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Banks vs. Firms: Who Benefits from Credit Guarantees?

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Abstract

Governments often support private credit with guarantee schemes, compensating lenders for borrower defaults. Such schemes often rely on banks to allocate guarantees among borrowers, but how banks do so is not well understood. We study this in an economy where entrepreneurial effort is crucial for efficiency but not contractible, creating a debt overhang problem. Credit guarantees can alleviate this problem only if they lower repayment obligations. We show that banks follow a pecking order, prioritizing risky, highly indebted firms from whom they extract more guarantee surplus by increasing repayment obligations. The competitive equilibrium is inefficient: a social planner would tilt the allocation towards more productive firms and pass all benefits through lower repayments. Our findings align with evidence from guarantees granted in Spain post-COVID.

JEL Codes: G10,G18,G21,G28

Keywords: Credit guarantees, debt overhang, liquidations.

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1 Introduction

Governments often support private credit through guarantee schemes, which compensate private lenders in the event of borrower default. Some of these schemes are used on a regular basis to support a particular type of credit (e.g., the US federal government guarantees mortgages through the Federal Housing Administration and the Department of Veterans Affairs), while others are put in place during times of crisis. For instance, during the recent Covid pandemic, credit guarantee schemes were some of the largest policy programs implemented in Europe: as early as April 2020, Germany, France and Italy had jointly committed about €1.9 billion to guarantee private credit.

A key feature of guarantee programs is that they rely on private lenders to allocate the guarantees among borrowers. In most scenarios, governments commit to a volume of guarantees while banks decide who receives guaranteed loans and at which terms. This raises a number of key 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? 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 also have pre-existing debts with their *creditor banks.* The only friction we consider is that entrepreneurial effort, which increases the probability of project success, is not contractible. This gives rise to a moral hazard problem (debt overhang): namely, debt reduces entrepreneurial effort and thus economic efficiency, leading to a decline in output and inefficient liquidations.

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 is able to borrow at the market interest rate enough to repay her pre-existing debt and to invest in her project. An entrepreneur is *captive* if she can only borrow enough to repay her pre-existing debt and to invest in her project if she obtains a subsidized interest rate from her creditor bank. The creditor bank grants this subsidy in the understanding that it is better to reduce the entrepreneur's debt burden – boosting her effort and thus her expected repayment – than to liquidate her outright. Finally, an entrepreneur is *insolvent* if she is unable to obtain enough credit and her project is liquidated. In this environment, aggregate output is decreasing in the credit needs of entrepreneurs because these aggravate the debt overhang and result in (i) more liquidations, (ii) more captive entrepreneurs, and (iii) lower entrepreneurial effort.

We study the effectiveness of credit guarantees in alleviating the debt overhang problem. Our goal is not to characterize an optimal policy, but rather to understand the effects of public credit guarantees that are allocated through banks (as is commonly done in practice). To do so, we assume that the government provides a total number of guarantees, which are distributed across banks for them to allocate among entrepreneurs. The effect of guarantees on efficiency depends on which entrepreneurs receive them and on how they affect entrepreneurial effort. If the interest rate faced by entrepreneurs does not change when they receive a guarantee, i.e., the expected payments of guarantees are fully appropriated by banks, then there is no effect on entrepreneurial effort nor output. Instead, if these payments are passed on to entrepreneurs in the form of a lower interest rate, entrepreneurial effort and thus output increase.

In equilibrium, all entrepreneurs whose risk exceeds a certain threshold receive guarantees but the conditions at which they do so differ. Solvent entrepreneurs benefit the most. Intuitively, bank competition implies that some of the expected payments generated by the guarantee are passed on to these entrepreneurs in the form of lower interest rates. Captive entrepreneurs are instead hurt by guarantees. This result is surprising but intuitive: banks' strong bargaining position relative to these borrowers implies that none of the payments generated by the guarantee are passed on to them. In fact, the interest rate subsidy received by captive entrepreneurs is reduced when loans are guaranteed because, at the margin, banks care less about the success of these borrowers when the guarantee compensates them in the event of failure.

Our results imply that banks follow a pecking order when allocating credit guarantees, granting them first to risky, captive entrepreneurs. These are the entrepreneurs for whom expected guarantee payments from the government are largest, and from whom the bank can fully extract these payments. In fact, banks may decide to keep alive risky, negative-NPV projects of existing borrowers just to collect the guarantee. Moreover, when guarantees are scarce, banks are also able to extract rents from solvent entrepreneurs as they do not fully pass on to them the benefits of guarantees.

We explore the efficiency properties of this allocation of credit guarantees by banks. 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, the planner fully passes on the expected payments of guarantees to entrepreneurs in the form of a lower interest rate. All else equal, this boosts effort and increases the social surplus. Second, the planner takes into account the social benefit of guarantees through their effect on entrepreneurial effort, and allocates guarantees wherever their social marginal benefit is largest. As a result, the planner tilts the allocation of guarantees towards more productive, safer entrepreneurs.

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, by mid-2022, guaranteed credit still 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 over whom they have a stronger bargaining position. 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 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. To test for this prediction, we measure the pass-through of guarantees to the contractual interest rates of ICO-loans, and analyze how it 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

[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 7 for a detailed description of how each measure of risk is constructed.

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 (2023) 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. Jiménez et al. (2023), 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. For Italy, Cascarino et al. (2022), document that credit substitution appears to have been higher for guaranteed loans that had the highest coverage ratio.[2] 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.[3] Jointly considered, their size amounted to €140 billion, and they have been managed by the Official Credit Institute (ICO, by its Spanish abbreviation).

[2] For Italy, Core and De Marco (2023) find that public guarantees where allocated more, cheaper and faster by banks with better IT, suggesting that the information technology of banks also plays an important role in the allocation of public credit guarantees, a feature not present in our model.

[3] 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.

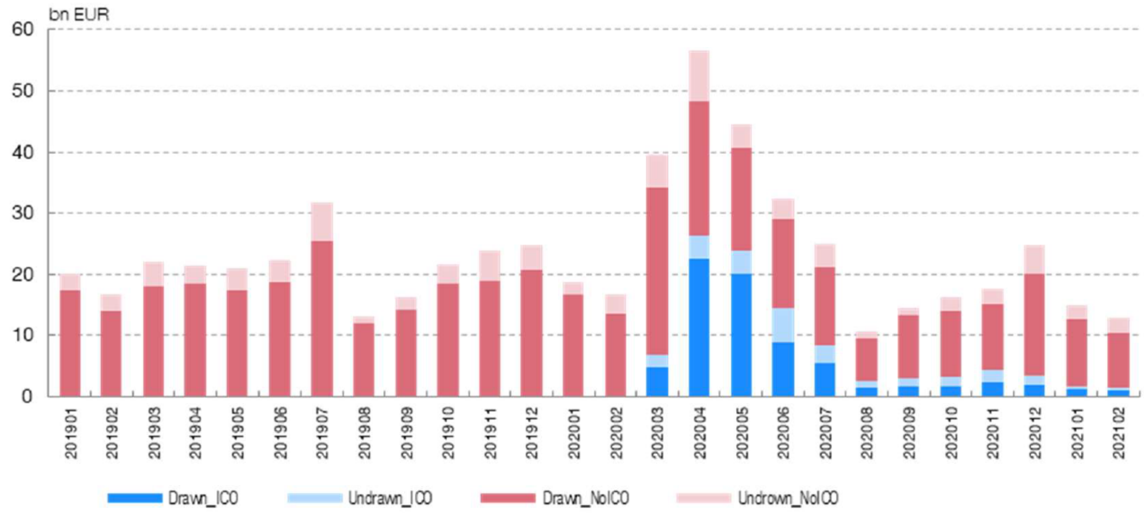


Figure 1: **Evolution of new credit operations to non-financial corporations (NFCs)**. This figure shows the evolution of new credit, drawn and undrawn, to NFCs from January 2019 to February 2021, distinguishing the portion arranged through the ICO facility.

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[4] 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

[4]A central risk database in Spain.

Figure 2: **Conditions of new loans with and without public guarantees.** The left panel of this figure shows the average maturity of ICO and non-ICO loans. The solid lines correspond to all ICO and non-ICO loans, whereas the dashed line shows the average maturity of the amount drawn of ICO loans (i.e., excluding credit lines). The center panel depicts the average size of ICO and non-ICO loans. The right panel 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, maturity, reference rate (fixed or floating), and the existence of other real or personal guarantees.

in its aftermath. Of the €170 billion of new credit 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, even when controlling — as in the figure's right panel — for loan characterisitcs such as the type of loan, its maturity, the reference rate (fixed or floating), and the existence of other real or personal guarantees.

To rationalize these facts and to better understand the drivers of firms' differential

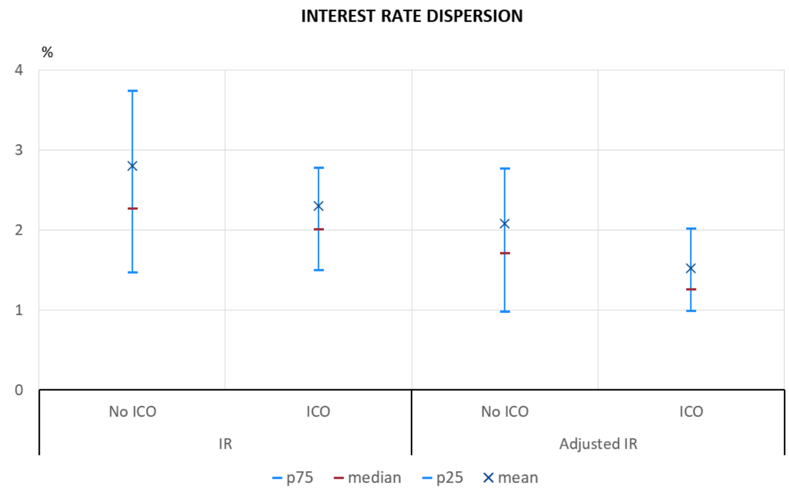


Figure 3: **Dispersion in the interest rates of new loans with and without public guarantees.** This figure reports the mean, median and the 25th and 75th percentiles of interest rates without public guarantees (No ICO) and with public guarantees (ICO). The left panel corresponds to the nominal rates whereas the right panel corresponds to the nominal rates adjusted by type of loan, the maturity, the reference rate (fixed or floating), and the existence of other real or personal guarantees.

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.

3 The model

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

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, and that 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 not continued, the project is liquidated 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.

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 $B_{0,i}$. For simplicity, we suppose that an entrepreneur's pre-existing debt is owed to only one bank (henceforth, her *creditor 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 minimum between the project's liquidation value λ and $B_{0,i}$. Finally, all agents have access to a storage technology that yields a gross return of one.

3.1 First-best allocation

We begin by characterizing the first-best allocation. Letting

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

denote the first-best level of effort of entrepreneur with productivity A, it follows that her project is socially profitable if and only if

$$p_A^{fb} \cdot A - C\left(p_A^{fb}\right) - k \geq \lambda \iff A \geq A_\ell^{fb}.$$

Thus, there exists a threshold A_ℓ^{fb} such that it is socially efficient to continue all projects with productivity weakly above this threshold, and to liquidate those below.

Thus, in the first-best allocation, the social surplus generated by a project with productivity A is given by

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

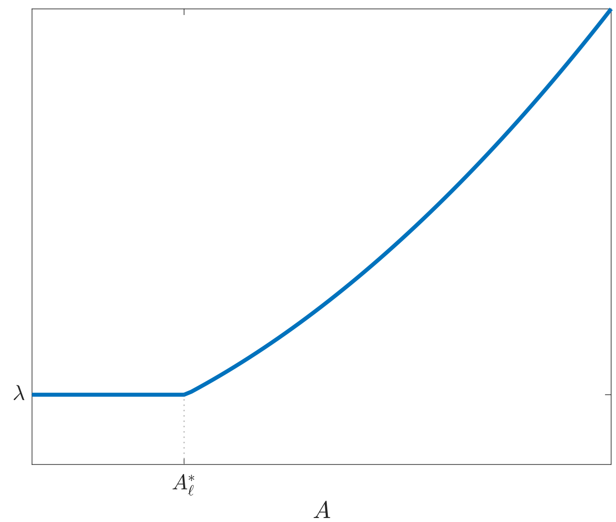


Figure 4: First-best total surplus of entrepreneur with productivity A.

resulting in a total surplus of

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

The first-best social surplus is depicted in Figure 4.

4 Equilibrium without guarantees

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., $B_{0,i} = B_0, \forall i$. 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 relative to liquidation values, i.e., $B_0 > \lambda$. We show our findings are robust to relaxing these assumptions in Appendix C.

4.1 Credit contracts

To continue their projects, entrepreneurs must obtain credit $B_0 + k$ from banks to be able to repay their existing debts and to invest. Since effort p_A is assumed to be noncontractible, credit contracts can only be contingent on the project's outcome. It is thus without loss to focus on equilibrium contracts that stipulate, for an entrepreneur with productivity A, an interest rate R_A to be repaid in the event of success for a loan of $B_0 + k$.

The bank's expected revenue from offering contract R_A to an entrepreneur with productivity A equals

$$p_A(R_A) \cdot \underbrace{R_A \cdot (B_0 + k)}_{\equiv B_{1,A}} \tag{3}$$

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

$$A - R_A \cdot (B_0 + k) = C'(p_A) \tag{4}$$

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 $B_{1,A}$ 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 first-best level characterized in Equation (1). The reason is that, when $B_{1,A} > 0$, the entrepreneur does not fully internalize the return to her effort because part of it accrues to the creditor bank.

Competition is modeled as follows. First, banks can post a credit contract for each entrepreneur of type A. After contracts are posted, entrepreneurs choose which contract to accept. If an entrepreneur fails to obtain credit (either because no contract is offered to her or because she rejects all offers), her project is liquidated and her creditor bank obtains λ.

4.2 Equilibrium allocation

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 constraint. Formally,*

$$\bar{B}_A = \arg\max_B p_A \cdot B$$
$$s.t. \quad A - B = C'(p_A) \tag{5}$$

We henceforth use $\bar{p}_A \equiv C'^{-1}\left(A - \bar{B}_A\right)$ to denote the effort level associated to the debt capacity, and $\bar{R}_A \equiv \frac{\bar{B}_A}{B_0+k}$ to denote the interest rate that maximizes the bank's expected revenues for a loan of size B_0+k. Given Definition 1, the following proposition characterizes equilibrium contracts.

Proposition 1 *For an entrepreneur with productivity A there are three possibilities in equilibrium:*

1. $\bar{p}_A \cdot \bar{R}_A \geq 1$*: the entrepreneur is solvent, she accepts contract* R_A^* *that solves*

$$R_A^* = \frac{1}{p_A(R_A^*)} \tag{6}$$

in the credit market, and continues her project.

2. $\bar{p}_A \cdot \bar{R}_A \in \left[\frac{\lambda+k}{B_0+k}, 1\right)$*: the entrepreneur is captive, accepts contract* $R_A^* = \bar{R}_A$ *from her creditor bank, and continues her project.*

3. $\bar{p}_A \cdot \bar{R}_A < \frac{\lambda+k}{B_0+k}$*: the entrepreneur is insolvent and her project is liquidated.*

Proposition 1 characterizes the equilibrium levels of credit for each entrepreneur as a function of her debt capacity. Solvent entrepreneurs can credibly promise to repay the market interest rate in expectation, and thus are able to secure the necessary credit to continue their projects from any bank. In contrast, captive entrepreneurs can only continue their projects by borrowing from their creditor bank, which grants them a discount on the interest rate to reduce repayments until $B_{1,A} = \bar{B}_A$. The creditor bank does this in the understanding that it is better to reduce the entrepreneur's payments – boosting their effort and thus the likelihood of being repaid their pre-existing debts – than to liquidate them outright.[5] Finally, insolvent entrepreneurs are unable to obtain credit and are liquidated.

[5]Note that a necessary condition for an entrepreneur to be captive to their own creditor is that pre-existing debt is higher that liquidation values, i.e. $B_0 > \lambda$. Otherwise, the bank would prefer to liquidate and be fully repaid than to grant an interest rate subsidy.

It is convenient to reinterpret the thresholds characterized in Proposition 1 in terms entrepreneurial productivity.

Proposition 2 *There exist thresholds* A_ℓ^* *and* A_h^**, with* $A_\ell^{fb} < A_\ell^* < A_h^*$ *such that entrepreneurs with productivity:*

1. $A \geq A_h^*$ *are solvent, obtain credit in the market to pay back their original debt and continue their projects.*

2. $A \in [A_\ell^*, A_h^*)$ *are captive, obtain credit from their creditor bank at a discounted interest rate and continue their projects.*

3. $A < A_\ell^*$ *are insolvent and their projects are liquidated.*

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.

$$\bar{p}_{A_\ell^*} \cdot \bar{R}_{A_\ell^*} = \frac{\lambda + k}{B_0 + k} \tag{7}$$

As the entrepreneur's debt capacity increases in A, all entrepreneurs with productivity above A_ℓ^* obtain credit and continue their projects. However, entrepreneurs with $\bar{p}_A \cdot \bar{R}_A < 1$ must obtain a subsidized rate from their creditor bank in order to avoid liquidation, while entrepreneurs above this threshold can obtain credit at the market interest rate. Thus, A_h^* is implicitly defined as the productivity threshold for which entrepreneurs are able to pay the market interest rate in expectation:

$$\bar{p}_{A_h^*} \cdot \bar{R}_{A_h^*} = 1 \tag{8}$$

Proposition (2) implies that the social surplus in the competitive equilibrium is given by

$$Y^* = \underbrace{\lambda \cdot F\left(A_\ell^*\right))}_{\text{Insolvent E.}} + \underbrace{\int_{A_\ell^*}^{A_h^*} \left(\bar{p}_A \cdot A - C\left(\bar{p}_A\right) - k\right) \cdot dF\left(A\right)}_{\text{Captive Entrepreneurs}} + \underbrace{\int_{A_h^*}^{\bar{A}} \left(p_A^* \cdot A - C\left(p_A^*\right) - k\right) \cdot dF\left(A\right)}_{\text{Solvent Entrepreneurs}} \tag{9}$$

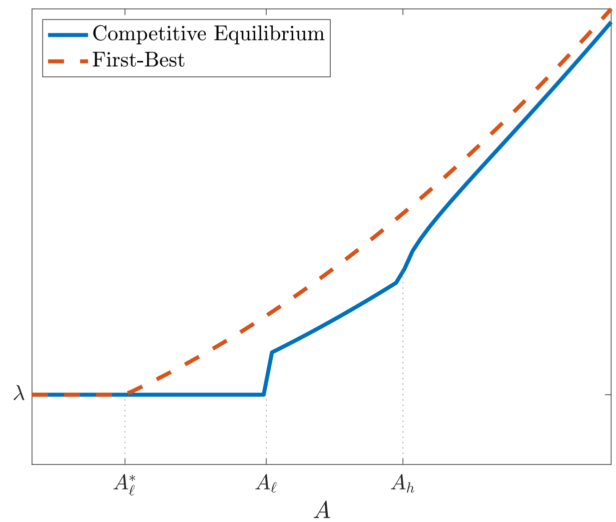


Figure 5: First-Best vs. Competitive Equilibrium Surplus.

where $p_A^* \equiv p(R_A^*)$. Figure 5 illustrates total surplus in the competitive equilibrium (solid line) relative to the first-best allocation (dashed line).[6] As the Figure shows, the competitive equilibrium surplus is below that of first-best, both along the extensive and intensive margins. First, some entrepreneurs who should continue with their projects under the first-best level of effort are liquidated in equilibrium, i.e., $A_\ell^* > A_\ell^{fb}$. Second, even those entrepreneurs who continue with their projects exert a suboptimal level of effort, i.e., $p_A^* < p_A^{fb}$ for all $A \geq A_\ell^*$.

In this economy, the non-contractibility of effort creates a debt overhang problem that destroys surplus relative to the first-best allocation. Can credit-guarantee schemes help reduce the debt burden of entrepreneurs thereby mitigating this destruction of surplus? We turn to this question next.

5 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 among entrepreneurs. Guarantees are potentially useful to reduce the debt overhang problem, but only if banks use them to reduce the debt repayments

[6] For the figures we suppose that $C(p) = \frac{p^2}{2}$.

demanded of entrepreneurs.

5.1 Credit contracts with guarantees

In the presence of guarantees, the credit contract obtained by entrepreneurs with productivity A becomes a pair $\{R_A, x_A\}$, 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 units of guarantees offered to an entrepreneur with productivity A generates an expected revenue of

$$p_A \cdot R_A \cdot (B_0 + k) + (1 - p_A) \cdot x_A \tag{10}$$

for the bank, of which $(1-p_A)\cdot x_A$ are expected transfers from the government. We suppose that x_A cannot exceed k to reflect the rules of the ICO program, which stipulated that guarantees could not be used to roll-over pre-existing debt.[7]

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 scarce guarantees to an entrepreneur. Although ρ is taken as given by each individual bank, it is an equilibrium object that, as we show below, ensures that the demand for guarantees does not exceed the total supply $\bar{X}$. It is immediate that the bank will optimally allocate guarantees to entrepreneurs with productivity A if and only if the expected income from the guarantee exceeds the cost, i.e., $1 - p_A^g > \rho$. In this case, moreover, the bank will grant a full guarantee to maximize the expected transfer from the government. Thus, we have that $x_A^g \in \{0, k\}$.[8].

5.2 Equilibrium with guarantees

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

[7]What is important for our findings is that $x_A < B_0 + k$, i.e., debt cannot be fully insured by public guarantees. If that were the case, banks incentives to grant guaranteed loans would be greatly distorted, as they would not be concerned by borrowers' repayment abilities. Consistent with this, in practice, credit guarantees tend to partially insure creditor banks.

[8]We show this formally in the proof of Proposition 3 in Appendix B

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 constraint. Formally*

$$\bar{B}^g_A = \arg\max_B \quad p_A \cdot B + (1 - p_A) \cdot k \tag{11}$$

$$s.t. \quad A - B = C'(p_A) \tag{12}$$

We henceforth use $\bar{p}^g_A \equiv C'^{-1}\left(A - \bar{B}^g_A\right)$ to denote the effort level associated to the debt capacity with guarantees, and $\bar{R}^g_A \equiv \frac{\bar{B}^g_A}{B_0+k}$ to denote the interest rate that maximizes the bank's expected revenues for a guaranteed loan of size $B_0 + k$.

It follows from comparing Definitions 1 and 2 that the introduction of guarantees reduces the debt capacity of entrepreneurs. The reason is that banks have weaker incentives to promote entrepreneurial effort when guarantees compensate them in the event of failure. Formally, the bank's marginal benefit of promoting entrepreneurial effort falls from B to $B - k$ if the loan is guaranteed. As a consequence, guarantees increase the interest rate that maximizes the bank's expected revenues, i.e., $\bar{R}^g_A > \bar{R}_A$, at the expense of lower effort, i.e., $\bar{p}^g_A < \bar{p}_A$.

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 2.

Productivity threshold $A_\ell(\rho)$ for which the bank is indifferent between liquidating or continuing a project is implicitly defined by

$$\bar{p}^g_{A_\ell(\rho)} \cdot \bar{R}^g_{A_\ell(\rho)} = \frac{\lambda + (\bar{p}^g_{A_\ell(\rho)} + \rho) \cdot k}{B_0 + k}. \tag{13}$$

Equation (13) 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 $A_\ell(\rho) < A_\ell$, as revealed by comparing this expression with Equation (7), so that credit guarantees reduce liquidations.

Productivity threshold $A_h(\rho)$ is implicitly defined as the minimum between A_h^* and the productivity level that satisfies

$$\bar{p}^g_{A_h(\rho)} \cdot \bar{R}^g_{A_h(\rho)} = \frac{B_0 + min\{1, \bar{p}^g_{A_h(\rho)} + \rho\} \cdot k}{B_0 + k}. \tag{14}$$

Thus, the presence of guarantees may change the solvency threshold depending on whether entrepreneurs with productivity A_h^* receive guarantees or not. If they do, guarantees allow otherwise captive entrepreneurs to become solvent and thus $A_h(\rho) \leq A_h^*$.

This discussion is formalized in the following Proposition, which extends Proposition 2 to incorporate the effect of credit guarantees.

Proposition 3 *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, obtain contract*

$$\{R^g_A, x^g_A\} = \begin{cases} \left\{R^g_A : \frac{1}{p_A(R^g_A)} \cdot \frac{B_0 + (p_A(R^g_A)+\rho)\cdot k}{B_0+k}, k\right\} & if \quad \rho \leq 1 - p_A(R^g_A) \\ \left\{\frac{1}{p_A(R^g_A)}, 0\right\} & o.w. \end{cases} \tag{15}$$

in the credit market, and continue their projects.

2. *$A \in [A_\ell(\rho), A_h(\rho))$ are captive, obtain contract*

$$\{R^g_A, x^g_A\} = \begin{cases} \left\{\frac{1}{\bar{p}^g_A}, k\right\} & if \quad \rho \leq 1 - \bar{p}^g_A \\ \left\{\frac{1}{\bar{p}_A}, 0\right\} & o.w. \end{cases} \tag{16}$$

from their creditor bank, and continue their projects.

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

Proposition 3 captures the main effects of guarantees in equilibrium. Solvent entrepreneurs benefit from guarantees, since their interest rate declines in proportion $\frac{B_0+(p^g_A(R^g_A)+\rho)\cdot k}{B_0+k}$. Intuitively, bank competition implies that some of the expected transfers generated by the guarantee are passed on to solvent entrepreneurs in the form of

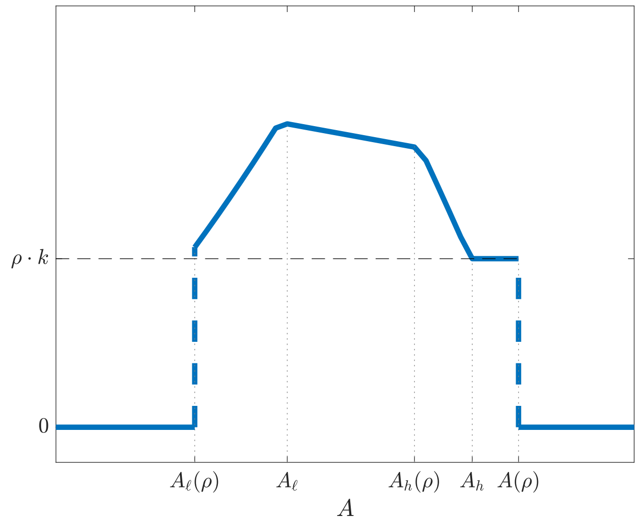


Figure 6: **Banks' extra revenues from granting guaranteed credit in equilibrium.** This figure plots the extra revenues that banks obtain from granting guaranteed credit contracts in equilibrium, as a function of entrepreneurial productivity A.

a lower interest rate. Captive entrepreneurs instead do not benefit from guarantees: moreover, since $\bar{R}^g_A > \bar{R}_A$, they actually have to pay a higher interest rate if the loan is guaranteed. This result is surprising but intuitive. In the absence of guarantees, banks grant captive borrowers an interest-rate discount to boost their effort and thus their probability of success. With guarantees, banks reduce this discount because, at the margin, they care less about entrepreneurial success once the government compensates them in the event of failure. Thus, entrepreneurs that remain captive are actually hurt by guaranteed contracts, but they are forced to accept them because no one else offers them credit and their alternative is liquidation.

It is useful to characterize the threshold entrepreneur that receives guarantees in equilibrium.

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

$$A(\rho) : 1 - p_{A(\rho)}\left(R^g_{A(\rho)}\right) = \rho.$$

Taken jointly, these results imply that banks follow a pecking order in allocating guarantees, granting them first to captive entrepreneurs and only then to solvent ones.

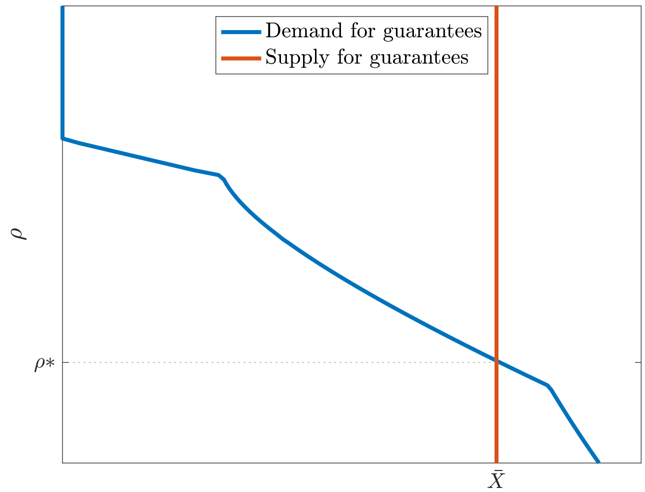


Figure 7: **Supply and Demand of Guarantees**

To see why bank incentives operate in this manner, Figure 6 illustrates the extra revenues that a bank obtains from granting guarantees to different entrepreneurs. The figure is drawn for a given level of ρ and it assumes that $A(\rho) > A_h(\rho)$, so that guarantees are granted in equilibrium to all captive and some solvent entrepreneurs. The bank's additional revenue from granting guaranteed credit 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 expected transfers generated by guarantees, $(1 - \bar{p}^g_A) \cdot k$. Profits from entrepreneurs with $A < A^*_\ell$ are lower as banks must partially share with these entrepreneurs the benefits of guarantees in order to induce effort and prevent liquidation. Profits from entrepreneurs with $A > A^*_\ell$ are lower because the benefits of guarantees decrease as the probability of project success increases. Finally, the revenues from giving guarantees are lowest for solvent entrepreneurs, from which the bank only obtains 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 the demand of guarantees does not exceed its supply:[9]

$$k \cdot [G(A(\rho)) - G(A_\ell(\rho))] = \bar{X}. \tag{17}$$

[9]In the Proof of Proposition 3 we provide the formal proof of the determinant of ρ in equilibrium.

The left-hand side of Equation (17) 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^g, that satisfies Equation (17), as depicted in Figure 7. It is immediate that ρ^g is decreasing in the supply of guarantees, and that it is strictly positive as long as guarantees are scarce, i.e., as long as $\bar{X} < k \cdot (1 - G(A_\ell(0)))$.

5.3 Discussion

In the environment studied here, where the non-contractibility of effort gives rise to debt overhang, guarantees may seem like a useful measure to reduce entrepreneurs' debt burden and thus increase equilibrium output. However, Proposition 3 shows that the effect of guarantees on efficiency is actually ambiguous, as banks do not necessarily pass on their benefits to entrepreneurs through lower interest rates.

On the one hand, guarantees allocated to entrepreneurs with $A \geq A_h$ always enhance effort and output. These are solvent entrepreneurs that continue to receive credit $B_0 + k$ and, due to bank competition, benefit from guarantees through a fall in the interest rate. When guarantees are scarce, however, the pass-through of the benefits of guarantees to entrepreneurs is limited as the bank sets their (implicit) marginal price, ρ, above their marginal cost, zero.[10] On the other hand, guarantees allocated to entrepreneurs with $A \in [A_\ell, A_h(\rho^g))$ always reduce efficiency. These are captive entrepreneurs who see their interest rate rise when credit is guaranteed, as banks care less about inducing high effort. For these entrepreneurs, effort and output consequently fall.

These results are reflected in Figure 8, which compares the social surplus in the competitive equilibrium with and without guarantees. In this example, guarantees increase efficiency for solvent entrepreneurs and for those captive that become solvent. They reduce efficiency for captive entrepreneurs that remain captive, and they have mixed effects on the efficiency of entrepreneurs that would have been liquidated without guarantees but now continue their projects. In particular, the figure highlights that

[10] A full pass-through of credit guarantees to entrepreneurs would entail a reduction in the interest rate of $(1 - p_A) \cdot \frac{k}{B_0 + k}$, which is equivalent to offering guarantees at a zero price.

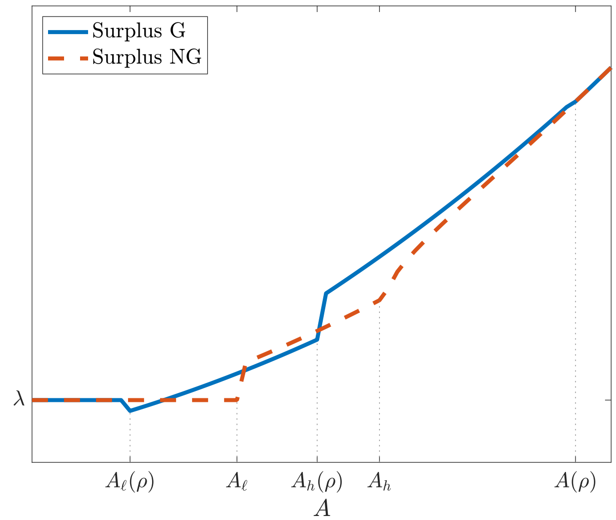


Figure 8: Social surplus of entrepreneurs with productivity A, with and without credit guarantees.

banks may keep alive negative-NPV projects just to cash-in the guarantees. This allocation of guarantees cannot be socially optimal, as we show formally in the next section.

These results have been derived under the assumption that all entrepreneurs begin with the same level of pre-existing debt $B_0 > \lambda$, which is due at $t = 0$ and is rolled over if the entrepreneur obtains credit and avoids liquidation. In Appendix D, we show that results are unchanged when we extend the model to allow for heterogeneity in the level of pre-existing debt across entrepreneurs. The only difference is that the effort exerted by an entrepreneur depends both on her productivity and her level of debt, $p(A, B_0)$, and thus thresholds A_h^* and $A_h(\rho)$ from Propositions 2 and 3 must also be indexed by B_0. We also show that results are unaffected if banks are able to renegotiate pre-existing debts (see Appendix C.2), or if these debts are long-term, i.e. B_0 is due at $t = 1$ (see Appendix C.3).

6 Constrained-Optimal Allocation of Guarantees

To explore whether the equilibrium allocation of guarantees maximizes social surplus, we consider the problem of a planner that chooses how to allocate $\bar{X}$ guarantees subject to entrepreneurs' incentive and banks' participation constraints. In particular, the planner chooses contracts $\{R_A^p, x_A^p\}$ to maximize total surplus, where R_A^p is the interest rate charged to the entrepreneur with productivity A on loan $B_0 + k$ and $x_A^p \in [0, k]$ is the amount of the loan that is guaranteed. Defining $p_A^* \cdot R_A^* \equiv \frac{\lambda+k}{B_0+k}$ for $A \leq A_\ell^*$, the planner problem can be formally stated as follows:

$$\max_{\{\mathcal{I}_A, R_A, x_A\}_A} \int_0^{\bar{A}} [(p_A \cdot A - C(p_A) - k) \cdot \mathcal{I}_A + \lambda \cdot (1 - \mathcal{I}_A)] \cdot dF(A) \tag{18}$$

$$s.t. \qquad A - R_A \cdot (B_0 + k) = C'(p_A), \quad \forall A \tag{19}$$

$$[p_A \cdot R_A \cdot (B_0 + k) + (1 - p_A) \cdot x_A - k] \cdot \mathcal{I}_A + \lambda \cdot (1 - \mathcal{I}_A) \geq p_A^* \cdot R_A^* \cdot (B_0 + k) - k, \quad \forall A \tag{20}$$

$$\int_0^{\bar{A}} x_A \cdot dF(A) = \bar{X}. \tag{21}$$

where $\mathcal{I}_A$ is an indicator function that takes value one if the planner grants entrepreneur with productivity A a loan and zero otherwise. Equation (19) represents entrepreneurs' incentive compatibility constraints, Equation (20) represents banks' participation constraints, and Equation (21) is the feasibility constraint faced by the planner.

It is immediate that banks' participation constraints must bind in the planner allocation, as a lower interest rate R_A increases the objective by implementing higher entrepreneurial effort. If the planner grants credit to an entrepreneur with productivity A, it follows from constraints (19) and (20) that p_A^p is implicitly given by

$$A - \frac{p_A^* \cdot R_A^* \cdot (B_0 + k) - (1 - p_A^p) \cdot x_A^p}{p_A^p} = C'(p_A^p), \tag{22}$$

Equation (22) anticipates a first difference between the planner's and banks' allocation of guarantees. Namely, the planner fully passes on to entrepreneurs the expected transfers from guarantees, $(1 - p_A^p) \cdot x_A$, in the form of lower interest rates. Thus, in the planner allocation, guarantees always boost entrepreneurial effort and output.

Moreover, from the planner's perspective, the marginal benefit of granting guarantees to an entrepreneur with productivity A is

$$MB_A(x_A^p) \equiv (A - C'(p_A^p)) \cdot \underbrace{\frac{p_A^p \cdot (1 - p_A^p)}{C''(p_A^p) \cdot (p_A^p)^2 + x_A^p - p_A^* \cdot R_A^* \cdot (B_0 + k)}}_{= \frac{dp_A^p}{dx_A^p}}. \tag{23}$$

where $\frac{dp_A^p}{dx_A^p} > 0$ is obtained from (22). Equation (23) shows that the planner values both the effect of guarantees on entrepreneurial effort and the social marginal benefit of this effort, $A - C'(p_A)$, which is positive in equilibrium.

The social marginal cost of granting guarantees is given by the multiplier of the feasibility constraint (21), which we denote by $\nu \geq 0$. The following result characterizes the planner's allocation of guarantees among entrepreneurs.

Proposition 4 *In the planner allocation, entrepreneurs with productivity A receive credit contract,*

$$\{R_A^p, x_A^p\} = \left\{ R_A^p : \frac{p_A^* \cdot R_A^*}{p(R_A^p)} - \frac{1 - p_A^p}{p(R_A^p)} \cdot \frac{x_A(\nu^p)}{B_0 + k}, x_A(\nu^p) \right\} \tag{24}$$

if and only if

$$p(R_A^p) \cdot A - C(p(R_A^p)) - k \geq \lambda, \tag{25}$$

and

$$p(R_A^p) \cdot R_A^p \cdot (B_0 + k) + (1 - p(R_A^p)) \cdot x_A(\nu^p) - k \geq \lambda, \tag{26}$$

where

$$x_A(\nu^p) \begin{cases} = k & \text{if} \quad MB_A(k) \geq \nu^p \\ = 0 & \text{if} \quad MB_A(0) < \nu^p \\ : MB_A(x_A(\nu^p)) = \nu^p & o.w. \end{cases} \tag{27}$$

Otherwise, entrepreneurs with productivity A obtain no credit. Finally, ν^p ensures that the feasibility constraint (21) *holds, i.e.,*

$$\int_0^{\bar{A}} x_A(\nu^p) \cdot \mathcal{I}_A \cdot dF(A) = \bar{X}. \tag{28}$$

The planner's solution highlights the two distortions present in banks' allocation of guarantees. First, the planner fully passes on the expected transfers from guarantees to entrepreneurs in the form of lower interest rates. This is different from banks, who pass on these benefits only partially to solvent entrepreneurs and not at all to captive entrepreneurs (see Proposition 3). Second, the planner takes into account the social benefit of guarantees through their effect on effort and on the resulting social surplus, and allocates guarantees to equalize their social marginal benefit across entrepreneurs.

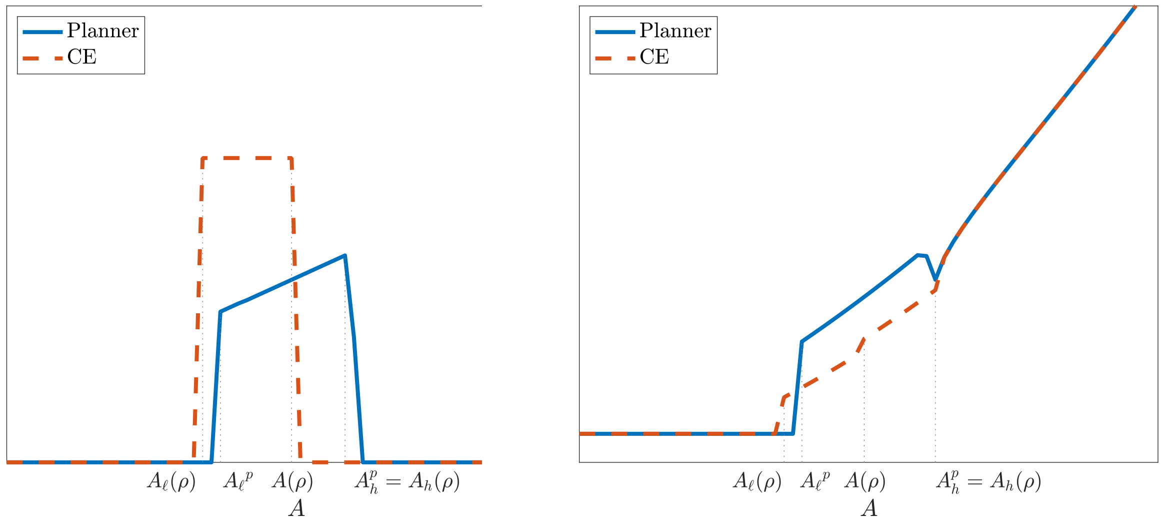
As Corollary 1 shows, banks instead grant guarantees to all entrepreneurs with $1 - p$ above a certain threshold. Intuitively, banks do not care about the effect of guarantees on social surplus as they try to maximize their expected income by granting guarantees to the riskiest borrowers from whom they can exert market power.

Figure 9 illustrates these results by depicting both the planner's and banks' allocation of guarantees and the surplus in both allocations. 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. 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.

The results of this sections raise an important question that lies outside the scope of this paper: why design a program that allocates public guarantees through banks if they do so inefficiently? A benign view is that the distortions highlighted here are compensated by other advantages that banks have over the public sector in allocating guarantees, e.g., greater information about borrowers or the ability to intervene with greater speed. According to this view, the transfer of resources to banks is an unfortunate side-effect of tapping into these advantages. A less benign view is that banks' ability to capture some of the benefits of guarantees is a feature and not a bug of the scheme: namely, it provides an indirect way to transfer resources to the banking system in a situation where direct transfers might be controversial or difficult to implement.

7 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.



(a) Allocation of guarantees

(b) Total surplus

Figure 9: **Planner vs. Competitive Equilibrium**.

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

7.1 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, 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. Financial firms and companies that do not belong to the market economy are also excluded according to the NACE industry classification.[11] 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.

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

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

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 banks to firms in our sample during the period of reference had public guarantees. Finally, on average 23% of bank-firm relationships correspond to captive firms.

Panel C of Table 1 shows the distribution of newly extended credit facilities, both with and without public guarantees, in the period between March 2020 and February 2021. This distribution is based on the presence and strength of credit relationships between borrowers and banks as of February 2020. Our classification encompasses four distinct categories of firm-bank relationships: (i) newly initiated relationships where the firm had no prior outstanding credit with any bank; (ii) pre-existing relationships with the firm's main creditor bank, as indicated by the total amount of outstanding credit; (iii) pre-existing relationships with banks other than the firms' main creditor bank, and; (iv) relationships in which the firms had no prior credit engagement with the new bank extending the loan, but did maintain credit relationships with other banks. Column (1) shows the distribution of credit with public guarantees, while Column (2) shows this distribution for loans without public guarantees. Column (3) contains the distribution of firm assets across these four relationship categories. The table shows that about 75% all ICO credit was allocated to firms by banks with which they had pre-existing relationship, compared to only 68% of non-ICO credit. The table also shows that both types of credit were supplied to firms in all types of relationships.

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 D 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.

7.2 Results

7.2.1 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:

$$ICO/Total_f = \beta Risk_f + \delta X_f + \gamma_{ls} + \varepsilon_f \tag{29}$$

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%.[12] 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.[13] It does not just capture the ex-ante risk of formal 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.[14] 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.[15]

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

[13] To compute these probabilities we use firm-specific and global factors, as in Blanco et al. (2023), and also sectorial risk.

[14] 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.

[15] Bank debt maturities are taken from the CCR as at March 2020, while for other debt the

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.[16] 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 (29) 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-term non-ICO loans.[17] To deal with this effect, Table A1 in the Appendix reports the results to regression (29) when we compute the dependent variable by excluding loan renovations. Results are fully consistent with

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).

[16] 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 categories of firms considered by the European Commission (EC) definition: micro, small, medium-sized and large.

[17] 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 (29) 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%.

those reported in Table 2.

7.2.2 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 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:

$$ICO/Total_{fb} = \beta Captive_{fb} + \delta X_f + \gamma_{ilsr} + \gamma_b + \varepsilon_{fb} \tag{30}$$

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 (29). 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.[18]

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. Column (2) of this table also shows that the effect of being 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

[18]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).

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 is creditor to more than 50% of firm f's outstanding credit.

7.2.3 Pass-through of credit guarantees to captive borrowers

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 granted in month t 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 (30) 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:

$$\begin{aligned} i_{fbjt} &= \beta_1 \cdot ICO_{fbjt} + \beta_2 \cdot Captive_{fb} \cdot ICO_{fbjt} + \beta_3 \cdot Captive_{fb} \\ &\quad \delta X_f + \gamma_{ilsrt} + \gamma_{bt} + \gamma_c + \varepsilon_{fbjt} \end{aligned} \tag{31}$$

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, the evidence appears to be in line with the theory: although captive borrowers were more 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 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 dimensions of captivity. 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 credit registry does not contain information on fees at the loan level. However, we have aggregate information on fees for 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 of fees on new ICO loans relative to those on all new loans. Our main results remain unchanged once fees are taken into account. First, the fees on non-ICO loans are higher than those on ICO loans, so differential fees cannot account for the lower rates on ICO loans illustrated in Figure 2 and estimated in equation (31).[19] 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.[20]

Finally, we provide a model-based decomposition of banks' revenues in granting ICO

[19]See Figure A1 in the Appendix

[20]We estimate variation of equation (31) 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.

loans. To do so, we estimate a bank's expected excess revenue of granting an ICO loan to a captive borrower relative to granting a non-ICO loan to a non-captive borrower with similar characteristics (adjusted expected revenue, hereafter). This adjusted expected revenue is composed of three parts: the differential interest rate payments, net of the fee that the bank must pay for the guarantee, and the coverage of the guarantee in case of default. Through the lens of the model, it should just equal $1-p$ minus the fee per unit of guaranteed credit, since the bank should appropriate the entire surplus generated by the ICO loan.

To compute the adjusted expected revenue, we first calculate the difference between the interest rate charged on an ICO loan granted to a captive borrower and the average interest rate charged by the same bank in the same month on a non-ICO loan to a similar but non-captive borrower (i.e., a borrower that 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. We then calculate the coverage of the guarantee in case of default by multiplying the one-year probability of default times the part of the loan amount at origination that is covered by the guarantee (80% for SMEs and 70% for non-SMEs). Finally, the cost of the guarantee for the bank is calculated as the fee expressed in percentage points times the loan amount that is covered by the guarantee.[21]

The annual adjusted expected revenue computed in this way is sizable, exceeding 1.2% of the total amount of credit granted to captive borrowers and 1.3% of the credit granted to captive borrowers that operate in affected sectors.[22] Consistently with the model, moreover, more than 90% of these revenues come from the coverage of the guarantees in case of default.

[21] The cost of guarantees on loans granted to non-financial corporations of up to 1.5 million euros was of 20 bp on the total amount guaranteed. For loans exceeding this threshold, the cost varied with the size of the firm and the maturity of the loan. For the case of SMEs, for instance, the cost rose to 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 same costs for non-SMEs rose to 30, 60, and 120 bp, respectively.

[22] These revenues exhibit a high degree of heterogeneity. Within the sample of captive firms operating in affected sectors, for instance, they reach 0.5% and 1.9% for the 25th and 75th percentiles, respectively.

8 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 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

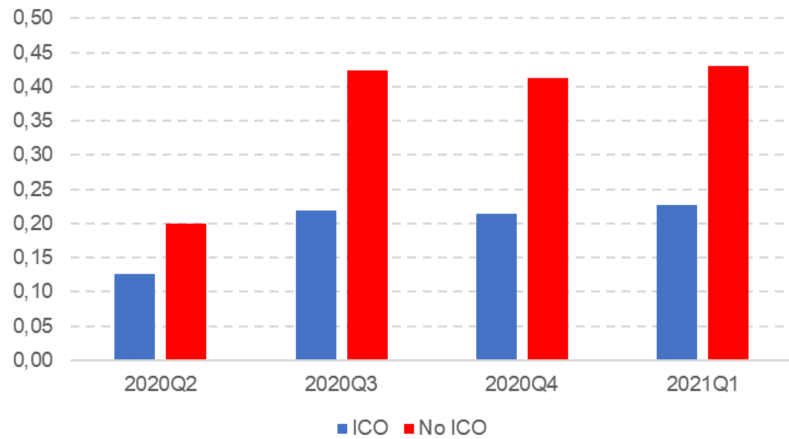

Figure A1: **Average Loan Fees (in %)**. This figure reports average fees for loans with and without public guarantees. Average fees for loans with guarantees are obtained directly from loan-level information. Average fees for loans without guarantees are instead based on aggregate monthly information on all new operations, and they are computed by comparing the weighted average of fees on loans with guarantees and the average fees on ll new operations.

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 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

Table 1: **Descriptive Statistics (Cont.).** In Panel C we present the distribution of newly extended credit facilities, both with and without public guarantees, over the period from March 2020 to February 2021. This distribution is contingent upon the presence and strength of credit relationships established between the borrowing companies and the lending institutions as of February 2020. Our classification encompasses four distinct categories of firm-bank relationships: (i) newly initiated relationships where the firm had no prior outstanding credit with any bank, (ii) pre-existing relationships with the firm's main bank, as indicated by the total outstanding credit amount, (iii) relationships in which the firms held credit with the banks offering the new loans, albeit not as their main lender, and (iv) relationships in which the firms had no prior credit engagement with the new bank extending the loan, but did maintain credit relationships with other banks. In column (1), we present the distribution of credit with public guarantees, while column (2) mirrors this distribution but focuses on loans without public guarantees. Column (3) provides an overview of the distribution of firm assets across the four aforementioned relationship categories. This information aids in comprehending the distribution patterns depicted in columns (1) and (2) and enhances the interpretive context of our findings. Panel D reports descriptive statistics on the loan interest rate and the dummy variable that denotes whether the loan has an ICO guarantee.

Panel C. Distribution of credit depending on bank-firm credit relationships.

	ICO Credit	No ICO Credit	Assets
With no previous bank relationships	17.7	17.5	14.1
From the main bank	17.6	20.2	12.6
From other banks with credit outstanding	57	47.8	61.9
From a new bank	7.7	14.5	11.4

Panel D. Descriptive statistics at the loan level.

	Units	Obs	Mean	Median	SD	10th Pctile	90th Pctile
Interest rate	%	1080430	2.57	2.17	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 (29) 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 (30) 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 (i.e., 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 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

B Proofs

Proof of Proposition 1. First, consider those entrepreneurs with $\overline{p}_A \cdot \overline{R}_A \geq 1$. By construction, if these entrepreneurs borrow to repay their debts and to invest k to continue their projects, they would have enough cash flows to repay $\frac{B_0+k}{p_A}$ in $t = 1$, where p_A solves

$$A - \frac{B_0 + k}{p_A} = C'(p_A). \tag{32}$$

As banks have deep pockets, competition among banks will drive the interest rate down to the banks marginal cost of funds, i.e., $R_A = \frac{1}{p_A}$. Thus, it is immediate that these entrepreneurs generate enough surplus to borrow in competitive credit markets to continue operating. Note that no bank (creditor or not) has an incentive to set the interest rate below its marginal costs of funds.

Second, consider those entrepreneurs with $\overline{p}_A \cdot \overline{R}_A \leq \frac{\lambda+k}{B_0+k}$. By construction, it is not possible to extract 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 $\lambda < B_0$), it is immediate that the creditor bank will liquidate the projects of these entrepreneurs.

Finally, consider those entrepreneurs with $\overline{p}_A \cdot \overline{R}_A \in \left[\frac{\lambda+k}{B_0+k}, 1\right)$. On the one hand, these entrepreneurs cannot not generate enough cash flows to repay a loan of size B_0+k at an interest rate given by the banks' marginal cost of funds. This, they cannot obtain funding from competitive banks. On the other hand, these entrepreneurs generate more cash flows than $\lambda+k$ if their projects are continued, and thus their creditor bank strictly prefers to offer a loan of size $B_0 + k$ at interest rate $\overline{R}_A$ than to liquidate the project. As a result, these entrepreneurs continue their projects by accepting an interest rate subsidy that only their creditor bank is willing to offer. Formally, the creditor bank will offer a loan contract for $B_0 + k$ with the interest rate that entails the highest expected repayment to the bank, subject to the incentive constraint of the entrepreneur, which is how $\overline{R}_A$ is defined. ■

Proof of Proposition 2. The result follows from Proposition 1 and the fact that $\bar{p}_A \cdot \bar{R}_A$ is increasing in A, as, all else equal, a higher A relaxes the incentive compatibility constraint (5). The determination of the thresholds is given by Equations (7) and (8) in the main text and explained in the corresponding section. ■

Table 4: **Pass-through of credit guarantees: Captive vs non-captive.** This table reports the results obtained from the estimation of equation (31) 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. 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. Column (2) contains the results obtained from the estimation of equation (31) whereas column (1) corresponds to a variation of equation (31) 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]

Proof of Proposition 3. The proof of this Proposition is isomorphic to the one of Proposition 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 $\overline{p}_A^g \cdot \overline{B}_A^g$ (as defined in Definition 2) whenever a guarantee is granted to entrepreneur A. Second, the bank must now decide who to grant a credit guarantee.

As credit guarantees are scarce, we solve the competitive equilibrium by supposing that the bank may price its borrowers for a unit of guarantee an amount $\rho \geq 0$. Even though guarantees are costless for the bank, they are a scarce resource, and as shown in the literature of Bertrand competition with capacity constraints (Peters (1984)), competitive banks may charge a price above marginal cost to ensure market clearing. We conclude by showing that, given the ρ that ensures market clearing for guarantees, no bank has an incentive to deviate and offer a guarantee at a lower price (or equivalently, a guaranteed loan with a loan interesr rate).

Consider first solvent entrepreneurs, which are those for which

$$\max\{\overline{p}_A \cdot \overline{B}_A, \overline{p}_A^g \cdot \overline{B}_A^g + (1 - \overline{p}_A^g) \cdot k\} \geq B_0 + k.$$

As these entrepreneurs generate enough cash flows to repay a market interest rate for a loan of size $B_0 + k$, banks will compete by offering the contract that maximizes the entrepreneurs' payoff. Formally, bank chooses contract $\{(B_A, x_A)\}$ such that that

$$\max_{B_A} \quad p_A \cdot (A - B_A) - C(p_A) \tag{33}$$

subject to

$$\begin{aligned} p_A \cdot B_A + (1 - p_A - \rho) \cdot x_A &\geq k + B_0 \qquad \forall A, (\gamma_A) \\ x_A &\leq k \qquad \forall A, (\mu_A) \\ 0 &\leq x_A \qquad \forall A, (\upsilon_A) \\ A - B_A &= C'(p_A) \qquad (IC_A) \end{aligned}$$

First, we replace the IC constraint by implicit function $p_A(B)$. With this, we have that the marginal benefit of increasing B_A is

$$-p_A + \gamma_A \cdot \left(p_A + \frac{dp_A}{dB_A} \cdot (B_A - x_A) \right) = 0.$$

where we have used the Envelope Condition, as the derivative of the objective wrt p_A is zero. It follows that $\gamma_A > 0$, as the constraint must always bind: given ρ, the bank charges the lowest interest rate it is willing to offer.

For guarantee x_A, we have that

$$\gamma_A (1 - p_A - \rho) - \mu_A + \upsilon_A = 0.$$

Thus, the result stated in the proposition follows, those with $1 - p_A \geq \rho$ receive a full guarantee, and $R_A = \frac{B_A}{B_0 + k}$ is given by the binding participation constraint of the bank ($\gamma_A > 0$).

Consider now captive entrepreneurs, which are those for which

$$\max\{\overline{p}_A \cdot \overline{B}_A, \overline{p}_A^g \cdot \overline{B}_A^g + (1 - \overline{p}_A^g) \cdot k\} \in [\lambda + k, B_0 + k) .$$

Recall that these entrepreneurs are captive as non-creditor banks are not willing to lend to them. As a result, their creditor bank will offer them a contract that maximizes the bank's expected payoff:

$$\max_{B_A, x_A} \quad p_A \cdot B_A + (1 - p_A - \rho) \cdot x_A \tag{34}$$

subject to

$$\begin{aligned} p_A \cdot B_A + (1 - p_A - \rho) \cdot x_A &\geq k + \lambda \qquad \forall A, (\gamma_A) \\ x_A &\leq k \, (\mu_A) \\ x_A &\geq 0 \, (\upsilon_A) \\ A - B_A &= c'(p_A) \qquad (IC_A) \end{aligned}$$

The FOCs boil down to:

$$\begin{aligned} B_A &: \left[p_A - \frac{(B_A - x)}{c''}\right](1+\gamma_A) = 0 \\ x_A &: (1 - p_A - \rho)(1+\gamma_A) - \mu_A + \upsilon_A > 0. \end{aligned}$$

The first FOC shows that the relationship between B_A and p_A changes once guarantees are introduced, and it is immediate that the solution for B_A is given by the debt capacity defined in Definitions 1 and 2 respectively.

The second condition says that the bank will allocate a full guarantee as long as $1 - p_A > \rho$, and the marginal revenue of doing so is $1 - p_A$. To check the lower bound on captives on whom banks allocate guarantees, we just need to check the lowest productivity for which

$$p_A \cdot B_A \geq \lambda + (p_A + \rho) \cdot k$$

Finally, ρ is determined to ensure market clearing of guarantees:

$$\int x_A(\rho) \cdot dF(A) = \bar{X}. \tag{35}$$

It follows that if guarantees are relatively scarce, i.e. $\int_{A_{\ell(0)}}^{\bar{A}} k \cdot dF(A) > \bar{X}$, then $\rho > 0$. Suppose we are in the latter scenario and $\rho > 0$. Next, we show there are no profitable deviations for a bank. To see this, suppose that one bank deviates by offering a loan contract with a lower repayment, $\{B_A - \epsilon \cdot k, x_A = k\}$ for entrepreneurs with productivity A in the competitive market. The bank will attract all solvent entreprenerus with productivity A, as entrepreneurs strictly prefer a lower repayment. At equilibrium contract B_A, the bank makes $\rho \cdot k$ profits from solvent entrepreneurs. Note, however, that the bank does not have idle guarantees to offer, and thus it must transfer the guarantee from some existing borrowers (from whom it is obtaining ρ) to the new borrowers (from whom it now obtains less that ρ). This deviation generates losses of $f(A) \cdot \epsilon \cdot k$ for the deviating bank. Contradiction.

The existance of thresholds $A_h(\rho)$ and $A_\ell(\rho)$ follows from the monotonicity of debt capacities with and without guarantees in A, and are defined and explained in the main text before the statement of this Proposition. ■

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 4. The determinants of B_A^p follow immediately from observation of the planner's problem and the first-order conditions stated in the main text that follows. The allocation of guarantees, x_A^p, 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 $\frac{dp_A^2}{d^2x_A} > 0$.

$$\frac{dp_A^2}{d^2x_A} = -\frac{2 \cdot p_A + [C'''(p_A) \cdot p_A^2 + 2 \cdot p_A \cdot C''(p_A)] \cdot \frac{dp_A}{dx_A}}{p_A \cdot (1 - p_A)} \cdot \left(\frac{dp_A}{dx_A}\right)^2 < 0. \quad (36)$$

■

C Robustness of modeling choices

C.1 Generalization of the baseline model

To clarify 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_0. Second, that this debt was high enough so that full repayment was not possible in the event of liquidation, i.e., $B_0 > \lambda$. 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 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 5 *For entrepreneur i with productivity A_i and pre-existing debt $B_{0,i}$, 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 loan* $B_{0,i} + k$ *at interest rate*
$$R_i = \frac{1}{p_i(R_i)} \tag{37}$$
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, and she obtains loan* $B_{0,i}+k$ *at interest rate*
$$R_i = \frac{\bar{B}_i}{B_{0,i} + k}$$
from her creditor bank 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 2. Note that now threshold A_h is indexed by B_0 as:

$$A_h(B_{0,h}) \quad : \quad \bar{p}_h \cdot \bar{B}_h = B_{0,h} + k \tag{38}$$

Next, consider those entrepreneurs with $B_{0,i} \leq \lambda$. These entrepreneurs are never captive to their bank because the latter will never be willing to offer an interest rate subsidy: the creditor bank can always liquidate the project to obtain full repayment (i.e., case 2. in Proposition 9 never arises). As a result, entrepreneur i can always borrow $B_{0,i} + k$ 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

$$\widetilde{A}(B_0): \quad \widetilde{p} \cdot \widetilde{A} - C(\widetilde{p}) - k = \lambda \tag{39}$$

where $\widetilde{p}$ satisfies

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

This result is formalized in the following proposition.

Proposition 6 *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:

$$\begin{aligned} Y = & \underbrace{\lambda \cdot \left(\int_0^\lambda F\left(\tilde{A}\left(B_0\right)\right) \cdot dG\left(B_0\right) + F\left(A_\ell\right) \cdot \left(1 - G\left(\lambda\right)\right) \right)}_{\text{Output of Insolvent Entrepreneurs}} + \underbrace{\int_\lambda \int_{A_\ell}^{A_h(B_0)} \bar{y}\left(A\right) \cdot dF\left(A\right) \cdot dG\left(B_0\right)}_{\text{Output of Captive Entrepreneurs}} \\ & + \underbrace{\int_0^\lambda \int_{\tilde{A}(B_0)} y\left(B_0, A\right) \cdot dF\left(A\right) \cdot dG\left(B_0\right) + \int_\lambda \int_{A_h(B_0)} y\left(B_0, A\right) \cdot dF\left(A\right) \cdot dG\left(B_0\right)}_{\text{Output of Solvent Entrepreneurs}} \end{aligned} \tag{40}$$

where

$$\bar{y}\left(A\right) = p_A(\bar{B_A}) \cdot A - C\left(p_A(\bar{B_A})\right) - k \tag{41}$$

$$y\left(B_0, A\right) = p_A\left(B_0\right) \cdot A - C\left(p_A\left(B_0\right)\right) - k \tag{42}$$

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.

C.2 Debt Renegotiation

In our baseline model of Section 3 we claimed that it was without loss of generality to suppose that all entreneurs, if financed, received a loan $B_0 + k$ at an interest rate of R_A, which could be below one if the entrepreneur was captive.

We now show that our findings are isomorphic to those obtained in a setting in which the interest rate charged by banks is always equal to their marginal cost of funds, i.e., one, but banks are able to renegotiate downwards the debt of their borrowers when needed. In this scenario, captive borrowers re-negotiate their debt downwards to $\bar{p}_A \cdot \bar{B}_A - k < B_0$, and borrow $\bar{p}_A \cdot \bar{B}_A$ from their creditor banks to continue their projects.

Under this interpretation, Proposition 1 is then adjusted as follows.

Proposition 7 *For an entrepreneur with productivity A there are three possibilities in equilibrium:*

1. $\bar{p}_A \cdot \bar{B}_A \geq B_0 + k$: *the entrepreneur is solvent, she borrows* $B_0 + k$ *in the credit market, and continues her project, where*

$$B^*_{1,A} = \frac{B_0 + k}{p_A(B^*_{1,A})} \tag{43}$$

2. $\bar{p}_A \cdot \bar{B}_A \in [\lambda + k, B_0 + k)$: *the entrepreneur is captive, she renegotiates her debt downwards to* $\bar{p}_A \cdot \bar{B}_A - k$ *and is able to borrow to continue her project, where*

$$B^*_{1,A} = \bar{B}_A. \tag{44}$$

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

The proof of the proposition is adjusted as follows.

Proof of Proposition 7. First, consider those entrepreneurs with $\overline{p}_A \cdot \overline{B}_A - k \geq B_0$. By construction, if these entrepreneurs invested k and continued their projects, they would have enough cash flows to repay $\frac{B_0+k}{p_A}$, which is the lowest repayment they could obtain from competitive banks, and where p_A solves

$$A - \frac{B_0 + k}{p_A} = C'(p_A). \tag{45}$$

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 $\frac{B_0+k}{p_A}$, and thus cannot access competitive markets for loans of size $B_0 + k$. 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. ■

The rest of the propositions in the paper can be easily adjusted to a setting with the renegotiation interpretation, as was shown for Proposition 1. What is important are the net transfers between entrepreneurs and banks at different points in time, and these are always: k from the bank to the entrepreneurs at $t = 0$, and $B_{1,A}$ from the entrepreneur to the bank in the success scenario in $t = 1$. Whether the reduction in repayments, $B_0 + k - p_A \cdot B_{1,A}$, needed to continue the projects of captive entrepreneurs occurs through a downwards renegotiation of existing debt B_0 or through a roll-over of B_0 at a subsidized rate $R_A < 1$ has no impact on outcomes.

C.3 Long-term debt

In our baseline model of Section 3 we suppose that debt B_0 is due at time $t = 0$, and that it must therefore be rolled-over for the entrepreneur to be able to continue her project. We now show that our results are robust to an environment with long-term debt by supposing that B_0 is due at $t = 1$. In this scenario, the entrepreneur must only raise k at $t = 0$ to continue her projects.

When debt is long-term, the issue of dilution of pre-existing debts at $t = 0$ may arise. To abstract from this, we assume throughout that the creditor banks has seniority at $t = 1$. As a result, new creditors cannot benefit from diluting pre-existing debt-holders.

Using the definition of debt capactiy from Definition 1, we adjust the main Proposition 1 as follows

Proposition 8 *For an entrepreneur with productivity A there are three possibilities in equilibrium:*

1. $\bar{p}_A \cdot \bar{B}_A \geq k + \bar{p}_A \cdot B_0$*: the entrepreneur is solvent, she borrows k in the credit market at* $R_A = 1$*, and continues her project. Her repayment obligations at* $t = 1$ *are*

$$B^*_{1,A} = \frac{B_0 + k}{p_A(B^*_{1,A})}. \tag{46}$$

2. $\bar{p}_A \cdot \bar{B}_A \in [\lambda + k, \bar{p}_A \cdot B_0 + k)$*: the entrepreneur is captive, she obtains loan k from her creditor bank at rate* $\bar{R}_A = \frac{\bar{B}_A}{\bar{p}_A} < 1$*, and is able to continue her project. Her repayment obligations at* $t = 1$ *are*

$$B^*_{1,A} = \bar{B}_A. \tag{47}$$

3. $\bar{p}_A \cdot \bar{B}_A \leq \lambda + k$*: the entrepreneur cannot continue her project and it is liquidated.*

The proof of Proposition 8 is isomorphic to the one of Proposition 7, where B_0 is now replaced by $\bar{p}_A \cdot B_0$. The remaining proofs follow as well once this adjusment is made, highlighting that there are not conceptual differences between the model with short- vs long-term debt. In both scenarios the banks internalizes that its expected repayment may increase through debt/interest rate reductions, allowing captive entrepreneurs to continue their projects and excerting higher effort.

D 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 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 9 *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*

$$\{b_i, B_{1,i}\} = \left\{B_{0,i} + k, \frac{B_{0,i} + k}{p_i(B_{1,i})}\right\} \tag{48}$$

   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 2. Note that now threshold A_h is indexed by B_0 as:

$$A_h(B_{0,h}) \quad : \quad \bar{p}_h \cdot \bar{B}_h = B_{0,h} + k \tag{49}$$

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 9 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

$$\widetilde{A}(B_0): \quad \widetilde{p} \cdot \widetilde{A} - C(\widetilde{p}) - k = \lambda \tag{50}$$

where $\widetilde{p}$ satisfies

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

This result is formalized in the following proposition.

Proposition 10 *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:

$$Y = \underbrace{\lambda \cdot \left(\int_0^{\lambda} F\left(\underline{A}\left(B_0\right)\right) \cdot dG\left(B_0\right) + F\left(\underline{A}\right) \cdot G\left(\lambda\right) \right)}_{\text{Output of Insolvent Entrepreneurs}} + \underbrace{\int_{\lambda} \int_{\underline{A}(B_0)}^{\bar{A}(B_0)} \bar{y}\left(A\right) \cdot dF\left(A\right) \cdot dG\left(B_0\right)}_{\text{Output of Captive Entrepreneurs}} \tag{51}$$

$$+ \underbrace{\int_0^{\lambda} \int_{\underline{A}(B_0)} y\left(B_0, A\right) \cdot dF\left(A\right) \cdot dG\left(B_0\right) + \int_{\lambda} \int_{\bar{A}(B_0)} y\left(B_0, A\right) \cdot dF\left(A\right) \cdot dG\left(B_0\right)}_{\text{Output of Solvent Entrepreneurs}}$$

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

otherwise, and

$$\bar{y}(A) = p_A(\bar{B_A}) \cdot A - C\left(p_A(\bar{B_A})\right) - k \tag{52}$$

$$y(B_0, A) = p_A(B_0) \cdot A - C(p_A(B_0)) - k \tag{53}$$

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.

E 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 (30) 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 (30) 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 (31) 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)	(2)	(3)	(4)
	All	Affected	All	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 (31) 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 (31) 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) All	(2) 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