling especially if one considers that around 50% of non-financial corporations in Spain do not have bank credit in their balance-sheets.

[8] In particular, we exclude sectors 64, 65, 66, 84, 94, 97, 98, and 99 according to the NACE classification.

To study the supply of guaranteed credit to captive borrowers, we use a sample that contains bank-firm relationships. Panel B of Table 1 contains information on the distribution of the ratio of new ICO loans over the total amount of new credit at the firm-bank level, as well as on the distribution of captive borrowers. As we explain below in detail, a firm is defined to be captive to a bank if it is risky and has previous debt with that bank. Consistently with the information at the firm level, on average 66% of the credit granted by each bank to the firms in our sample during the period of reference had public guarantees. Finally, on average 23% of bank-firm relationships correspond to captive firms.

We use a loan-level dataset to understand the extent to which the benefits of guarantees were passed through to different firms. This sample consists of approximately one million loans granted between March 2020 and February 2021 for which we have information on interest rates and other loan characteristics, as detailed in Panel C of Table 1. The average interest rate for the total sample of loans is 2.57%, and around 32% of the loans in the sample have a public guarantee.

6.2 Results

6.2.1 Firm access to ICO loans

We first study whether riskier firms obtain on average more guaranteed credit. To do so, we propose a regression analysis in which the dependent variable ($ICO/Total_f$) is the ratio of the total amount of new ICO loans obtained by a given firm during the period March 2020 – February 2021 over the total amount of new loans (ICO and non-ICO loans) obtained during the same period. We then regress $ICO/Total_f$ on a series of variables that proxy for firm risk:

$$ICO/Total_f = \beta Risk_f + \delta X_f + \gamma_{ls} + \varepsilon_f \tag{25}$$

The term $Risk_f$ refers to firm-f risk measures, which are computed using balance sheet information as of December 2019. Our first measure is a dummy variable that takes value one if firm f's estimated probability of not being able to honor its debt and/or miss debt payments exceeds 1%.[9] The expected default probability is obtained based on the methodology developed by Blanco et al. (2023) for the Banco de España internal credit assessment, which extends the approach of Altman (1968) to Spanish firms.[10] It does not just capture the ex-ante risk of formal

[9]According to the Eurosystem credit assessment framework, an asset is eligible as collateral as long as their expected default probability of default is below 1%.

[10]We consider not only firm-specific and global factors as in Blanco et al. (2023), but also sectorial risk.

default (i.e., a firm filing for bankruptcy), but also the risk of delinquency. Our second measure is a dummy variable that denotes whether the firm operates in a sector that has been severely affected by the pandemic, defined as a sector in which sales fell by more than 15% during 2020.[11] Our third variable is a measure of liquidity risk in the form of a dummy variable, which takes value one when the liquidity needs of the firm lie in the top tercile of the distribution. Liquidity needs are defined as the shortfall between revenue and outlays, with the latter including costs related to the firm's operating activity (inputs, salary costs, debt interest), the repayment of outstanding financial and non-financial debt, and fixed asset investment.[12]

X_f is a vector that contains controls at the firm level to deal with the initial existence of bank debt, its profitability (ROA), size (logarithm of total assets), leverage (equity over total assets), and liquidity (cash and equivalents over total assets), while γ_{ls} denotes the use of location-size fixed effects.[13] Since we aggregate all ICO loans received during the first year of the public-guarantees program at the firm level, we cannot use firm fixed-effects. In its place, we compare the reliance on ICO credit by firms that – according to the aforementioned characteristics – are similar and operate in the same zip-code.

Results obtained from the estimation of equation (25) are reported in Table 2. Column (1) corresponds to the case in which we denote a firm as risky if its default probability is above 1%. We find that the proportion of ICO credit is 5 percentage points (pp) higher for risky firms than it is for relatively safe firms. Similar results are obtained when we use risk measures based on whether the firm operates in an affected sector (column (2)) or it has high liquidity needs (column (3)). The findings are robust to including all three risk measures simultaneously (column (4)), suggesting that they each capture a different type of risk. In line with the theory, these results suggest that riskier firms benefited to a larger extent from loan guarantees.

These results are computed by aggregating all newly-originated loans, regardless of their maturity. However, since the maturity of ICO loans differed significantly from that of non-ICO loans, this dependent variable may be biased downward. Intuitively, the volume of total credit that we compute for the sample period may be artificially "inflated" by the rolling-over of short-

[11]For the Spanish economy, these sectors include: accommodation and food services, manufacturing and refining of oil, social and cultural services, transportation and storage, manufacturing of textiles, and manufacturing of transport equipment. .

[12]Bank debt maturities are taken from the CCR as at March 2020, while for other debt the outstanding amount of short-term debt on firms' balance sheets in 2019 (according to the CBI) is used. For more details, see Blanco et al. (2021).

[13]We do not saturate this specification with industry fixed-effects because we use the industry as a measure of risk (i.e., depending on how different sectors were affected by the pandemic). The location fixed-effects are defined at zip-code level. The size fixed-effects correspond to the four cuategories considered by the European Commission (EC) definition: micro, small, medium-sized and large.

term non-ICO loans.[14] To deal with this effect, Table A1 in the Appendix reports the results to regression (25) when we compute the dependent variable by excluding loan renovations. Results are fully consistent with those reported in Table 2.

6.2.2 Allocation of ICO loans to captive firms

We now turn to the second prediction of the model: all else equal, banks should have an incentive to extend ICO loans to their captive borrowers. In the data, we study whether captive firms receive a larger share of ICO credit relative to total credit during the sample period. In our baseline specification, we say that a firm f is captive to bank b if it is considered ex-ante risky (i.e., the probability of default as of December 2019 is higher than 1%) and has a previous credit relationship with bank b.

Our main regression is as follows:

$$ICO/Total_{fb} = \beta Captive_{fb} + \delta X_f + \gamma_{ilsr} + \gamma_b + \varepsilon_{fb} \tag{26}$$

The dependent variable $ICO/Total_{fb}$ denotes the ratio of ICO loans as a share of total loans (ICO and non-ICO) obtained by firm f from bank b between March 2020 and February 2021. The variable of interest $Captive_{fb}$ denotes whether firm f is captive to bank b according to the definition outlined above. The vector X_f contains the same set of firm characteristics as in equation (25). γ_{ilsr} denotes fixed effects at the industry-location-size-risk level, while γ_b denotes the use of fixed-effects at the bank level to capture unobserved shocks to bank credit supply.[15]

Results are reported in column (1) of Table 3. As the theory predicts, captive borrowers receive a significantly higher share of ICO-credit relative to non-captive borrowers. At 3 pp, the difference is also economically significant. The table also shows that the effect of being

[14]As an example, consider the case of a firm that does not have any bank debt but receives a non-ICO loan from a given bank for an amount of €100.000 in March 2020. Suppose moreover that this is a monthly loan, which is renovated every month until the end of our sample period. Finally, suppose that the firm also receives an ICO loan for the same amount in March 2020, with a maturity of 5 years. The value associated to the dependent variable in equation (25) for that firm would be 1/13, but this would be misleading, since the fraction of outstanding ICO loans over total credit in February 2021 would rise to 50%.

[15]Industry corresponds to the 4-digit NACE code, location is defined at the zip-code level, size corresponds to four categories of firms according to the EC definition of size (micro, small, medium-sized and large firms) and risk corresponds to the credit quality step (CQS) categories defined by the ECB. We define these categories based on the 1-year estimated default probabilities of firms. CQS1 and CQS2 correspond to PD lower than 0.1% and CQS 3 comprises firms with a PD between 0.1% and 0.4%. All these categories of risk (CQS1 – CQS3) correspond to firms that can be classified as investment grade corporations. The firms categorized in CQS4 – CQS8 correspond to the high-yield category. The specific cutoff points of the CQS in this category are: between 0.4% and 1% (CQS4), between 1% and 1.5% (CQS5), between 1.5% and 3% (CQS6), between 3% and 5% (CQS7) and above 5% (CQS8).

captive is stronger for firms operating in severely affected sectors.

We perform numerous robustness tests. Table A2 in the Appendix shows that results are robust to excluding loan renovations from our measure of credit in the dependent variable. The table also shows that results are robust to excluding bank-firm pairs with an exceptionally low average maturity of outstanding credit (i.e., below three months as of February 2020). This is an alternative way to check that our results are not driven by loan renovations determined by the ex-ante structure of maturities in certain bank-firm relationships. Finally, Table A3 in the Appendix shows that these results are also robust to different measures of firm captivity, where the dummy indicating a preexisting relationship between firm f and bank b is alternatively replaced by one indicating whether bank b is firm f's main bank, or whether it has a share of outstanding credit above 50%.

6.2.3 Terms of ICO loans to captive firms

The third prediction of the theory refers to banks' appropriation of the surplus created by guarantees. To test this prediction, we study the pass-through of credit guarantees to the interest rates paid by firms on ICO loans. In particular, we regress the interest rate paid by firm f to bank b on loan j on: (i) a dummy variable that denotes whether firm f is captive to bank b; (ii) a dummy variable that indicates whether loan j has an ICO guarantee; (iii) the interaction of these two variables, and (iv) firm and loan characteristics and fixed effects. One clarification relative to Equation (26) is that now fixed effects are indexed by time, as we use month fixed effects to deal with changing conditions over the sample period, and γ_c is used to control for loan characteristics through dummy variables (i.e., maturity buckets, ten in total corresponding to each decile of the distribution, and type of credit - financial credit, leasing, ... - for which we have both ICO and non-ICO loans).

Formally, we run the following regression:

$$
\begin{aligned}
i_{fbjt} &= \beta_1 \cdot Captive_{fb} + \beta_2 \cdot ICO_{fbjt} + \beta_3 \cdot Captive_{fb} \cdot ICO_{fbjt} \\
&\quad \delta X_f + \gamma_{ilsrt} + \gamma_{bt} + \gamma_c + \varepsilon_{fbjt}
\end{aligned} \tag{27}
$$

Table 4 contains these estimation results. Column (1) removes the variable $Captive_{fb}$ and its interaction to estimate the discount offered on the average ICO loan regardless of whether the beneficiary is captive or not. This exercise confirms the existence of a substantial interest-rate discount (around 36 bp) on ICO loans. Column (2) shows that this discount was non-existing for captive borrowers, however, as β_2 is positive and significant and the linear combination of

β_1 and β_2 is not satistically different from zero. Thus, in line with the theory, the evidence suggests that although captive borrowers were likely to receive ICO loans from their banks, they did not benefit from lower interest rates on these loans even though they were publicly guaranteed.

Columns (3) and (4) compute the interest rate pass-through for firms in affected sectors. The key takeaways are that ICO loans commanded a lower interest rates than non-ICO loans, and captive firms paid higher interest rates than non-captive firms. The premium paid by captive firms in ICO loans is double the one obtained for the whole sample of firms, and captive firms in affected sectors did not face a discount in ICO loans (i.e., the linear combination of β_1 and β_2 is not statistically different from zero).

Our captive variable is a combination of two things: risk (as captured through the probability of default) and a pre-existing relationship with a bank. Tables A4 and A5 in the Appendix show that our results regarding the allocation of ICO loans and the interest rate on these loans are driven by the interaction of both aspects. In addition, we find similar results when we use firm-time fixed effects to control for credit demand (Table A6).

We conclude with a final robustness check. Thus far, we have used interest rates net of fees because the latter are not available in the credit registry at the loan level. However, we have aggregate information regarding fees on new operations on a monthly basis, and also granular information on fees at the loan level for ICO loans. This allows us to calculate the weighted average fees associated to new ICO loans relative to those associated to all new loans. Our main results remain unchanged once fees are taken into account. First, the fees associated to non-ICO loans are higher than those associated to ICO loans, so that differential fees cannot account for the lower rates on ICO loans illustrated in Figure 2 and estimated in equation (27).[16] Second, the finding that captive firms paid a premium on ICO loans relative to non-captive firms is not significantly affected once fees are not taken into account.[17]

Finally, to assess whether banks actually made money by granting guarantees to captive borrowers, we estimate the expected revenue of a loan with public guarantees granted to a captive borrower in excess of that associated to a loan without public guarantees granted to a non-captive borrower with similar characteristics (adjusted expected revenue, hereafter). Concretely, the adjusted expected revenue consists of three parts: interest rate payments plus the coverage of the guarantee in case of default, minus the remuneration of the guarantee.

[16] See Figure A1 in the Appendix

[17] We estimate variation of equation (27) on the sample of ICO loans for which we have information on fees, using as the dependent variable the fees of each loan in percentage points. The findings, which are reported in Table A7 in the Appendix, suggest that the difference in fees charged to captive and non-captive firms that receive an ICO loan was not statistically different from zero.

First, the excess revenue from interest rate payments is obtained as the difference between the interest rate charged on each specific loan granted to a captive borrower in excess of the average interest rate charged by the same bank in the same month to a borrower that operates in the same industry and zip-code and with similar risk and size for the same type of loan. This spread is multiplied by one minus the one-year probability of default and the loan amount. Second, the coverage of the guarantee in case of default is obtained as the one-year probability of default times the coverage of the guarantee, which is obtained as the product of the loan amount at origination and the percentage coverage of the guarantee (80% for SMEs and 70% for non-SMEs). Third, the remuneration of the guarantee is obtained as the remuneration in percentage points times the loan amount and the coverage of the guarantee.[18] The annual adjusted expected revenue amounts to more than 1.2% of the total amount of credit granted to captive borrowers. However, it exhibits a high degree of heterogeneity and reaches 0.7% and 1.5% for the 25th and 75th percentiles, respectively.

7 Conclusions

Many countries implemented large-scale guarantee programs to sustain private credit in response to the COVID-19 pandemic. A little-understood aspect of such guarantees is the role that banks play in allocating them and, thus, in shaping their economic effects. We have studied this role in an economy where entrepreneurial effort is crucial for efficiency but it is not contractible, giving rise to a debt overhang problem.

The key insight of the model is that banks have distorted incentives when deciding how to allocate guarantees. In particular, they are inclined to grant guaranteed credit to riskier firms in order to maximize the expected payments from the government. Among these, banks prioritize highly-indebted captive firms, from whom they can extract a higher share of the surplus created by the guarantee. This allocation of guarantees is suboptimal, as a social planner planner would tilt it towards more productive, safer firms, and would fully pass-through the benefits of guarantees in the form of lower repayments.

The model's main predictions are confirmed on the universe of all credit guarantees granted

[18]The remuneration of the guarantees for loans granted to non-financial corporations up to 1.5 million euros was 20 bp on the balance of the total amount guaranteed. For loans with a nominal amount greater than 1.5 million euros, the remuneration varies according to the size of the firm and the maturity of the loan. For instance, for the case of SMEs the remuneration is 20, 30 and 80 bp for new loans with maturities up to 1 year, from 1 to 3 years and from 3 to 5 years, respectively. The remuneration of guarantees to firms that cannot be considered SMEs for new loans with maturities up to 1 year, from 1 to 3 years and from 3 to 5 years is 30, 60, and 120 bp, respectively.

in Spain following the outbreak of COVID-19: (i) riskier firms obtained a substantially higher share of guaranteed credit between March of 2020 and February of 2021; (ii) among these, firms that were captive to their creditor bank obtained a significantly higher share of guaranteed credit relative to non-captive firms, and; (iii) while non-captive firms obtained a significant interest-rate discount on guaranteed credit, there was no such discount for captive firms.

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A Figures and Tables

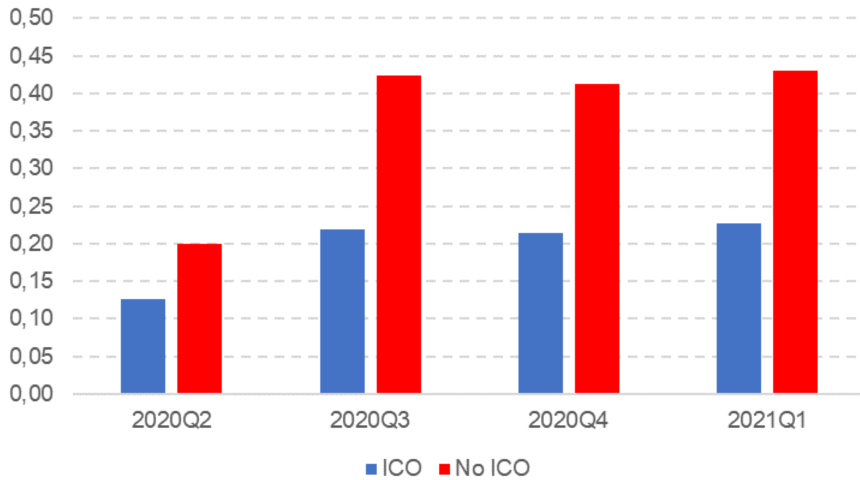

Figure A1: **Average Loan Fees (in %).**

Table 1: **Descriptive Statistics.** Panel A contains descriptive statistics on firms' characteristics. ICO/Total is the ratio of the total amount of new ICO loans obtained by a given firm from all banks in our sample during the period March 2020 – February 2021 over the total amount of new loans (ICO and non-ICO loans) obtained during the same period. All firm characteristics are defined based on their financial statements as of December 2019. Risky (PD > 1%) is a dummy variable that is equal to one when the 1-year probability of default is higher than 1%, and zero otherwise. Affected sector is a dummy variable that is equal to one when the firm operates in a sector that is adversely affected by the pandemic (i.e., sales fell by more than 15% in 2020), and zero otherwise. Liquidity needs is a dummy variable that is equal to one when the liquidity needs of the firm lie in the top tercile of the distribution, and zero otherwise. The variable firms without bank debt takes value one when the firm did not have bank debt as of December 2019. SME indicates whether the firm is a micro, small, or medium-sized firm according to the EC definition. The rest of firm characteristics refer to its solvency (equity over total assets), liquidity (cash and equivalents over total assets), size (logarithm of total assets) and profitability (return on assets). Panel B contains descriptive statistics at the firm-bank level. ICO/Total is the ratio of the total amount of new ICO loans obtained by a given firm from a given bank during the period March 2020 – February 2021 over the total amount of new loans (ICO and non-ICO loans) obtained during the same period from the same bank. Captive firm is a dummy variable that denotes whether a given firm can be considered as captive by a given bank and it occurs when the firm is risky (its PD is above 1%) and had a previous credit relationship with that bank. ICO/Total (Mat >Feb21), ICO/Total (Renov) and ICO/Total (Mat >1Q) are analogous to ICO/Total but the first variable uses all loans that mature after February 2021, the second one excludes those that are renovated, and the last one is based on bank-firm pairs for which the average maturity of the outstanding credit as of February 2020 was longer than three months. Panel C reports descriptive statistics on the loan interest rate and the dummy variable that denotes whether the loan has an ICO guarantee.

Panel A. Descriptive statistics at the firm level.

	Units	Obs	Mean	Median	SD	10th Pctile	90th Pctile
ICO/Total	%	209941	65.0	87.3	41.1	0	100
Risky (PD > 1%)	%	209941	25.9	0	43.8	0	100
Affected sector	%	209941	21.6	0	41.1	0	100
High liquidity needs	%	209941	32.0	0	46.6	0	100
Firms without bank debt	%	209941	20.7	0	40.5	0	100
SME	%	209941	97.6	100	15.3	100	100
Equity / TA	%	209941	33.1	33.7	34.7	-0.1	76.7
Cash and equivalents / TA	%	209941	14.8	6.9	33.2	0.1	41.1
Log (TA)	-	209941	5.9	5.8	1.6	3.9	8.0
ROA	%	209941	3.6	2.7	14.9	-9.8	19.9

Panel B. Descriptive statistics at the bank-firm level.

	Units	Obs	Mean	Median	SD	10th Pctile	90th Pctile
ICO/Total	%	269524	65.98	100	43.07	0	100
Captive firm	%	269524	23.09	0	42.14	0	100
ICO/Total (Mat>Feb21)	%	247955	71.03	100	42.33	0	100
ICO/Total (Renov)	%	253506	65.64	100	43.46	0	100
ICO/Total (Mat>1Q)	%	254954	67.70	100	42.81	0	100

Panel C. Descriptive statistics at the loan level.

	Units	Obs	Mean	Median	SD	10th Pctile	90th Pctile
Interest rate	%	1080430	2.57	352.17	1.62	1	4.644
ICO Loan	%	1080430	32.07	0	46.68	0	100

Table 2: **Firms' access to ICO loans.** This table reports the results obtained from the estimation of equation (25) in which the dependent variable is the ratio of the total amount of new ICO loans obtained by a given firm during the period March 2020 to February 2021 over the total amount of new loans (ICO and non-ICO loans) obtained during the same period and it is regressed on a series of variables that proxy for firms' risk. Column (1) contains the coefficients obtained when our measure of risk is a dummy variable that denotes if the probability that a firm will not be able to honor its debt and missed payments is higher than 1%. In column (2) we use a dummy variable that denotes whether the sector has been severely affected by the pandemic (i.e., sales fell by more than 15% in 2020). Column (3) contains the results obtained when we use a measure of liquidity risk which is a dummy variable that takes value one when the liquidity needs of the firm lie in the top tercile of the distribution. In column (4) we use the three risk measures jointly. All columns are estimated with a set of explanatory variables that enable us to control for the firm availability of bank credit or not, its profitability, size, leverage, and liquidity; and with location-size fixed effects. Standard errors (in brackets) are clustered by firm. *, **, and *** denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

Dep var: ICO/Total credit	(1)	(2)	(3)	(4)
Risky (PD>1%)	0.049***			0.049***
	[0.003]			[0.003]
Affected sector		0.070***		0.071***
		[0.002]		[0.002]
High liquidity needs			0.022***	0.012***
			[0.002]	[0.002]
Observations	204,459	204,459	204,459	204,459
R-squared	0.107	0.109	0.105	0.112
Firm Controls	YES	YES	YES	YES
Location-Size FE	YES	YES	YES	YES

Table 3: **Credit supply to captive borrowers.** This table reports the results obtained from the estimation of equation (26) in which the dependent variable is the ratio of the total amount of new ICO loans obtained by a given firm f from a bank b during the period March 2020 – February 2021 over the total amount of new loans (ICO and non-ICO loans) obtained during the same period from the same bank. The explanatory variable of interest Captive firm denotes whether a given firm f can be considered as captive by bank b. A firm is considered a captive borrower for a given bank if it is risky (its PD is above 1%) and had a previous credit relationship with that bank. Results for the whole sample of firms are reported in column (1) whereas in column (2) we report the results for subgroup of firms that were more severely affected by the pandemic. All columns are estimated with a set of explanatory variables that enable us to control for the firm availability of bank credit or not, its profitability, size, leverage, and liquidity; and with fixed effects at the industry-location-size-risk level (ILSR) and the bank level. Standard errors (in brackets) are clustered by firm. *, **, and *** denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

Dep var: ICO/Total credit	(1) All	(2) Affected
Captive firm	0.031***	0.049**
	[0.008]	[0.020]
Observations	186,538	33,902
R-squared	0.468	0.437
ILSR FE	YES	YES
Bank FE	YES	YES

Table 4: **Pass-through of credit guarantees: Captive vs non-captive.** This table reports the results obtained from the estimation of equation (27) in which the dependent variable is the interest rate of a given loan granted by bank b to firm f (in %) and the explanatory variables of interest are: (i) a dummy variable which denotes whether the firm is captive for the bank that grants the loan, (ii) a dummy variable that indicates whether the loan has an ICO guarantee and (iii) the interaction of these two variables. Column (2) contains the results obtained from the estimation of equation (27) whereas column (1) corresponds to a variation of equation (27) in which we remove the term captive and its interaction with the dummy denoting ICO loans. Columns (3) and (4) are analogous to columns (1) and (2) but the coefficients are estimated for those firms in sectors that were more severely affected by the pandemic (i.e., their sales fell by more than 15% in 2020). All columns are estimated with a set of explanatory variables that enable us to control for the firm availability of bank credit or not, its profitability, size, leverage, and liquidity and for the loan characteristics; and with fixed effects at the industry-location-size-risk-time level (ILSRT) and at the bank-time level. The last two rows provide the coefficent and standard errors for the linear combination of ICO Loan and Captive firm x ICO Loan. Standard errors (in brackets) are clustered by firm and bank. *, **, and *** denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

Dep var: Interest rate (%)	(1) All	(2) All	(3) Aff	(4) Aff
ICO Loan (a)	-0.357**	-0.409***	-0.434**	-0.504**
	[0.155]	[0.154]	[0.210]	[0.201]
Captive firm x ICO Loan (b)		0.161***		0.312***
		[0.039]		[0.076]
Captive firm		0.118**		0.060
		[0.053]		[0.167]
Observations	978,884	978,884	109,901	109,901
R-squared	0.580	0.580	0.624	0.624
ILSRT FE	YES	YES	YES	YES
Bank-Time FE	YES	YES	YES	YES
Loan Controls	YES	YES	YES	YES
(a) + (b)		0.248		0.192
		[0.158]		[0.242]

B Proofs

Proof of Proposition 3.1. First, consider those entrepreneurs with $\overline{p}_A \cdot \overline{B}_A - k \geq B$. By construction, if these entrepreneurs invested k and continued their projects, they would have enough cash flows to repay $\frac{B+k}{p_A}$, which is the lowest repayment they could obtain from competitive banks, and where p_A solves

$$A - \frac{B+k}{p_A} = C'(p_A). \tag{28}$$

It is immediate that these entrepreneurs generate enough surplus to avoid liquidation. Moreover, they will not accept a loan with a higher repayment, and their creditor bank will not be willing to renegotiate their debt downwards.

Second, consider those entrepreneurs with $\overline{p}_A \cdot \overline{B}_A - k < \lambda$. By construction, the bank will never be able to obtain more than λ from these entrepreneurs if they were to continue their projects. As liquidation ensures that the bank obtains λ (as we have supposed that $\lambda < B$), it is immediate that banks will liquidate the projects of these entrepreneurs.

Finally, consider those entrepreneurs with $\overline{p}_A \cdot \overline{B}_A - k \in [\lambda, B)$. As the creditor bank can extract more than λ from these entrepreneurs if their projects are continued, it is immediate that the bank strictly prefers to continue the project. These entrepreneurs, however, do not generate enough cash flows to repay $\frac{B+k}{p_A}$, and thus cannot access competitive markets for loans of size $B + k$. As a result, these entrepreneurs must renegotiate their existing debts. We have supposed that the renegotiation protocol is that the creditor bank makes a TIOLI offer to the entrepreneur. This means that the bank will offer the contract with the highest expected repayment, subject to the incentive and participation constraints of the entrepreneur, which is how contract $\overline{B}_A$ is defined. ■

Proof of Proposition 3.2. The result follows from Proposition 3.1 and the fact that $\bar{p}_A \cdot \bar{B}_A$ is increasing in A, as, all else equal, a higher A relaxes both constraints (5)-(6). The determination of the thresholds is given by Equations (8) and (9) and explained in the corresponding section. ■

Proof of Proposition 4.1. The proof of this Proposition is isomorphic to the one of Proposition 3.1, with the following two adjustments. First, as guarantees may increase the expected repayment a bank can expect from a given entrepreneur, our notion of debt capacity must be adjusted to $\overline{p}^g_A \cdot \overline{B}^g_A$ whenever $\overline{p}^g_A \cdot \overline{B}^g_A > \overline{p}_A \cdot \overline{B}_A$. Second, the bank now must decide who to grant a credit guarantee, where the opportunity cost of doing so is by ρ. We analyze this next.

Consider solvent entrepreneurs. By granting a guarantee to a solvent entrepreneur, the bank obtains $\rho \cdot x_A$. In turn, solvent entrepreneurs prefer a credit contract with a guarantee if the latter reduces their repayments, i.e., if $1 - p_A - \rho > 0$ as can be seen from (14). Moreover, for those entrepreneurs with $1 - p_A - \rho \geq 0$ both bank profits and reduction in repayments are maximized at $x_A = k$. It follows that $x_A = k$ for all entrepreneurs with $1 - p_A - \rho > 0$.

Consider captive entrepreneurs. By granting guarantees to a captive entrepreneur, the bank can increase their expected repayment by (at least) $(1 - p_A) \cdot x_A$. By observing (15), it follows that the bank's expected repayment net of the opportunity cost of granting the guarantee, $\rho \cdot x_A$, is maximized at $x_A = k$ for all entrepreneurs with $1 - p_A - \rho \geq 0$ and at $x_A = 0$ zero otherwise. ■

Proof of Corollary 1. Follows from $p_A(B_{1,A})$ being increasing in A, as, all else equal, a higher A implies a higher marginal benefit of effort. ■

Proof of Proposition 5.1. The determinants of b^g_A and B^g_A follow immediately from observation of the planner's problem. The allocation of guarantees, x^g_A, however, requires to show that $MB_A(\cdot)$ decreases in x. First, we have that $A - C'(p_A) = B_A > 0$ and that $-C''(p_A)\frac{dp_A}{dx_A} = \frac{dB_A}{dx_A}$. As $\frac{dp_A}{dx_A} > 0$, it remains to show that $\frac{dp_A^2}{d^2x_A} > 0$.

$$\frac{dp_A^2}{d^2x_A} = -\frac{2 \cdot p_A + [C'''(p_A) \cdot p_A^2 + 2 \cdot p_A \cdot C''(p_A)] \cdot \frac{dp_A}{dx_A}}{p_A \cdot (1 - p_A)} \cdot \left(\frac{dp_A}{dx_A}\right)^2 < 0. \tag{29}$$

■

C Generalization of the baseline model

To broadcast the main mechanism at play in the baseline model we made the following two assumptions. First, that all entrepreneurs had the same outstanding debt, B. Second, that this debt was high enough so that full repayment was not possible in the event of liquidation, i.e., $B > \lambda$. In this section we show how the equilibrium characterization changes when we allow entrepreneurs to have outstanding debt $B_{0,i} \sim^{iid} G$ with support in $[0, \bar{B}]$ with $\bar{B} > \lambda$.

First, it is easy to see that the equilibrium contracts are as those described in Proposition 3.1. As now entrepreneurs vary both in their productivity A_i and debt level $B_{0,i}$, we indexed them by i and adjust the proposition as follows:

Proposition C.1 *For entrepreneur i with productivity A_i there are three possibilities in equilibrium:*

1. $\bar{p}_i \cdot \bar{B}_i \geq B_{0,i} + k$*: the entrepreneur is solvent and she accepts contract*

$$\{b_i, B_{1,i}\} = \left\{ B_{0,i} + k, \frac{B_{0,i} + k}{p_i(B_{1,i})} \right\} \tag{30}$$

in the credit market to continue her project.

2. $\bar{p}_i \cdot \bar{B}_i \in [\lambda + k, B_{0,i} + k)$*: the entrepreneur is captive, her original debt is renegotiated down to* $\bar{p}_i \cdot \bar{B}_i - k$ *and she obtains contract*

$$\{b_i, B_{1,i}\} = \{\bar{p}_i \cdot \bar{B}_i, \bar{B}_i\}$$

in the credit market to continue her project.

3. $\bar{p}_i \cdot \bar{B}_i < \lambda + k$*: the entrepreneur is insolvent and her project is liquidated.*

Consider first those entrepreneurs with $B_{0,i} > \lambda$. These entrepreneurs are as the ones described in our baseline setting, and the continuation/investment decisions are characterized by Proposition 3.2. Note that now threshold A_h is indexed by B_0 as:

$$A_h(B_{0,h}) \quad : \quad \bar{p}_h \cdot \bar{B}_h = B_{0,h} + k \tag{31}$$

Next, consider those entrepreneurs with $B_{0,i} \leq \lambda$. These entrepreneurs are never captive to their bank because their debts are not renegotiated in equilibrium: their creditor bank can always liquidate the project to obtain full repayment (i.e., case 2. in Proposition C.1 never arises). As a result, entrepreneur i must borrow $b_i = B_{0,i} + k$ to continue her project, and she will choose to do so if and only if the value of continuation exceeds that of liquidation, i.e., when $A_i \geq \widetilde{A}(B_0)$ for

$$\widetilde{A}(B_0): \quad \widetilde{p} \cdot \widetilde{A} - C(\widetilde{p}) - k = \lambda \tag{32}$$

where $\widetilde{p}$ satisfies

$$\widetilde{A} - \frac{B_0 + k}{\widetilde{p}} = C'(\widetilde{p}).$$

This result is formalized in the following proposition.

Proposition C.2 *Consider the set of firms with $B_{0,i} < \lambda$. Then, there exist threshold $\widetilde{A}(B_0)$ weakly increasing in B_0, such that entrepreneurs with*

1. *$A_i \geq \widetilde{A}(B_{0,i})$ borrow to pay back their original debt and continue their projects.*

2. *$A_i < \widetilde{A}(B_{0,i})$ liquidate their projects and pay back their original debt.*

Proof. Follows from the fact that project surplus increases in A. ■

Total output in this economy is then given by:

$$Y = \underbrace{\lambda \cdot \left(\int_0^\lambda F\left(\underline{A}\left(B_0\right)\right) \cdot dG\left(B_0\right) + F\left(\underline{A}\right) \cdot G\left(\lambda\right) \right)}_{\text{Output of Insolvent Entrepreneurs}} + \underbrace{\int_\lambda \int_{\underline{A}(B_0)}^{\bar{A}(B_0)} \bar{y}\left(A\right) \cdot dF\left(A\right) \cdot dG\left(B_0\right)}_{\text{Output of Captive Entrepreneurs}} \tag{33}$$
$$+ \underbrace{\int_0^\lambda \int_{\underline{A}(B_0)} y\left(B_0, A\right) \cdot dF\left(A\right) \cdot dG\left(B_0\right) + \int_\lambda \int_{\bar{A}(B_0)} y\left(B_0, A\right) \cdot dF\left(A\right) \cdot dG\left(B_0\right)}_{\text{Output of Solvent Entrepreneurs}}$$

where $\underline{A}(B_0) = A_\ell$ and $\bar{A}(B_0) = A_h(B_0)$ when $B_0 > \lambda$, $\underline{A}(B_0) = \bar{A}(B_0) = \tilde{A}(B_0)$ otherwise, and

$$\bar{y}\left(A\right) = p_A(\bar{B_A}) \cdot A - C\left(p_A(\bar{B_A})\right) - k \tag{34}$$
$$y\left(B_0, A\right) = p_A\left(B_0\right) \cdot A - C\left(p_A\left(B_0\right)\right) - k \tag{35}$$

The analysis of credit guarantees and their allocation within this setting is isomorphic to the one in the baseline model once we update the characterization of who is liquidated, captive, or solvent following the results in this Appendix.

D Robustness Exercises

Table A1: **Firms access to guarantee loans. Dealing with rollovers/renovations.** This table reports the results of a regression analysis similar to that in column (4) of Table 2 (Column (1) in this table which is reported for comparability) but using different sample of loans to define the dependent variable. In column (2) we use all loans that mature after the end of our sample period (February 2021) to obtain the dependent variable whereas in column (3) we exclude loans that are renovated over our sample period. Standard errors (in brackets) are clustered by firm. *, **, and *** denote significance at the 10 %, 5%, and 1% level (two-tail) respectively.

Dep var: ICO/Total credit			
	(1)	(2)	(3)
Risky (PD>1%)	0.049***	0.047***	0.056***
	[0.003]	[0.003]	[0.004]
Affected sector	0.071***	0.055***	0.071***
	[0.002]	[0.002]	[0.002]
High liquidity needs	0.012***	0.022***	0.010***
	[0.002]	[0.002]	[0.002]
Observations	204,459	194,843	197,147
R-squared	0.112	0.109	0.115
Firm Controls	YES	YES	YES
Location-Size FE	YES	YES	YES

Table A2: **Credit supply to captive borrowers. Dealing with rollovers/renovations.** This table reports the results of a regression analysis similar to that in column (1) of Table 3 (column (1) in this table which is reported for comparability) but using different sample of loans to define the dependent variable. In column (2) we use all loans that mature after the end of our sample period (February 2021) to obtain the dependent variable whereas in column (3) we exclude loans that are renovated over our sample period. Finally, in column (4) we report the results for the bank-firm pairs for which the average maturity of the outstanding credit as of February 2020 was longer than three months. Standard errors (in brackets) are clustered by firm. *, **, and *** denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

	(1) Baseline	(2) Mat>21Feb	(3) Renov	(4) Mat>1Q
Captive firm	0.031***	0.057***	0.031***	0.048***
	[0.008]	[0.009]	[0.008]	[0.008]
Observations	186,538	166,069	170,979	171,550
R-squared	0.468	0.458	0.474	0.467
ILSR FE	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES

Table A3: **Credit supply to captive borrowers. The role of the main bank.** This table reports the results obtained from a variation of equation (26) in which we redefine the variable captive depending on whether firms are captive to their main bank or not. The results in column (1) correspond to those in column (1) of Table 3 and are reported for comparability. In column (2) we consider that a firm can be defined as captive just for its main bank. In column (3) we use a more restrictive definition of captivity such that firms can be defined as captive just for its main bank whenever the amount of credit outstanding granted by the main bank is higher than 50%. In all columns being captive is conditioned on having a probability of default as of December 2019 higher than 1%. All columns are estimated with a set of explanatory variables that enable us to control for the firm availability of bank credit or not, its profitability, size, leverage, and liquidity and for the loan characteristcs; and with fixed effects at the industry-location-size-risk level (ILSR) and the bank level. Standard errors (in brackets) are clustered by firm. *, **, and *** denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

Dep var: ICO/Total credit	(1)	(2)	(3)
Captive (Baseline)	0.031***		
	[0.008]		
Captive (Main bank)		0.014***	
		[0.004]	
Captive (Bank with share > 50%)			0.014**
			[0.006]
Observations	186,538	186,538	186,538
R-squared	0.468	0.468	0.468
ILSR FE	YES	YES	YES
Bank FE	YES	YES	YES

Table A4: **Access to credit guarantees: The role of risk and relationship lending.** This table reports the results obtained from a variation of equation (26) in which we consider the two characteristics that define a captive borrower (risk and bank relationships) separately and their interaction. Given that we use the risk as an explanatory variable, we use fixed effects at the industry-location-size-time level (i.e., we do not interact the set of fixed-effects with the risk buckets based on CQS). Column (1) contains the results for the whole sample of firms whereas column (2) reports the results for the firms that operate in sectors that have been more severely affected by the pandemic (i.e., their sales fell by more than 15% in 2020). All columns are estimated with a set of explanatory variables that enable us to control for the firm availability of bank credit or not, its profitability, size, leverage, and liquidity and for the loan characteristics; and with fixed effects at the industry-location-size-time level (ILST) and at the bank-time level. Standard errors (in brackets) are clustered by firm. *, **, and *** denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

Dep var: ICO/Total credit	(1) All	(2) Affected
Captive firm	0.031***	0.036**
	[0.007]	[0.015]
Risky (PD > 1%)	0.001	-0.006
	[0.007]	[0.015]
Previous bank-firm relationship	-0.010***	-0.003
	[0.004]	[0.007]
Observations	207,353	38,731
R-squared	0.427	0.387
ILST FE	YES	YES
Bank FE	YES	YES

Table A5: **Pass-through of credit guarantees: The role of risk and relationship lending.** This table reports the results obtained from a variation of equation (27) in which we consider the two characteristics that a define a captive borrower (risk and bank relationships) separately such that we include these variables, the dummy denoting whether the loan has a public guarantee and all the interactions associated to the three variables. Given that we use the risk as an explanatory variable, we use fixed effects at the industry-location-size-time level (ILST) (i.e., we do not interact the set of fixed-effects with the risk buckets based on CQS). The analysis is conducted based on the firms that operate in sectors that were more severely affected by the pandemic (i.e., their sales fell by more than 15% in 2020). The results are reported in column (2). Column (1) contains the results obtained when we consider the risk and the existence of previous relationships jointly (as in column (4) of Table 4) and industry-location-size-risk-time level (ILSRT) instead of ILST fixed-effects as in column (2). Column (1) is reported for comparability. Besides these sets of fixed-effects, all columns are estimated with a set of explanatory variables that enable us to control for the firm availability of bank credit or not, its profitability, size, leverage, and liquidity and for the loan characteristics; and with fixed effects at the bank-time level. Standard errors (in brackets) are clustered by firm and bank. *, **, and *** denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

Dep var: Interest rate (%)	(1) Affected	(2) Affected
ICO Loan	-0.504**	-0.577***
	[0.201]	[0.184]
Prev. Rel		0.129***
		[0.043]
Risky		0.118
		[0.086]
Prev. Rel. x Risky	0.060	-0.042
	[0.167]	[0.088]
Prev. Rel. x ICO Loan		0.028
		[0.057]
Risky x ICO Loan		0.138*
		[0.070]
Prev. Rel. x Risky x ICO Loan	0.312***	0.132*
	[0.076]	[0.077]
Observations	109,901	121,886
R-squared	0.624	0.618
ILSRT FE	YES	NO
ILST FE	NO	YES
Bank-Time FE	YES	YES
Loan Controls	YES	YES

Table A6: **Credit supply to captive borrowers. Alternative controls for demand.** This table reports the results of a regression analysis similar to that in Columns (2) and (4) of Table 4 (Columns (1) – (2) in this table which are reported for comparability) but using firm-time fixed effects to control for demand. Results for the whole sample of firms are reported in column (3) whereas column (4) contains the ones obtained for the firms that operate in sectors that have been more severely affected by the pandemic (i.e., their sales fell by more than 15% in 2020). All columns are estimated with a set of explanatory variables including whether a firm has bank credit or not, its size, leverage, and liquidity, along with loan characteristics and bank-time level fixed effects. In columns (1) and (2) we control for credit demand using fixed effects at the industry-location-size-risk- time level (ILSRT) whereas in columns (3) and (4) we control for demand using firm-time fixed effects. Standard errors (in brackets) are clustered by firm and bank. *, **, and *** denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

Dep var: Interest rate (%)	(1) All	(2) Affected	(3) All	(4) Affected
ICO Loan	-0.409***	-0.504**	-0.385***	-0.496**
	[0.154]	[0.201]	[0.145]	[0.190]
Captive Firm x ICO Loan	0.161***	0.312***	0.132***	0.240***
	[0.039]	[0.076]	[0.038]	[0.088]
Captive Firm	0.118**	0.060	0.109**	0.094
	[0.053]	[0.167]	[0.047]	[0.183]
Observations	978,884	109,901	947,755	99,265
R-squared	0.580	0.624	0.582	0.628
ILSRT FE	YES	YES	NO	NO
Firm-Time FE	NO	NO	YES	YES
Bank-Time FE	YES	YES	YES	YES
Loan Controls	YES	YES	YES	YES

Table A7: **Fees of loans with credit guarantees: Captive vs Non-Captive** This table reports the results obtained from a variation of equation (27) that is estimated on the sample of ICO loans in which the dependent variable is the fees of each individual loan (in %) and the explanatory variable of interest is a dummy which indicates whether firm f can be considered as captive by bank b. Note that we do not have information on fees for loans without public guarantees and as a consequence we cannot estimate the coefficients in (27) that involve the dummy variable that is equal to one for ICO loans. Column (1) contains the results for the whole sample of firms whereas column (2) reports the results for the firms that operate in sectors that were more severely affected by the pandemic (i.e., their sales fell by more than 15% in 2020). All columns are estimated with a set of explanatory variables including whether a firm has bank credit or not, its size, leverage, and liquidity, along with loan characteristics and industry-location-size-risk-time (ILSRT) and bank-time fixed effects. Standard errors (in brackets) are clustered by firm and bank. *, **, and *** denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

Dep var: Fees (%)		
	(1)	(2)
	All	Affected
Captive Firm	-0.005	-0.012
	[0.010]	[0.025]
Observations	115,347	22,446
R-squared	0.689	0.703
ILSRT FE	YES	YES
Bank-Time FE	YES	YES
Loan Controls	YES	YES