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Alberto Martín, Sergio Mayordomo
and Victoria Vanasco

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Alberto Martín

CREI, UPF AND BSE

Sergio Mayordomo

BANCO DE ESPAÑA

Victoria Vanasco

CREI, UPF AND BSE

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Abstract

Governments often support private credit with guarantee schemes, compensating lenders for borrower defaults. Such schemes typically rely on banks allocating guarantees among borrowers, but how banks do so is not well understood. We study this in an economy where entrepreneurial effort, crucial for efficiency, is not contractible, creating a debt overhang problem. Credit guarantees can boost efficiency only if they lower repayment obligations, but their allocation by banks is subject to two distorsions. First, insofar as guarantees are scarce, banks extract rents from all allocated guarantees. Second, banks tilt the allocation of guarantees towards their less productive and highly-indebted borrowers, from whom they can extract even larger rents. Our findings align with evidence from guarantees granted in Spain after the COVID-19 pandemic.

Keywords: credit guarantees, debt overhang, liquidations.

JEL classification: G10, G18, G21, G28.

Resumen

Los gobiernos a menudo apoyan el crédito privado con esquemas de garantías públicas, que compensan a los prestamistas por los incumplimientos de los prestatarios. Estos esquemas suelen depender de los bancos para asignar los avales entre los prestatarios. El presente artículo analiza el proceso de asignación por los bancos de este tipo de garantías en una economía donde el esfuerzo empresarial, crucial para la eficiencia, no es contratable, lo que crea un problema de sobreendeudamiento. Las garantías de crédito pueden aumentar la eficiencia solo si reducen las obligaciones de pago, pero su asignación por parte de los bancos está sujeta a dos distorsiones. Primero, en la medida en que las garantías son escasas, los bancos extraen rentas de todas las que se asignan. Segundo, los bancos tienden a realizar dicha asignación entre sus prestatarios menos productivos y altamente endeudados, de quienes pueden extraer rentas aún mayores. Nuestros resultados se alinean con la evidencia de los avales otorgados en España después del COVID.

Palabras clave: garantías públicas de crédito, sobreendeudamiento, liquidaciones.

Códigos JEL: G10, G18, G21, G28.

1 Introduction

Governments often support private credit through guarantee schemes that compensate lenders in the event of borrower default. Some schemes are permanent, supporting specific credit types (e.g., the U.S. federal government guarantees mortgages via the Federal Housing Administration and the Department of Veterans Affairs), while others are implemented during crises. For example, during the COVID-19 pandemic, credit guarantee schemes were among the largest policy responses in Europe: by April 2020, Germany, France, and Italy had committed €1.9 billion to guarantee private credit.

A defining feature of these programs is their reliance on private lenders to allocate guarantees. Typically, governments set the volume of guarantees, while banks determine which borrowers receive guaranteed loans and on what terms. This raises several important questions: What incentives do banks have in allocating guarantees? How is the surplus from guarantees shared between banks and firms? Is the allocation by banks socially efficient? This paper develops a model to address these questions and tests its predictions with data on all credit guarantees granted in Spain post COVID-19.

We study a canonical economy comprising entrepreneurs and banks. Entrepreneurs operate projects of varying productivity, which require investment to avoid liquidation. They have heterogeneous pre-existing debts with their *creditor banks*, and can borrow either from these banks or in the competitive market. A key friction in our model is non-contractible entrepreneurial effort, which increases project success probability. This friction introduces a moral hazard problem because debt repayments reduce effort, leading to lower output and inefficient liquidations (debt overhang, as in Myers (1977)).

Entrepreneurs fall into three categories in equilibrium: *solvent*, *captive*, or *insolvent*. *Solvent* entrepreneurs can borrow at market rates to repay debt and invest. *Captive* entrepreneurs instead depend on subsidized rates from their creditor bank –determined through Nash bargaining,– to continue their projects. Creditor banks, despite having bargaining power over captive borrowers, offer such subsidies in the understanding that they boost effort and improve debt recovery. *Insolvent* entrepreneurs cannot secure credit and face liquidation. In this framework, an increase in credit needs (e.g., the pandemic) exacerbates the debt overhang problem, resulting in (i) more liquidations, (ii) more captive entrepreneurs, and (iii) lower entrepreneurial effort and output.

We examine the role of credit guarantees in mitigating debt overhang. Namely, we consider a government that provides a fixed volume of guarantees to banks for them to allocate among entrepreneurs.[1] The effect of guarantees depends on how they influence effort through reduced repayment burdens. If banks fully capture the expected guarantee payments, entrepreneurial effort and output remain unchanged.

[1] Rather than characterizing the optimal policy, our goal is to assess the impact of a guarantee program like the one designed in Spain.

Conversely, if they reduce the interest rate faced by entrepreneurs, effort and output increase. The key insight of the model results from two observations: (i) creditor banks can mitigate debt overhang by subsidizing the interest rate on the loans that they grant, and (ii) guarantees also address debt overhang when they result in lower interest rates. We show that guarantees are partially used by banks to substitute the subsidies that they would otherwise grant entrepreneurs, effectively limiting their efficacy.

In equilibrium, all borrowers above a risk threshold receive guarantees, but their terms differ. Since guarantees are scarce, banks earn rents on each unit they allocate. Moreover, banks obtain additional profits from their captive borrowers, against which they effectively have bargaining power. Solvent entrepreneurs thus benefit the most from guarantees, while captive entrepreneurs could even be harmed by them. These results imply a pecking order in banks' allocation of guarantees, which are granted first to risky and – among these – to captive entrepreneurs. In essence, banks prioritize entrepreneurs who are expected to generate the largest payments from the government and from whom they can extract more surplus.

We contrast the competitive equilibrium with the allocation of guarantees chosen by a planner to maximize social surplus. We uncover 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 social surplus. Second, the planner takes into account the social benefit of guarantees through their effect on effort, and allocates guarantees wherever their social marginal benefit is largest. In an example, we show that – relative to the market – the planner tilts the allocation of guarantees to prevent the inefficient liquidation of entrepreneurs with a positive surplus but a severe overhang problem.

We test the predictions of the model by studying the large guarantee program that Spain implemented in 2020 (ICO program), which was endowed with €140 billion in funds. Guarantees, which were distributed among banks to 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 and was viewed as essential in enabling many companies to cover their main liquidity needs (see e.g. Banco de España (2020) and Blanco and Mayordomo (2023)). 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, when most ICO 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 date and maturity, and the existence of guarantees. We merge this loan-level data with firm balance-sheet information from the quasi-census of non-financial firms from the Central Balance Sheet Data Office Survey (CBSDO). The data derives from the accounts filed with the Spanish Commercial Register and it contains information on firms' balance sheets, profit and loss accounts, and other non-financial characteristics such as industry, year of incorporation, and demographic status.

The first testable prediction of the model is that credit guarantees are more likely to be allocated to riskier borrowers. This prediction is intuitive and not unique to our theory: banks have a natural incentive to maximize expected guarantee payments from the government, which increase with borrowers' probability of failure. To test this, we evaluate how different firm-level measures of risk relate to the ratio of ICO-guaranteed loans (ICO loans) to total credit received during the sample period. We find that, consistent with our model, the share of ICO loans received is significantly higher for borrowers with a higher probability of default or that have higher liquidity needs.[2]

The second testable prediction is unique to our model: conditional on the level of risk, banks are more likely to extend guarantees to their captive borrowers, especially so when they have more bargaining power. To test this prediction, we say that a firm is captive to a given bank if it is considered ex-ante risky (in our preferred specification, if the firm has a high probability of default as of December 2019) and has a previous credit relationship with the bank. In line with the theory, we find that the share of ICO-to-total loans is significantly higher for captive than for non-captive firms. We also find that this result intensifies with the bank's bargaining position, proxied by the fraction of the firms' total debt that the bank holds. Crucially, we show that it is the interaction of risk and pre-existing relationship that drives our results, i.e. our measure of captivity, and not either of these variables considered separately. These findings are robust to alternative measures of risk, captivity, and bargaining power.

The third, and perhaps main, 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, specially so when banks have a stronger bargaining position. To test this prediction, we measure the interest rate differential between ICO- and non-ICO loans and compare it across captive and non-captive firms. We find that ICO loans entail a significant interest-rate discount relative to non-ICO loans for non-captive borrowers (around 33 basis points on average), but that the discount is halved for

[2]The measures of default risk and liquidity needs are computed internally at the Banco de España, and are as of December 2019. Section 7 preents a detailed description of each measure.

captive borrowers and is reduced further as the bank's bargaining power intensifies. These findings are robust to different specifications of risk and captivity.

A crucial implication of our findings is that ICO loans granted to captive firms should have a weaker effect on firm outcomes than ICO loans granted to non-captive firms. We verify this implication by showing that the share of credit that a firm obtains in the form of ICO loans from *non-captor* banks is positively correlated with an increase in non-current and tangible assets. In contrast, the share of credit that a firm obtains in the form of ICO loans from *captor* banks is uncorrelated to the growth of its assets, although it is positively correlated with an increase in its leverage and in the probability of having NPLs in subsequent years.

Overall, our empirical findings suggest that banks have skewed the allocation of guarantees toward borrowers from whom they can extract a greater share of benefits. This implies that, if debt overhang is a concern in the face of a large shock like COVID, banks have diluted the potential advantages of guarantees due to their own incentives. While we cannot directly assess the significance of debt overhang in Spain with our data, there is a substantial body of empirical work that documents the detrimental effects of debt repayments on firm performance. (e.g. Kalemli-Ozcan et al. (2022); Micucci and Rossi (2017); Önder et al. (2024)).

Literature review. 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 (Honohan, 2010; 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 in the financial sector (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. We contribute the study of 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 the real economy (Bartoli et al., 2013; Bonfim et al., 2023; Kim, 2024). An implication of our model is that loan guarantees can increase output as long as banks do not fully absorb their benefits. 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 guaranteed principal causes an average increase of \$19,000 in loan volumes. Other papers have established a link between loan guarantees and aggregate real variables, with evidence of positive effects on employment, growth, and access to finance (Hancock et al., 2007; Lelarge et al., 2010; Brown and Earle, 2017; De Blasio et al., 2017; Mullins et al., 2018; Gonzalez-Uribe and Wang, 2022; Barrot et al., 2024).

Perhaps closest to us are 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, finds 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. Ciani et al. (2020) and Altavilla et al. (2021) reports a similar finding using data from multiple countries within the Euro Area. For Italy, Cascarino et al. (2022) documents that credit substitution appears to have been stronger for guaranteed loans that had the highest coverage ratio.[3] These empirical observations are 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 its correlation with firm characteristics.

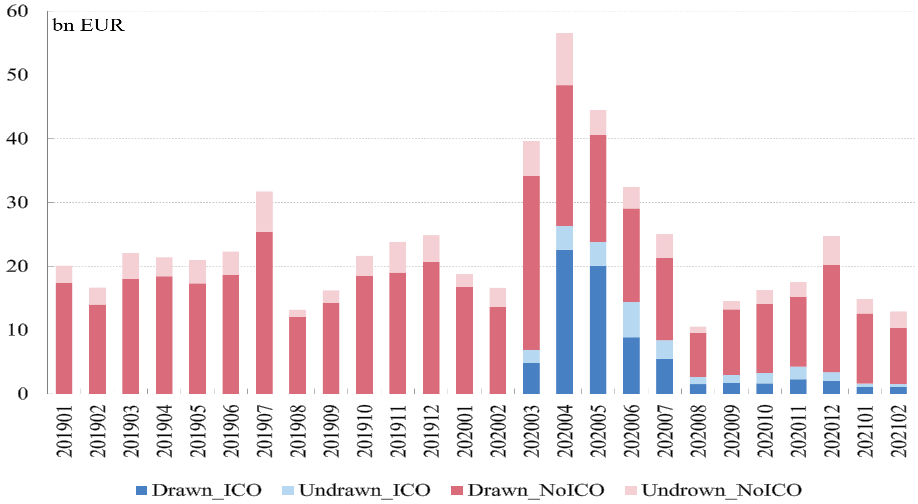
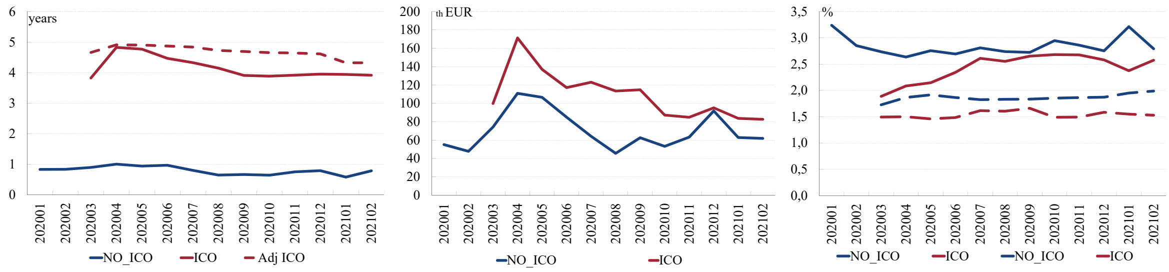


Figure 1: **Evolution of new credit operations to non-financial corporations (NFCs)**. This figure shows the evolution of new credit, drawn and undrawn, to NFCs from January 2019 to February 2021, distinguishing the portion arranged through the ICO facility.

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

[3]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.

result in an even larger demand shock that drives activity below potential. Closer to us, Brunnermeier and Krishnamurthy (2020) analyze several credit-market interventions to 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 work by studying the effect of loan guarantees allocated through banks, and by assessing these effects theoretically and empirically with data from the guarantee program in Spain.



(a) Maturity (b) Size (c) Interest Rates

Figure 2: **Conditions of new loans with and without public guarantees.** Panel (a) shows the average maturity of ICO and non-ICO loans, with dashed line conditioning on drawn ICO loans (i.e., excluding credit lines). Panel (b) shows the average size of ICO and non-ICO loans. Panel (c) shows the average interest rate (without fees) for both type of loans, with dashed lines adjusting by type of loan, maturity, reference rate (fixed or floating), and the existence of real or personal guarantees.

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.[4] Jointly considered, their size amounted to €140 billion, and they have been managed by the Official Credit Institute (ICO, by its Spanish abbreviation).

ICO guarantees cover up to 80% of the potential losses on bank finance extended to the self-employed and SMEs, and up to 70% or 60% of financing losses extended to non-SMEs depending on whether this financing is composed of new loans or rollovers. All loans granted to firms domiciled in Spain after March 17, 2020 were eligible for the program, excepting firms that were in a delinquency situation at CIRBE[5] 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

[4]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.

[5]A central risk database in Spain.

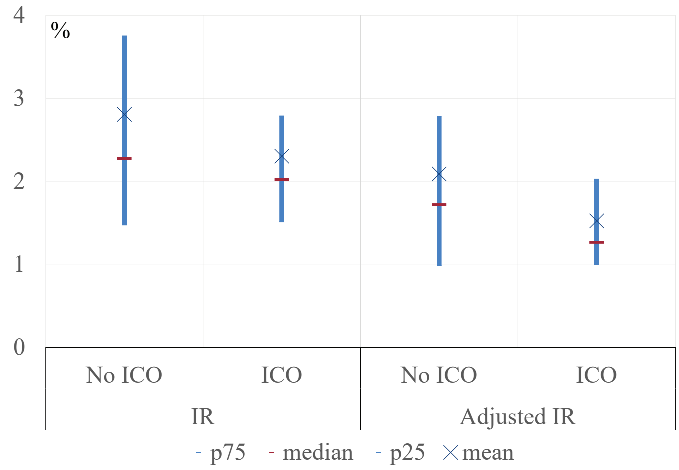


Figure 3: **Dispersion in the interest rates of loans with and without ICO guarantees.** This figure reports the mean, median and the 25th and 75th percentiles of interest rates without public guarantees (No ICO) and with public guarantees (ICO). The left panel corresponds to the nominal rates whereas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

key feature of the program is that banks were granted a share of total guarantees, based on their market share, for them to allocate across 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, almost 85% of them during 2020. Figure 1 shows the evolution of new credit, drawn and undrawn, extended to non-financial corporations between January 2019 and February 2021. ICO loans made up a significant share of total credit during the COVID crisis, with 40% of the new credit granted between March and June of 2020 with ICO guarantees. By mid-2022, ICO guaranteed credit 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 higher for firms facing greater financial difficulties, such as those in COVID affected sectors, SMEs, or high risk (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, on average ICO loans had longer maturity, were larger, and had lower nominal interest rates –even when adjusting for loan characteristics,– than non-ICO loans. However, not all firms benefited the same. As shown in Figure 3, the interest rate dispersion on ICO loans was substantially higher than that of non-ICO loans, even when controlling for loan characteristics, such as the type of loan, maturity, reference rate (fixed or floating), and the existence of other real or personal guarantees.

Motivated by these facts, we develop next a model to study banks' incentives to allocate and price public credit guarantees across heterogeneous borrowers.

3 The model

We study an economy with heterogeneous entrepreneurs that have pre-existing debts and must invest to continue their projects. The key friction is that the return to investment depends directly on entrepreneurial effort, which is not contractible, giving rise to a debt overhang problem that reduces output relative to the efficient benchmark.

The economy lasts for two periods, $t = \{0, 1\}$. It is populated by a continuum of entrepreneurs with measure one and 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). All agents have access to a storage technology.

Entrepreneurs differ along two dimensions. The first one is technological: at $t = 0$, each entrepreneur is endowed with a project that requires k units of investment to continue. If continued, the project yields A units of the consumption good at $t = 1$ in the event of success and nothing otherwise. We assume that $A \sim F(A)$, with full support in $\left[0, \bar{A}\right]$. The second source of heterogeneity is the stock of pre-existing debt b, where $b \sim G(b)$ with full support in $\left[\underline{b}, \bar{b}\right]$. Thus, an entrepreneur is characterized by a pair $\{A, b\}$, which we refer to as her *type*. We assume, for simplicity, that (i) productivity and pre-existing debts are independently distributed, (ii) an entrepreneur's pre-existing debt is owed to one bank (henceforth, her *creditor bank*) at $t = 0$, and (iii) pre-existing debts are equally distributed across banks.[6]

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

Bankers have deep pockets and the credit market is competitive and modeled as follows. First, competitive banks post credit contracts for each entrepreneur type $\{A, b\}$. After contracts are posted, entrepreneurs are given the chance to negotiate a credit contract with their creditor bank through Nash bargaining. Entrepreneurs then choose a credit contract, either from the market or from their creditor bank. If an entrepreneur fails to obtain credit, her project is liquidated, in which case she obtains $\max\{\lambda - b, 0\}$ and her creditor bank $\min\{\lambda, b\}$.

3.1 First-best allocation

We begin by characterizing the first-best allocation. Letting

[6] While the one creditor bank assumption is made for tractability, it is not a bad approximation to the Spanish data. As of February 2020, approximately 60% of firms in Spain with bank debt maintained a relationship with a single bank. For the remaining multi-bank firms, the main bank accounted for 52% of their credit.

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

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. Importantly, first-best allocations depend only on entrepreneurs' productivity A and are independent of their pre-existing debts b.

In the first-best, the social surplus generated by a project with productivity A is

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

resulting in a total surplus of

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

Figure 4 depicts the surplus of entrepreneurs as a function of A in the first-best.

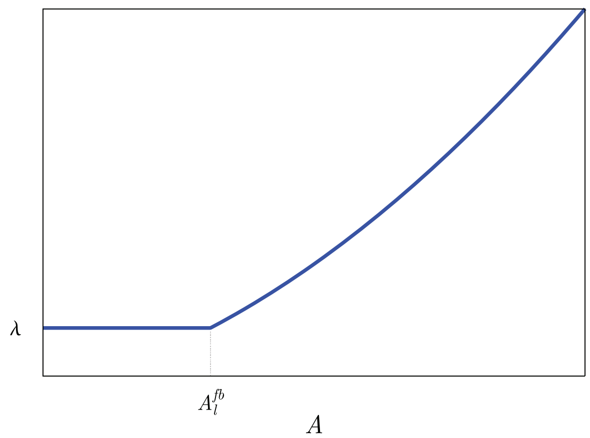


Figure 4: **First-best surplus of entrepreneur with productivity A.**

4 Equilibrium without guarantees

We begin by characterizing the contracts offered in the credit market in the absence of credit guarantees, which determine overall investment and surplus in this economy.

4.1 Credit contracts

An entrepreneur of type $\{A, b\}$ needs to secure credit totaling $b + k$ to repay existing debt and continue her project. Since effort p is non-contractible, credit contracts can only be contingent on the project's outcome. Therefore, we focus without loss of generality on contracts that specify, for an entrepreneur of type $\{A, b\}$, a repayment amount $B_{A,b}$ in the event of project success for a loan of $b+k$. This implies an interest rate of $R_{A,b} = \frac{B_{A,b}}{b+k}$.[7] The bank's expected revenue at $t = 1$ from offering contract B to an entrepreneur of type $\{A, b\}$ is

$$p_A(B) \cdot B \tag{3}$$

where $p_A(B)$ is the entrepreneurs' incentive-compatible effort level, given by

$$A - B = C'(p_A) \tag{4}$$

We use the notation $p_A(\cdot)$ to emphasize that, conditional on the repayment level B, an entrepreneur's productivity A is the sole determinant of her effort.

From Equation (4), it is clear that the equilibrium effort level is suboptimal compared to the first-best level in Equation (1). The reason is straightforward: as long as the repayment required by the credit contract is positive, i.e., $B > 0$, the entrepreneur fails to fully internalize the benefit of her effort that accrues to the creditor bank.

4.2 Equilibrium allocation

To characterize equilibrium credit contracts, we define an entrepreneur's maximum and minimum debt capacity.

Definition 1. *The maximum 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 revenue subject to the entrepreneur's incentive constraint. Formally,*

$$\bar{B}_A : \quad arg\, max_B \quad p_A(B) \cdot B \tag{5}$$

The minimum debt capacity of an entrepreneur with productivity A, denoted by $\underline{B}_A$, is the repayment entailed by the contract that maximizes the entrepreneur's expected surplus subject to her creditor bank's participation constraint when $b > \lambda$. Formally,

[7] We impose no restrictions on the form of contracts between the bank and the entrepreneur. Since cash flows are realized only upon success, debt and equity contracts are equivalent in this setting. Any contract can be characterized by the repayment amount B contingent on success, given a loan of $b+k$.

$$\underline{B}_A: \quad p_A(B) \cdot B = \lambda + k \tag{6}$$

We henceforth use $\bar{p}_A \equiv p_A(\bar{B}_A)$ and $\underline{p}_A \equiv p_A(\underline{B}_A)$ to respectively denote the effort levels associated to the maximum and minimum debt repayments of an entrepreneur with productivity A. Importantly, an entrepreneur's maximum (minimum) debt repayment increases (decreases) in her productivity A, and is independent of her pre-existing debt b. Given Definition 1, the following proposition characterizes equilibrium credit contracts for each entrepreneur type.

Proposition 1 (Credit Contracts). *In equilibrium, there are three possibilities for an entrepreneur of type $\{A, b\}$:*

1. *If $\bar{p}_A \cdot \bar{B}_A \geq b + k$, she is solvent and obtains contract*

$$B^*_{A,b} = \frac{b+k}{p_A(B^*_{A,b})} \qquad\qquad R^*_{A,b} = \frac{1}{p_A(B^*_{A,b})}. \tag{7}$$

2. *If $\bar{p}_A \cdot \bar{B}_A \in [\lambda + k, b + k)$, she is captive and negotiates with her creditor bank contract*

$$B^*_{A,b} = w_A(\gamma) \cdot \bar{B}_A + (1 - w_A(\gamma)) \cdot \underline{B}_A \qquad\qquad R^*_{A,b} = \frac{B^*_{A,b}}{b+k} < \frac{1}{p_A(B^*_{A,b})},$$

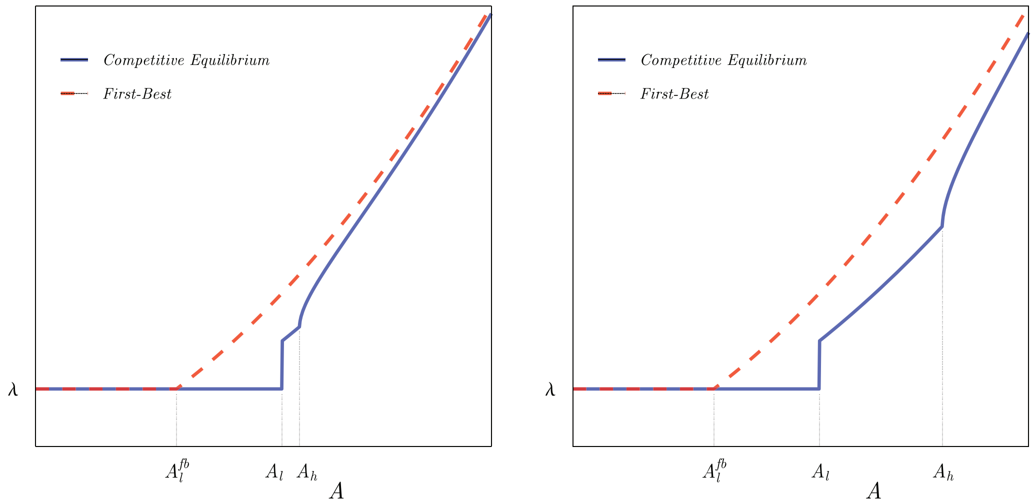
where $\gamma \in [0, 1]$ is the bank's bargaining power and $w_A(0) = 0$, $w'_A > 0$, $w_A(1) = 1$.

3. *If $\bar{p}_A \cdot \bar{B}_A < \lambda + k$, she is insolvent and receives no credit offers.*

Solvent entrepreneurs have a high repayment capacity and can fully access credit markets at competitive rates: thus, they can secure all the necessary funding from any bank. On the other extreme, insolvent entrepreneurs have a low repayment capacity and cannot meet the repayment threshold $k + \lambda$: thus, they are denied further credit by all banks. In the middle, captive entrepreneurs have limited repayment capacity and must rely on negotiations with their creditor bank, where they face diminished bargaining power. In spite of this, they secure the necessary funding at a subsidized interest rate. Even when the creditor bank holds full bargaining power ($\gamma = 1$), it prefers to subsidize the loan in order to boost the entrepreneur's effort and thus the likelihood of being repaid.[8] The negotiated interest rate is a convex combination of the rates that maximize the surplus of the entrepreneur and of the bank.[9]

[8] A necessary condition for an entrepreneur to be captive is that their pre-existing debt exceeds the liquidation value, i.e., $b > \lambda$. Otherwise, the bank would liquidate to ensure full repayment.

[9] For a formal analysis of the Nash bargaining solution and the characterization of the weight $w_A(\gamma)$, we refer the reader to the proof of Proposition 1.



(a) Low debt level (b) High debt level

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

Entrepreneurs' access to credit markets determines their ability to continue their projects. In particular, those entrepreneurs whose productivities are high relative to their funding needs continue their projects, as formalized in the following proposition.

Proposition 2 (Investment)**.** *There exist thresholds $A_\ell^*(b)$ and $A_h^*(b)$, both weakly increasing in b, such that an entrepreneur of type $\{A, b\}$ with*

1. *$A \geq A_h^*(b)$ borrows from competitive banks and continues her project;*
2. *$A \in [A_\ell^*(b), A_h^*(b))$ negotiates with her creditor bank and continues her project;*
3. *$A < A_\ell^*(b)$ liquidates her project and obtains* $\max\{0, \lambda - b\}$.

To understand the thresholds defined in Proposition 2, consider first entrepreneurs whose debt obligations exceed liquidation values, i.e., with $b > \lambda$. These entrepreneurs obtain nothing in case of liquidation, and are thus strictly better off continuing their projects. As a result, they do so whenever they obtain credit, and their investment thresholds are those implied by Proposition 1:

$$A_h^*(b) \quad \equiv \{A : \bar{p}_A \cdot \bar{B}_A = b + k\} \tag{8}$$

$$A_\ell^*(b) = A_\ell^* \quad \equiv \{A : \bar{p}_A \cdot \bar{B}_A = \lambda + k\} \tag{9}$$

Next, consider those entrepreneurs with $b \leq \lambda$. These entrepreneurs are never captive as their creditor bank can obtain full repayment through liquidation. As these entrepreneurs do get a surplus after liquidation, they continue their projects only when doing so is better than liquidation:

$$A_h^*(b) = A_\ell^*(b) \equiv \{A : p_A(B_A^*) \cdot A - C(p_A(B_A^*)) = \lambda + k\}. \tag{10}$$

As in the first-best, the competitive equilibrium is characterized by a productivity threshold above which entrepreneurs continue their projects. However, the competitive equilibrium entails a loss of efficiency relative to the first-best. Figure 5 illustrates this by depicting the total surplus in the competitive equilibrium (solid line) and in the first-best (dashed line) for two levels of pre-existing debt.[10] 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 are liquidated in equilibrium, i.e., $A_\ell^*(b) > A_\ell^{fb}$. Second, even those entrepreneurs who continue their projects exert a sub-optimal level of effort, i.e., $p_A < p_A^{fb}$ for all $A > A_\ell^*(b)$. Comparison of both panels reveals that, in the competitive equilibrium, total surplus is decreasing, and the likelihood of being captive is increasing, in the level of pre-existing debt.

The source of inefficiency is the non-contractibility of entrepreneurial effort, which creates a debt overhang problem that destroys surplus relative to the first-best. The ability of entrepreneurs to negotiate with their creditor bank ameliorates the severity of this friction, as banks are effectively willing to subsidize some (and if needed all) the repayment of pre-existing debts for those entrepreneurs that are sufficiently productive. But this negotiation cannot fully solve the debt overhang problem unless effort is contractible, as the following lemma shows.

Lemma 1 (No Moral Hazard)**.** *Suppose effort p is contractible. Then, the competitive equilibrium obtains the first-best allocations: $A_\ell^*(b) = A_\ell^{fb}, \forall b$, and $p_A^* = p_A^{fb}, \forall A$.*

If the underlying problem is one of debt overhang due to the non-contractibility of effort, can credit-guarantee schemes boost efficiency by helping reduce the debt burden of entrepreneurs? We turn to this question next.

5 The effect of credit guarantees

We modify the environment by assuming that the government grants a total of $\bar{X}$ units of guarantees, which are distributed equally across banks. Banks then decide how to allocate them among entrepreneurs. Guarantees can in principle ameliorate the debt overhang problem, but only if banks use them to reduce entrepreneurs' debt repayments.

5.1 Credit contracts with guarantees

In the presence of guarantees, the credit contracts offered by banks become a pair $\{B, x\}$, where x denotes the units of guarantees assigned to the contract. Each unit

[10] For the figures, we suppose that $b > \lambda$ in both panels, $C(p) = \frac{p^2}{2}$, and $\gamma = 1$.

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 of this type offered to an entrepreneur with productivity A generates an expected revenue for the bank of

$$p_A(B) \cdot B + (1 - p_A(B)) \cdot x, \tag{11}$$

of which $(1-p_A(B)) \cdot x$ are expected transfers from the government. We suppose that x cannot exceed k to reflect the rules of most public guarantee programs, which stipulate that guarantees cannot be used to roll-over pre-existing debts.[11]

As banks are in charge of allocating a (potentially) scarce resource, $\bar{X}$, it is useful to define the shadow value of granting a unit of guarantee, which we denote by ρ. This shadow value measures the opportunity cost that a bank faces when allocating a guarantee to an entrepreneur: as we shall see, it is an equilibrium object that ensures that the demand for guarantees does not exceed its supply $\bar{X}$. It is immediate from Equation (11) that a bank will optimally allocate guarantees to an entrepreneur of type $\{A, b\}$ if and only if the expected income from the guarantee exceeds the cost, i.e., $1 - p_A(B_{A,b}) > \rho$. In this case, moreover, we show that the bank will grant a full guarantee to maximize the expected transfer from the government. Thus, in equilibrium, $x \in \{0, k\}$.[12]

5.2 Equilibrium with guarantees

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

Definition 2. *The maximum debt capacity with guarantees of an entrepreneur with productivity A, denoted by $\bar{B}^g_A$, is the repayment entailed by a contract with $x = k$ that maximizes the bank's expected revenue subject to the entrepreneur's incentive constraint. Formally,*

$$\bar{B}^g_A : \quad arg\,max_B \quad p_A(B) \cdot B + (1 - p_A(B)) \cdot k \tag{12}$$

The minimum debt capacity with guarantees of an entrepreneur with productivity A, denoted by $\underline{B}^g_A$, is the repayment entailed by a contract with $x = k$ that maximizes the entrepreneur's expected surplus subject to the bank's participation constraint when $b > \lambda$. Formally,

[11] What is important for our findings is that $x < b + k$, 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 only partially insure creditor banks.

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

$$\underline{B}^g_A: \quad p_A(B)\cdot B + (1-p_A(B)-\rho)\cdot k = \lambda + k \tag{13}$$

We henceforth use $\bar{p}^g_A \equiv p_A(\bar{B}^g_A)$ and $\underline{p}^g_A \equiv p(\underline{B}^g_A)$ to denote the effort level associated to the corresponding debt capacity with guarantees.

It follows from comparing Definitions 1 and 2 that the introduction of guarantees both increases the maximum and reduces the minimum debt capacity of entrepreneurs. The maximum debt capacity rises because guarantees reduce the bank's incentive to encourage entrepreneurial effort through a lower repayment. In essence, the bank substitutes repayment reductions — previously used to incentivize effort — with guarantees that compensate for losses in the event of failure. Conversely, the minimum debt capacity decreases because, as long as $1-p>\rho$, the entrepreneur's repayment can be lowered without violating the bank's participation constraint. This occurs because the guarantee offsets the bank's potential loss, allowing the benefits of the guarantee to be passed on to the entrepreneur in the form of reduced repayment obligations.

The following Proposition combines and extends Propositions 1 and 2 to incorporate credit guarantees.

Proposition 3 (Credit contracts with guarantees)**.** *Given a shadow price of guarantees ρ, there exist thresholds $A^g_\ell(b,\rho)$ and $A^g_h(b,\rho)$, both weakly increasing in b and ρ and satisfying $A^g_\ell(b,\rho)\le A^g_h(b,\rho)$, such that an entrepreneur of type $\{A,b\}$ with*

1. *$A\ge A^g_h(b,\rho)$ is solvent, obtains contract*

$$B^g_{A,b} = \frac{b+\big(p_A(B^g_{A,b})+\rho\big)\cdot k}{p_A(B^g_{A,b})}\cdot\frac{x_{A,b}}{k} + B^*_{A,b}\cdot\left(1-\frac{x_{A,b}}{k}\right), \tag{14}$$

$$x_{A,b} = k\cdot\mathcal{I}(1-p_A(B^g_{A,b})\ge\rho) \tag{15}$$

in the credit market to continues her project.

2. *$A\in[A^g_\ell(b,\rho),A^g_h(b,\rho))$ is captive, negotiates contract*

$$B^g_{A,b} = \big(w^g_A(\gamma)\cdot\bar{B}^g_A + (1-w^g_A(\gamma))\cdot\underline{B}^g_A\big)\cdot\frac{x_{A,b}}{k} + B^*_{A,b}\cdot\left(1-\frac{x_{A,b}}{k}\right), \tag{16}$$

$$x_{A,b} = k\cdot\mathcal{I}(1-p_A(B^g_{A,b})\ge\rho) \tag{17}$$

with creditor bank to continues her project, where $w^g_A(0)=0$, $w^{g\prime}_A>0$, $w^g_A(1)=1$.

3. *$A<A^g_\ell(b,\rho)$, is insolvent and her project is liquidated.*

As in the economy without guarantees, the equilibrium is characterized by two productivity thresholds: $A^g_\ell(b,\rho)$, which denotes the productivity below which projects are liquidated, and $A^g_h(b,\rho)$, which denotes the productivity above which entrepreneurs are solvent. The main innovation is that these thresholds are increasing in the shadow price of guarantees, ρ, with $\lim_{\rho\to\infty} A^g_\ell(b,\rho) = A^*_\ell(b)$ and $\lim_{\rho\to\infty} A^g_h(b,\rho) = A^*_h(b)$. Figure 6 depicts the change in social surplus after the introduction of guarantees for the case of $\gamma = 1$ and constant pre-existing debt $b > \lambda$.

Proposition 3 highlights the main effects of guarantees in equilibrium. First, all borrowers who are sufficiently risky — i.e., those for whom $1 - p > \rho$ — receive a full guarantee, though the benefits are not distributed equally. For solvent entrepreneurs, bank competition ensures that part of the expected transfers generated by the guarantee is passed through to them, reducing their expected repayments by $(1 - p - \rho) \cdot k$. However, this pass-through is incomplete because banks retain a rent of $\rho \cdot k$ per guaranteed loan.[13] For captive entrepreneurs, the lack of competition among banks further diminishes the pass-through as long as $\gamma > 0$. In fact, when banks' bargaining power is sufficiently high, captive entrepreneurs may not benefit at all from guarantees. Specifically, since $\bar{B}^g_A > \bar{B}_A$, they might face higher repayments because banks have weaker incentives to encourage entrepreneurial effort when a guarantee is in place. These insights are formalized in the following Corollary.

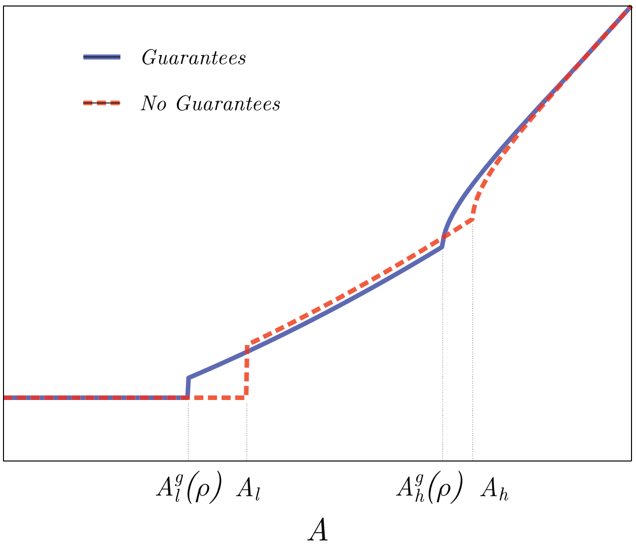


Figure 6: **Competitive equilibrium surplus, with and without credit guarantees.**

Corollary 1. *The following results follow from Proposition 3,*

1. *If $\rho > 0$, no entrepreneur receives a full pass-through of credit guarantees.*
2. *If $\gamma > 0$, the pass-through of credit guarantees is lower for captive than for solvent entrepreneurs, conditional on risk.*

[13] We define the pass-through of a credit guarantee as the reduction in repayment $B_{A,b}$ associated with obtaining a full guarantee. For an entrepreneur type $\{A, b\}$, a full pass-through would reduce the expected repayment $p_A \cdot B_{A,b}$ by $(1 - p_A(B_{A,b})) \cdot k$, equivalent to providing guarantees at no cost.

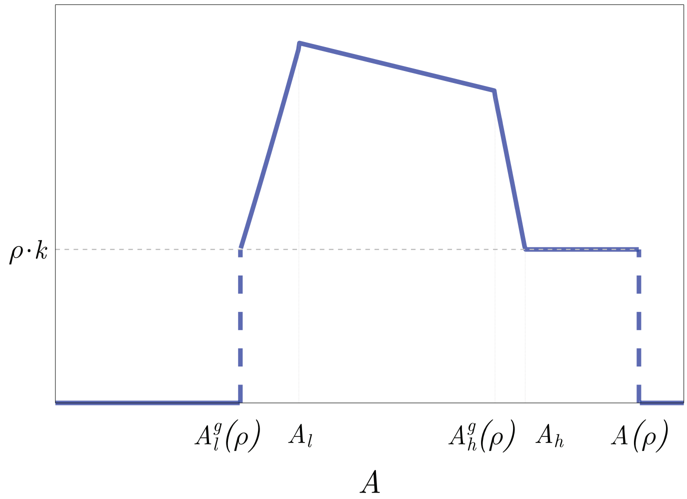


Figure 7: **Banks' extra revenues from granting guaranteed credit in equilibrium when $\gamma = 1$.** This figure plots the extra revenues that banks obtain from granting guaranteed credit contracts in equilibrium, as a function of entrepreneurial productivity A.

3. *If γ is sufficiently large, the pass-through of credit guarantees for captive entrepreneurs is negative, i.e., they pay a higher interest rate when loans are guaranteed than they would in their absence.*

For a given level of risk, banks follow a pecking order, prioritizing guarantees for captive entrepreneurs over solvent ones. Figure 7 illustrates the additional revenues earned by banks in the economy with guarantees from an entrepreneur with productivity A and debt level $b > \lambda$ when $\gamma = 1$. The revenues generated from guarantees are non-monotonic in A, reaching their peak at A_ℓ^*. These entrepreneurs are the riskiest ones for whom the bank can fully extract the expected transfers generated by guarantees. For entrepreneurs with $A < A_\ell^*$, profits are lower because banks must share some of the benefits of the guarantees to incentivize effort and prevent liquidation. For those with $A > A_\ell^*$, profits decline as the benefits of guarantees decrease with rising success probabilities, which reduce the expected compensation from the guarantees.

To complete the characterization of equilibrium, we find the value of ρ that clears the market for guarantees:[14]

$$\int \int x_{A,b}(\rho) \cdot dF(A) \cdot dG(b) = \bar{X}. \tag{18}$$

The left-hand side of Equation (18) denotes the total guarantees allocated by banks as a function of ρ, where $x_{A,b}(\rho)$ is defined in Proposition 3, and it is decreasing in ρ. The right-hand side is the total amount of guarantees that banks have available to distribute among entrepreneurs, and it is independent of ρ. It follows that there is a unique value, ρ^g, that satisfies Equation (18), as depicted in Figure 8. Note that ρ^g represents the rent per unit of guarantee that is captured by banks: this is a benefit that

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

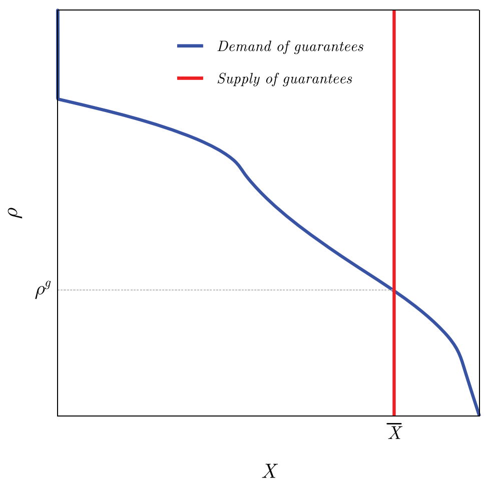


Figure 8: **Supply and Demand of Guarantees**

banks appropriate from being in charge of allocating scarce guarantees. 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 $\bar{X} < \int \int x_{A,b}(0) \cdot dF(A) \cdot dG(b)$.

5.3 Discussion of Modeling Assumptions

Non-contractible effort. The moral hazard arising from non-contractible effort is the key friction underlying our theoretical insight, as it ties debt repayments to output and enables debt renegotiation. If effort is contractible, first-best allocations are obtained: there is no need for debt renegotiation and guarantees cannot enhance efficiency (Lemma 1). While banks would still appropriate part of the benefits of guarantees (likely more so when guarantees are scarce or banks hold significant bargaining power), this would be inconsequential for efficiency. We believe our core insight would hold under other frictions that link debt repayments to output, as evidenced in Kalemli-Ozcan et al. (2022); Micucci and Rossi (2017); Önder et al. (2024).

Negotiating Pre-Existing Debts. We assume that, upon renegotiating with captive borrowers, banks grant a loan of $b + k$ at a subsidized interest rate. In Appendix C.1, we show that this approach is isomorphic to one in which captive entrepreneurs negotiate a reduction in their pre-existing debt b with their creditor bank before accessing competitive markets. The reason is that both the creditor bank and the entrepreneur care only about the expected $t = 1$ repayment, $p \cdot B$, for a $t = 0$ transfer of resources of k: whether a certain level of B is attained through a reduction in the interest rate or in the face value of debt is inconsequential.

Long-term Debt. We assume that all pre-existing debt b is due at $t = 0$. In Appendix C.2, we demonstrate that our results are unaffected by debt maturity by solving the model with b due at $t = 1$. The debt overhang problem stems from repayment obligations at $t = 1$ being high, whether from short-term debt that must be rolled over from $t = 0$ or from long-term debt due at $t = 1$. In either case, renegotiation will adjust $t = 1$ debt repayments to avoid liquidation, either by lowering the interest rate on $t = 0$ loans or by reducing the face value of debt due in $t = 1$.

Dynamics. We assume that pre-existing debts b are given, but our results extend to dynamic settings where banks and firms are forward-looking when setting b. All we need is uncertainty about A and non-contingent repayments, b. These assumptions are realistic in our context: (i) firms' revenues are uncertain, especially during large macro shocks, and (ii) debt contracts typically feature non-contingent repayments. Captive firms are then those who experience a large negative productivity shock relative to their debt obligations.

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, for each entrepreneurial type $\{A, b\}$, the planner chooses contract $\{B^p, x^p\}$ to maximize the social surplus of investment. Formally:

$$\max_{\{\mathcal{I},B,x\}_{\{A,b\}}} \int\int [(p_A \cdot A - C(p_A) - k) \cdot \mathcal{I}_{A,b} + \lambda \cdot (1 - \mathcal{I}_{A,b})] \cdot dF(A) \cdot dG(b) \tag{19}$$

$$s.t. \quad A - B_{A,b} = C'(p_A), \quad \forall A, b \tag{20}$$

$$[p_A \cdot B_{A,b} + (1 - p_A) \cdot x_{A,b} - k] \cdot \mathcal{I}_{A,b} + \lambda \cdot (1 - \mathcal{I}_{A,b}) \geq \pi^*_{A,b}, \quad \forall A, b \tag{21}$$

$$\int\int x_{A,b} \cdot dF(A)dG(b) = \bar{X}. \tag{22}$$

where $\pi^*_{A,b}$ denotes banks' profits from lending to or liquidating an entrepreneur of type $\{A, b\}$ in the absence of guarantees (computed from Proposition 1), and $\mathcal{I}_{A,b}$ is an indicator function that takes value one when the planner grants a loan to entrepreneurs type $\{A, b\}$. Equation (20) is the incentive compatibility constraint of entrepreneurs, Equation (21) is the participation constraint of banks, and Equation (22) is the feasibility constraint faced by the planner.

It is immediate that banks' participation constraints bind in the planner allocation. Given this, we can compute the planner's marginal benefit of granting guarantees to an entrepreneur of type $\{A, b\}$,

$$MB_{A,b}(x^p_{A,b}) \equiv (A - C'(p_A(B^p_{A,b}))) \cdot \frac{dp_A}{dx^p_{A,b}} \tag{23}$$

where $\frac{dp_A}{dx^p_{A,b}} > 0$ can be derived from Equations (20) and (21). It is useful to rewrite this expression as:

$$MB_{A,b}(x^p_{A,b}) = (1 - p_A(B^p_{A,b})) \cdot \frac{\eta_{A,b}}{1 - \eta_{A,b} \cdot \left[1 - \frac{x^p_{A,b}}{B^p_{A,b}}\right]} \tag{24}$$

where $\eta_{A,b}$ denotes, in absolute value, the elasticity of p_A with respect to $B_{A,b}$.

Equations (23) and (24) capture the distortions present in the competitive equilibrium allocation of guarantees. First, the planner fully passes on the expected transfers from the guarantees, $(1-p_A)\cdot x^p_{A,b}$, in the form of a lower repayment. As a result, guarantees always boost entrepreneurial effort and output in the planner allocation. Second, the planner takes into account the effect of this lower repayment on entrepreneurial effort, as well as the social marginal benefit of this additional effort (Equation (23)). To ease comparison with the market allocation, Equation (24) expresses the planner's marginal value of granting a guarantee to an entrepreneur of type $\{A, b\}$ as the transfer entailed by the guarantee, $1 - p_A$, times a multiplier that is increasing in the elasticity $\eta_{A,b}$. Note that, the higher is the elasticity of effort to repayment, the higher is the planner's valuation of guarantees relative to banks.

Finally, the social marginal cost of granting guarantees is given by the multiplier of the feasibility constraint (22), which we denote by $\rho^p \geq 0$. The following result characterizes the planner's allocation of guarantees among entrepreneurs.

Proposition 4. *In the planner allocation, entrepreneurs of type* $\{A, b\}$ *with* $A \geq A^g_\ell(b, 0)$ *receive credit contract*

$$B^p_{A,b} = \frac{\pi^*_{A,b} - (1 - p_A(B^p_{A,b})) \cdot x^p_{A,b} + k}{p^p_A(B_{A,b})}, \tag{25}$$

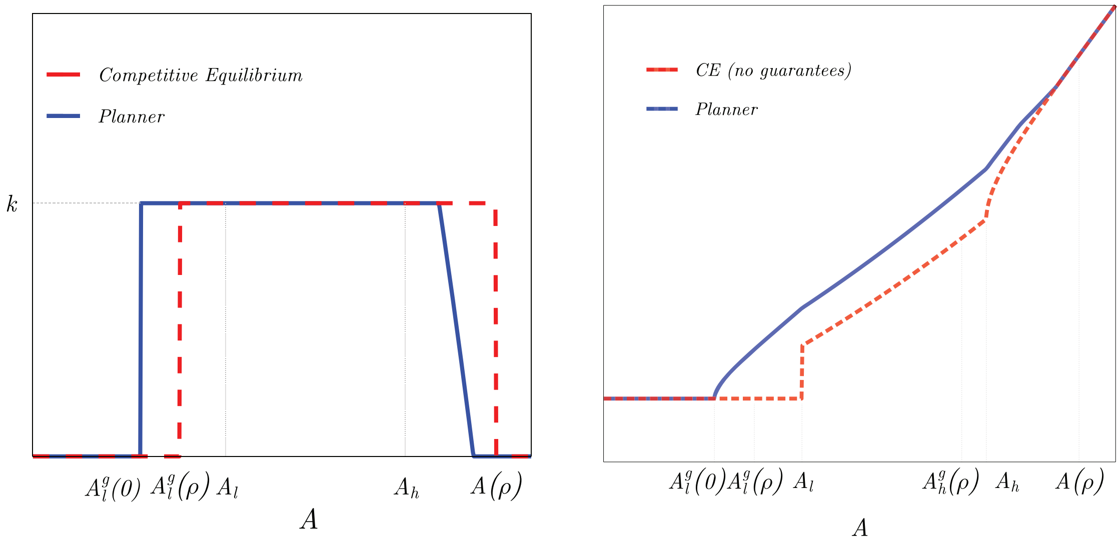
$$x^p_{A,b} \begin{cases} = k & \text{if} \quad MB_{A,b}(k) \geq \rho^p \\ = 0 & \text{if} \quad MB_{A,b}(0) < \rho^p \\ : MB_{A,b}(x^p_{A,b}) = \rho^p & o.w. \end{cases} \tag{26}$$

if and only if

$$p_A(B^p_{A,b}) \cdot A - C(p_A(B^p_{A,b})) \geq \lambda + k \tag{27}$$

where ρ^p *ensures feasibility constraint* (22) *binds. Otherwise, entrepreneurs obtain no credit and their projects are liquidated.*

Figure 9 illustrates Proposition 4 by depicting both the planner and market allocation of guarantees, as well as the social surplus of investment in both allocations. Panel (a) shows that, in this example, the planner tilts the allocation of guarantees towards riskier entrepreneurs.: by granting a full pass-through, the planner is able to prevent the liquidation of entrepreneurs that – despite being risky – generate a positive social surplus. Panel (b) shows that the improved allocation of guarantees by the



(a) Allocation of guarantees

(b) Total surplus

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

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 section raise a key question 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 here yields the following set of empirical predictions.

Prediction 1. Conditional on receiving credit, riskier entrepreneurs are more likely to receive guaranteed credit.

This prediction follows from Proposition 3, which shows that all solvent and captive entrepreneurs with $1 - p_A(B_A^g) \geq \rho^g$ receive guaranteed credit. The insight is not exclusive to our theory, and would follow naturally in any model where the private sector decides how to allocate guarantees: the higher the risk, the higher the expected transfer from the government to the bank-entrepreneur pair. The relation between risk and guarantees holds only up to a threshold level of risk, however, as some entrepreneurs are too risky to obtain credit (insolvent).

Prediction 2. For a given level of risk, captive entrepreneurs: (i) are more likely to receive guaranteed credit than solvent entrepreneurs, but (ii) are less likely to benefit from it through lower interest rates.

This prediction is unique to our model as it compares banks' incentives to grant guaranteed credit to captive relative to solvent (non-captive) entrepreneurs. The result is quite intuitive: as captive entrepreneurs need to negotiate with their creditor bank, the latter extracts some of the surplus from the guarantee. As banks extract more rents from captive than solvent entrepreneurs, they are also more eager to grant guarantees to the former. This finding follows from comparing the repayment of a captive entrepreneur without and with guarantees in Proposition 1 and 3 respectively. When $\gamma = 0$, captive entrepreneurs have full bargaining power and obtain the same pass-through of guarantees as solvents: $p_A \cdot B_A - p_A^g \cdot B_A^g = (1 - p_A^g - \rho) \cdot k$. As γ increases, however, the pass-through for captive entrepreneurs falls, generating the stated prediction. This finding relies on two essential ingredients of our model: (i) entrepreneurs' need to negotiate their debts with their creditor bank –due to the presence of debt overhang,- and (ii) banks have some bargaining power in negotiation.

Prediction 3. The higher is the bargaining power of a bank vis-à-vis a captive entrepreneur: (i) the more likely the entrepreneur is to receive guaranteed credit, but (ii) the less likely she is to benefit from it through lower interest rates.

This prediction is also unique to our setting, as it states how banks' bargaining power affects the access to guaranteed credit of captive entrepreneurs. If follows directly from the previous discussion.

Prediction 4. All else equal, a credit guarantee granted to a captive entrepreneur should have a smaller impact on the entrepreneur' real outcomes (e.g. probability of default, investment), than a credit guarantee granted to a non-captive entrepreneur.

This prediction is a direct consequence of Prediction 2. If captive entrepreneurs benefit less from the interest rate reduction associated with guarantees, then a guarantee granted to a captive entrepreneur should have a smaller effect on the entrepreneur's real outcomes.

We now test whether these predictions are borne in the Spanish data. If they are, we can conclude that banks have distorted the allocations of guarantees to capture a larger share of their benefits. In the presence of moral hazard, this implies that the potential benefits of guarantees may have been diluted due to banks' own incentives. Before turning to our main results, we describe the data.

7.1 Data

Our main data source is the Banco de España Central Credit Registry (CCR), which contains the universe of loans granted by 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 program). Our sample spans up to February 2021 because most public guarantees – €92 billion out of €107 billion – were granted before that date. The CCR contains information on the type of loan contract, the loan size, the interest rate applied, the origination date and maturity, the reference rate, and the existence of guarantees, either public 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.[15] Given that the public guarantees program began in March 2020, we use firms' balance-sheets as of December 2019.

Our analyses are performed on several samples. To study firms' access to ICO loans and their effect on real outcomes (Predictions 1 and 4), we use a sample that consists of 232,705 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. Moreover, to ensure a fair comparison between loans with and without public guarantees, we limit our sample to loans whose maturity at origination is over six months.[16] The average maturity for ICO loans is significantly longer than for non-ICO loans, at 4.3 years compared to 0.8 years. Approximately 80% of non-ICO loans have a maturity of less than six months,

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

[16] This criteria prevents firm credit from being artificially "inflated" by the rolling-over of very short-term non-ICO loans. See Table A3 for robustness analysis.

whereas this is true for less than 2% of ICO loans. Hence, our adjustment results in more comparable maturities for both types of loans, at 4.4 years for ICO loans and 3.5 years for non-ICO loans. We later confirm that our findings hold true even when considering loans with different maturities at origination.[17]

Panel A of Table 1 summarizes the main characteristics of firms in this sample. ICO credit represents 70% of the new credit obtained by firms in our sample, the vast majority of them SMEs. Around 26.5% of these firms exhibit a default probability higher than 1% based on the information available as of December 2019. However, 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 20.8% 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 allocation of guaranteed credit to captive vs. solvent (non-captive) borrowers (Predictions 2-3 (i)), we use a sample that contains bank-firm relationships. Panel B of Table 1 provides information on the distribution of ICO credit and borrower captivity at the firm-bank level. In our baseline, a firm is defined to be captive to a bank if it is risky *and* has pre-existing debt with that bank. On average, 26.7% of bank-firm relationships correspond to captive firms. We proxy a bank's bargaining power vis-à-vis a firm as the share of the firm's total liabilities that is owed to that bank. This share is 17.6% for the average bank-firm pair, indicating that bank lending is relatively concentrated and that some banks hold considerable market power over their borrowers.[18] Panel C of Table 1 shows how the distribution of ICO and non-ICO credit varies across types of firm-bank relationships (defined as of February 2020). The table shows that about 76% all ICO credit was allocated within bank-firm pairs that had a pre-existing relationship, compared to 69% of non-ICO credit. The table also shows that both types of credit were supplied to firms in all types of relationships.

To study the pass-through of guarantees to firms through lower interest rates (Predictions 2-3 (ii))), we use a loan-level dataset t. 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 characteristics. The average interest rate for the total sample is 2.56%, whereas it is only 2.4% for loans with an origination maturity higher than six months. The reason is that loans with public guarantees make up a higher share of long-maturity loans, 63% relative to 32% among the full sample of loans, and guaranteed loans tend to have lower interest rates (see Figure 2).

[17]Even when considering all loan maturities, ICO loans account for 67% of total new credit. This is because non-ICO loans with maturities under six months are relatively small compared to ICO loans.

[18]We relate market power to lender concentration, in line with Faria-e Castro et al. (2024).

Finally, we restrict our sample to profitable firms (i.e., with positive profits), since non-profitable firms should not receive credit according to the model. Table A1 in the Appendix includes the descriptive statistics for the subsample of firms with positive profits that remain after imposing the rich set of fixed effects that we use in our firm-level (Panel A) and firm-bank level (Panel B) regressions. Compared to the overall population of firms, these firms are slightly safer, have lower liquidity needs, more equity and cash, and better profitability ratios. Nonetheless, in our robustness exercises, we show that our findings are robust to including all firms in the sample.

7.2 Results

7.2.1 Prediction 1: Access to ICO loans

We begin by testing whether riskier borrowers obtained on average more ICO-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 over the total amount of new loans (ICO and non-ICO loans) obtained during our sample period. We then regress $ICO/Total_f$ on a series of variables that proxy for firm-f risk:

$$ICO/Total_f = \beta \cdot Risk_f + \delta \cdot X_f + \gamma_{ils} + \varepsilon_f \tag{28}$$

Our first variable is a measure of solvency risk captured by a dummy 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% by December 2019.[19] 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.[20] 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 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.[21]

The vector X_f contains firm-level controls such as profitability (ROA), size (logarithm of total assets), leverage (equity over total assets), and liquidity (cash and equivalents over total assets), while γ_{ils} denotes the use of industry-location-size fixed effects.[22] Since we aggregate all ICO loans received during the first year of the program

[19] 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%.

[20] To compute these probabilities we use firm, sector, and global factors, as in Blanco et al. (2023).

[21] 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.

[22] 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).

at the firm level, we cannot use firm fixed-effects. Instead, 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 (28) 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%. Our estimate suggests that the proportion of ICO credit is approximately 4 percentage points (pp) higher for risky firms than it is for relatively safe firms. The effect of risk on the proportion of ICO credit is also significant if we use a firm's liquidity needs as an indicator of risk (column (2)). These findings are robust to including the two risk measures simultaneously (column (3)), suggesting that they each capture a different type of risk. In line with the theory, riskier firms seem to have benefited more better access to loan guarantees.

Robustness tests. We perform several robustness tests. First, in Table A2, we replicate our baseline analysis for all firms regardless of profitability (column 1), and only for firms with negative profits (column 2). Using the entire sample of firms yields similar results to the baseline, while there is no relationship between risk and access to ICO credit within the sample of firms with negative profits. Column (4) reproduces the baseline analysis but proxies risk with the probability of default computed in December 2020, instead of December 2019. Thus, our results hold even when accounting for the pandemic's impact on firms' solvency, which is reassuring given that banks may have considered the potential effects of COVID-19 on firms' ability to repay their debts.

Finally, Table A3 replicates the analysis using alternative loan maturities to address concerns related to roll-overs and renovations of existing credit. Column (2) shows that our results remain valid when we restrict the sample to loans with longer maturities (one year instead of six months as in our baseline, reproduced in column (1)). Additionally, our results hold true when we consider the entire loan sample, regardless of maturity, while excluding loan renovations (column (3)), and when we use the full loan sample without accounting for renovation or roll-over issues (column (4)). Thus, our results do not appear to be driven by loan renovations or roll-over issues dictated by the pre-existing maturity structure of specific bank-firm relationships.

7.2.2 Prediction 2-3 (i): Allocation of ICO loans to captive borrowers

Prediction 2 (i). We now turn to the second prediction of the model: all else equal, banks should have stronger incentives to extend ICO loans to their captive borrowers. To test this prediction, we first need to define what constitutes a captive firm in our data. According to the model, a firm is captive to its creditor bank if (i) it has significant pre-existing debt with the bank, and (ii) its productivity is moderate, meaning that it requires a subsidy (or renegotiation) from the bank to avoid liquidation.

In our baseline specification, we classify a firm f as captive to bank b if it is deemed ex-ante risky (i.e., the probability of default as of December 2019 exceeds 1%) and has an existing credit relationship with bank b. We study the differences in access to ICO loans between captive and non-captive firms with the following regressiong:

$$ICO/Total_{fb} = \beta \cdot Captive_{fb} + \delta \cdot X_f + \gamma_{ilsr} + \gamma_b + \varepsilon_{fb} \tag{29}$$

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 (28), 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.[23]

Results are reported in columns (1)-(2) of Table 3. In line with the theory, all else equal, captive borrowers receive a significantly higher share of ICO-credit relative to non-captive (solvent) borrowers. At 4.3 pp, which is the point estimate when both risk and pre-existing relationship are included separately as controls (see Column (2)), the difference is also economically significant.

Prediction 3 (i). We also explore whether a bank's incentive to grant ICO loans to captive borrowers is stronger when its bargaining power is high. To do so, we proxy for a banks' bargaining power vis-à-vis a firm with the fraction of the firms's total debt (including bank credit and all other liabilities) owed to that bank.

To examine the role of bargaining power, we extend Equation (29) by incorporating our proxy of bargaining power and its interaction with our measure of captivity. Results, which are presented in column (3) of Table 3, indicate that captive borrowers receive a higher fraction of ICO credit, and that this fraction is increasing in the bargaining power of the *captor* bank.

Robustness tests. Once again we perform a series of robustness tests regarding the profitability of the firms considered and the maturity of the loans in our sample. In Table A4, we estimate Equation (29) for all firms (column 1), regardless of profitability, and for firms with negative profits (column 2). Compared to profitable firms (column

[23] 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).

3), we find that banks do not extend more ICO credit to captive firms with negative profits, consistent with our model prediction that very risky firms do not receive credit. The results for the entire sample of firms are similar to those for the sample of profitable firms, as profitable firms are more representative than those with negative profits.

In our baseline analysis, we use industry-location-size-risk (ILSR) fixed effects to maximize our sample size without limiting it to multi-bank firms. To confirm the robustness of our results, we apply firm fixed effects in column (4) of Table A4. This enables us to control for firm demand by comparing the credit granted to a given firm by two banks, with the firm being captive to one of them. This approach reduces our sample size by approximately 30% (from 91,000 to 64,000 firms). Our findings hold even when restricting the sample to multi-bank firms and using firm fixed effects, with coefficients remaining very similar to those obtained when ILSR fixed effects are used.

Finally, Table A5 estimates Equation (29) using alternative loan maturities and excluding loan renovations. Column (2) shows that our findings remain robust when applying a different maturity threshold (one year instead of the six-month threshold used in column (1)). Additionally, our results hold when considering the entire loan sample, regardless of maturity, while excluding loan renovations from the credit measure in the dependent variable (column (3)), and when using the entire loan sample without accounting for renovations or roll-over issues (column (4)).

7.2.3 Prediction 2-3 (ii): Pass-through of ICO guarantees

Prediction 2 (ii). Having established that banks are more likely to grant ICO credit to their captive borrowers, we now analyze the conditions under which ICO credit is granted. In particular, we test whether, all else equal, the pass-through of credit guarantees in the form of lower interest rates is weaker for captive than for non-captive borrowers. To do so, we use loan-level data on the pricing of ICO vs non-ICO loans granted to both types of borrowers. Our main regression is as follows,

$$\begin{aligned} i_{fbjt} \quad = \quad & \beta_1 \cdot ICO_{fbjt} + \beta_2 \cdot Captive_{fb} \cdot ICO_{fbjt} + \beta_3 \cdot Captive_{fb} \\ & \delta X_f + \gamma_{bilsrt} + \gamma_{ct} + \varepsilon_{fbjt} \end{aligned} \tag{30}$$

where i_{fbjt} denotes the interest rate paid by firm f to bank b on loan j granted in month t, which we regress 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 (29) is that now fixed effects are indexed by time, as we use month fixed effects to deal with changing conditions over the sample period. γ_{bilsrt} denotes the fixed effects for bank, industry, location, size, risk, and time, which address banks' common pricing dynamics for firms based on the same industry and zip code and with similar size (micro, small, medium-sized, or large corporations) and risk (CQS buckets). γ_{ct} controls for loan characteristics through the interaction of dummy variables (i.e., maturity buckets - ten in total corresponding to each decile of the distribution - interest rate structure – fixed or floating - and year-month for which we have both ICO and non-ICO loans).

Results are reported in Table 4. Column (1) omits the variable $Captive_{fb}$ and its interaction to estimate the discount offered on the average ICO loan regardless of whether the beneficiary is captive to the bank or not. This exercise confirms the existence of a substantial interest-rate discount (around 29 bp) on ICO loans. Column (2) shows that this discount was not significant for captive borrowers, as β_2 is positive and significant and the linear combination of β_1 and β_2 is not statistically different from zero. In light of the theory, this suggests that banks were able to appropriate part of the benefit of guarantees granted to their captive borrowers. Similar evidence of no passthrough of credit guarantee programs has been documented for the UK and for Italy in Gonzalez-Uribe and Wang (2022) and De Blasio et al. (2017) respectively.

Finally, column (3) reports results from a variation of Equation (30) that introduces the two characteristics that define captivity (risk and pre-existing relationship) on their own. Since risk is now an explanatory variable, we use fixed effects at the industry-location-size-time level. Our main result survives: the pass-through of credit guarantees through lower interest rates is driven by the interaction of risk and pre-existing relationship, and not by either of these two variables considered separately.

Prediction 3 (ii). Next, we analyze how the pass-through of credit guarantees is affected by banks' bargaining power vis-à-vis their captive borrowers. To do so, we perform the following regression analysis:

$$\begin{aligned} i_{fbjt} = {} & \beta_1 \cdot ICO_{fbjt} + \beta_2 \cdot Captive_{fb} \cdot ICO_{fbjt} + \beta_3 \cdot Captive_{fb} \cdot ICO_{fbjt} \cdot BargPower_{fb} \\ & + \beta_4 \cdot Captive_{fb} + \beta_5 \cdot Risky_f + \beta_6 \cdot Rel_{fb} + \beta_7 \cdot BargPower_{fb} \\ & + \beta_8 \cdot Risky_f \cdot ICO_{fbjt} + \beta_9 \cdot Rel_{fb} \cdot ICO_{fbjt} \\ & + \beta_{10} \cdot BargPower_{fb} \cdot ICO_{fbjt} + \beta_{11} \cdot BargPower_{fb} \cdot Captive_{fb} \\ & + \delta \cdot X_f + \gamma_{bilst} + \gamma_{ct} + \epsilon_{fbjt} \end{aligned} \tag{31}$$

The key coefficient of interest is β_3, which we would expect to be positive: namely, the higher a bank's bargaining power, the lower the pass-through in ICO loans granted to its captive borrowers (i.e., the higher the interest rate charged to these borrowers).

Results are reported in Table 5 and are consistent with our theoretical prediction. All else equal, the higher the captor banks' bargaining power, the lower the interest rate discount to guaranteed loans granted. This result is reflected in a positive and significant β_3 coefficient. Interestingly, the estimated interaction between bargaining power and captivity, as captured by β_{11}, is negative and significant. This suggests that captive firms obtain a *larger* interest-rate discount on non-ICO loans from banks that hold a high share of their debt. This is consistent with the notion that exposed banks have a stronger incentive to offer interest rate discounts to such firms.

We explore two alternative measures of bargaining power. First, we consider the fraction of a firm's total liabilities that are owed to the bank but only when the bank is the firm's primary lender (such that this variable is zero for the rest of the lenders). This approach focuses on the intensity of the bargaining power of a firm's main bank. The results, shown in column (2) of Table 5, are not significantly affected. Next, we refine this proxy further by examining the intensity of bargaining power only when the main bank's share of a firm's outstanding credit exceeds 50%. The results, presented in column (3), are also in line with the baseline specification. Importantly, the magnitude of coefficient β_3 in columns (2) and (3) suggests a stronger effect of bargaining power relative to the baseline.

Robustness tests. We conduct several robustness tests. First, in Table A6 in the Appendix we estimate Equation (30) using alternative loan maturities (above one year and all loans) and excluding loan renovations as in Tables A3 and (A5). Our results remain valid. Second, Table (A7) shows that our findings hold when we apply different sets of fixed effects to account for common pricing dynamics, beyond the influence of captivity and loan type (with or without public guarantee). Our results are robust across all alternative sets of fixed effects, relative to the baseline in Equation (31), which is shown in column (1) for comparison: (i) bank-industry-location-size-risk and loan contract-time FE (column (2)), (ii) bank-industry-location-size and loan contract-time FE (column (3)), (iii) bank-industry-location-size-time and loan contract-time FE (column (4)), (iv) industry-location-size-risk-time, bank and loan contract-time FE (column (5)), (v) industry-location-size-risk-time, bank-time and loan contract-time FE (column (6)), (vi) firm, bank and loan contract-time FE (column (7)), and (vii) firm-time, bank and loan contract-time FE (column (8)). Table A8, replicates Equation (30) for ICO loans and considers other loan characteristics such as size and maturity.

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, since fees on non-ICO loans are higher than fees on ICO loans, ICO loans have lower rates even when fees are taken into account (as estimated in Equation (30)).[24] Second, the finding that captive firms paid a premium on ICO loans relative to non-captive firms is not significantly affected once fees are taken into account.[25]

7.2.4 Prediction 4: Real effects associated with ICO guarantees

Finally, we analyze whether ICO loans granted by banks to whom the firm is captive (i.e., *captor* banks) are associated with smaller improvements on the firm's real outcomes compared to ICO guarantees granted by non-captor banks. This aligns with our earlier findings, which suggest that the pass-through benefits of ICO guarantees are lower for captive firms than for non-captive firms.

We examine the following firm outcomes: investment and non-performing loans (NPLs). Specifically, we regress these outcomes on (i) ICO loans obtained from captor banks and (ii) ICO loans obtained from non-captor banks, both measured as a share of the total credit granted to the firm. To proxy investment, we use the log change in firms' non-current assets as well as changes in tangible and intangible assets, between 2019 and 2020.[26] Our econometric specification is as in Table 2, where we control for the firm's probability of default, liquidity needs, size, profitability, leverage, and liquidity as of 2019, along with industry-location-size fixed effects. Additionally, we use deciles of the total credit obtained over the sample period by each firm relative to total assets to define an additional set of fixed effects in our regression.

The results on firms' investment are presented in the first three columns of Table 6. We find that the share of ICO credit received from captor banks has no significant effect on firms' tangible, intangible, or non-current assets. In contrast, ICO credit obtained from non-captor banks is significantly associated with an increase in tangible assets and, consequently, in non-current assets. Column (4) of Table 6 examines the change in firms' leverage ratios (total liabilities over total assets) between 2019 and 2020. While the share of ICO credit from captor banks is significantly associated with an increase in leverage, ICO credit from non-captor banks shows no effect on leverage.

Further evidence that captive firms benefit less from credit guarantees is seen in their likelihood of experiencing repayment difficulties. All else being equal, captive firms should be more likely to face challenges servicing their loans. To assess this, we repeat the regression from Table 6, replacing the dependent variable with a dummy indicating whether any of the firm's guaranteed credit became non-performing (NPL).

[24] See Figure A1 in the Appendix

[25] We estimate variation of equation (30) on the sample of ICO loans with a maturity at origination above six months 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 Appendix Table A9, suggest that the difference in fees charged to captive and non-captive firms that receive an ICO loan was neither statistically nor economically different from zero.

[26] Non-current assets include intangible assets, tangible assets, investment properties, and long-term financial investments.

The results, shown in Table 7, reveal that firms with a high share of ICO credit from their captor banks were significantly more likely to have NPLs from March 2020 and until February 2021 (column (1)) and until February 2022 (column (2))[27].

These findings strongly support our main prediction: credit guarantees provided by captor banks are not associated with substantial improvements in firms' fundamentals but instead with an increase in NPLs, in stark contrast to the positive outcomes linked to guarantees granted by non-captor banks.

7.2.5 Bank's expected excess revenues associated to ICO loans.

Finally, we provide a model-based decomposition of banks' revenues in granting ICO loans. To do so, we estimate an upper bound of this revenue by comparing 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.

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. The annual adjusted expected revenue computed in this way is sizable, exceeding 1.8% of the total amount of credit granted to captive borrowers. Consistent with the model, moreover, more than 90% of these revenues come from the coverage of the guarantees in case of default.

8 Conclusions

Governments frequently support private credit through guarantee schemes that compensate lenders for borrower defaults. However, an important yet underexplored aspect of these schemes is the role that banks play in allocating guarantees and the result-

[27] The number of observations in this regression analysis is lower than in Table 6 because we restrict the sample to firms that obtained credit with public guarantees.

ing implications for their economic effectiveness. This paper examines that role in an economy where entrepreneurial effort is essential for efficiency but is non-contractible, giving rise to a debt overhang problem.

The central insight of the model is that banks face distorted incentives when deciding how to allocate guarantees. These distortions arise primarily from two factors. First, when guarantees are scarce, banks extract rents from all allocated guarantees. Second, banks are inclined to allocate guarantees to their more captive firms —those that need to renegote existing debts with the bank,— in order to extract a larger share of the guarantee. The latter distortion is further exacerbated when banks have significant bargaining power over their captive firms, allowing them to extract even greater rents. Consequently, the allocation of guarantees is suboptimal. In contrast, a social planner would aim to pass through the full benefits of guarantees to firms in the form of reduced debt repayments and allocate guarantees to firms where they would yield the highest social marginal value, such as preventing liquidation or alleviating debt overhang for socially productive firms.

Empirical evidence from Spain's credit guarantee program during the COVID-19 pandemic supports the model's predictions. Between March 2020 and February 2021, riskier firms received a disproportionately higher share of guaranteed credit. Among these, firms classified as captive to their creditor banks obtained a higher share of guaranteed credit compared to non-captive firms but benefited less from the guarantees in the form of reduced interest rates. Moreover, for captive firms, the advantages of accessing guaranteed credit declined as the bargaining power of their banks increased. Finally, guaranteed credit was associated with higher investment for non-captive firms, whereas for captive firms, it resulted in increased leverage and higher levels of non-performing loans.

References

Altavilla, Carlo, Andrew Ellul, Marco Pagano, Andrea Polo and Thomas Vlassopoulos. (2021). "Loan guarantees, bank lending and credit risk reallocation". CEPR Working Paper, DP16727, Centre for Economic Policy Research. https://cepr.org/publications/dp16727

Altman, Edward I. (1968.). "Financial ratios, discriminant analysis and the prediction of corporate bankruptcy". *The Journal of Finance*, 23, pp. 589-609. https://doi.org/10.2307/2978933

Bachas, Natalie, Olivia S. Kim and Constantine Yannelis. (2021). "Loan guarantees and credit supply". *Journal of Financial Economics*, 139, pp. 872-894. https://doi.org/10.2139/ssrn.3367958

Banco de España. (2019). "Epígrafe 4. El impacto de la pandemia en España y la respuesta de la política económica". En Banco de España, *Informe Anual 2019*, pp. 115-171. https://repositorio.bde.es/handle/123456789/13052

Banco de España. (2021). *Informe Anual 2020*. https://www.bde.es/f/webbde/SES/Secciones/Publicaciones/PublicacionesAnuales/InformesAnuales/20/Files/InfAnual_Ing_2020.pdf

Barrot, Jean-Noël, Thorsten Martin, Julien Sauvagnat and Boris Vallée. (2024). "The labor market effects of loan guarantee programs". *The Review of Financial Studies*, 37(8), pp. 2315-2354. https://doi.org/10.1093/rfs/hhae014

Bartoli, Francesca, Giovanni Ferri, Pierluigi Murro and Zeno Rotondi. (2013). "Bank–firm relations and the role of Mutual Guarantee Institutions at the peak of the crisis". *Journal of Financial Stability*, 9, pp. 90-104. https://doi.org/10.2139/ssrn.1855856

Binmore, Kenneth George. (1980). *Nash bargaining theory III*. Suntory Toyota International Centre for Economics and Related Disciplines.

Blanchard, Olivier, Thomas Philippon and Jean Pisani-Ferry. (2020). "A new policy toolkit is needed as countries exit COVID-19 lockdowns". *Policy Contribution*, 12/2020. https://www.bruegel.org/policy-brief/new-policy-toolkit-needed-countries-exit-covid-19-lockdowns

Blanco, Roberto, Elena Fernández, Miguel García-Posada and Sergio Mayordomo. (2023). "An Estimation of Default Probabilities of Spanish Non-financial Corporations and Its Application to Evaluate Public Policies". Documentos Ocasionales, 2319, Banco de España. https://doi.org/10.53479/33512

Blanco, Roberto, and Sergio Mayordomo. (2023). "Evidence on the impact of the public guarantee and direct aid schemes on Spanish firms during the covid-19 crisis". Documentos Ocasionales, 2317, Banco de España. https://doi.org/10.53479/34592

Bonfim, Diana, Cláudia Custódio and Clara Raposo. (2023). "Supporting small firms through recessions and recoveries". *Journal of Financial Economics*, 147, pp. 658-688. https://doi.org/10.1016/j.jfineco.2023.01.004

Brown, J. David, and John S. Earle. (2017). "Finance and growth at the firm level: Evidence from SBA loans". *The Journal of Finance*, 72, pp. 1039-1080. https://doi.org/10.1111/jofi.12492

Brunnermeier, Markus, and Arvind Krishnamurthy. (2020). "Corporate debt overhang and credit policy". *Brookings Papers on Economic Activity*, Summer, pp. 447-488. https://doi.org/10.1353/eca.2020.0014

Cascarino, Giuseppe, Raffaele Gallo, Francesco Palazzo and Enrico Sette. (2022). "Public guarantees and credit additionality during the Covid-19 pandemic". Bank of Italy Temi di Discussione (Working Paper), 1369, Bank of Italy. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4110071

Ciani, Emanuele, Marco Gallo and Zeno Rotondi. (2020). "Public credit guarantees and financial additionalities across SME risk classes". Bank of Italy Temi di Discussione (Working Paper), 1265, Bank of Italy. https://doi.org/10.2139/ssrn.3612924

Core, Fabrizio, and Filippo De Marco. (2023). "Information technology and credit: evidence from public guarantees". *Management Science.* Forthcoming. https://doi.org/10.1287/mnsc.2023.4957

De Blasio, Guido, Stefania De Mitri, Alessio D'Ignazio, Paolo Finaldi Russo and Lavinia Stoppani. (2017). "Public guarantees on loans to SMEs: an RDD evaluation". Bank of Italy Temi di Discussione (Working Paper), 1111, Bank of Italy. https://doi.org/10.2139/ssrn.2964813

Elenev, Vadim, Tim Landvoigt and Stijn Van Nieuwerburgh. (2020). "Can the COVID bailouts save the economy?". NBER Working Paper, 27027, National Bureau of Economic Research. https://doi.org/10.3386/w27207

Faria-e-Castro, Miguel, Pascal Paul and Juan M. Sánchez (2024). "Evergreening". *Journal of Financial Economics*, 153(103778). https://doi.org/10.1016/j.jfineco.2024.103778

Gale, William G. (1990). "Federal lending and the market for credit". *Journal of Public Economics*, 42, pp. 177-193, https://doi.org/10.1016/0047-2727(90)90011-6

Glode, Vincent, and Christian Opp. (2021). "Private Renegotiations and Government Interventions in Debt Chains". https://econ.ntu.edu.tw/wp-content/uploads/2023/12/HKBU_1101029.pdf

Gonzalez-Uribe, Juanita, and Su Wang. (2022). "The real effects of small-firm credit guarantees during recessions". https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3382280

Gourinchas, Pierre-Olivier, Sebnem Kalemli-Özcan, Veronika Penciakova and Nick Sander. (2020). "Covid-19 and SME failures". IMF Working Papers, 207, International Monetary Fund. https://doi.org/10.5089/9781513557748.001

Guerrieri, Veronica, Guido Lorenzoni, Ludwig Straub and Iván Werning. (2022). "Macroeconomic implications of COVID-19: Can negative supply shocks cause demand shortages?". *American Economic Review*, 112, pp. 1437-1474. https://doi.org/10.2139/ssrn.3570096

Hancock, Diana, Joe Peek and James A. Wilcox. (2007). "The repercussions on small banks and small businesses of bank capital and loan guarantees". AFA 2008 New Orleans Meeting Paper. https://doi.org/10.2139/ssrn.973976

Honohan, Patrick. (2010). "Partial credit guarantees: Principles and practice". *Journal of Financial Stability*, 6, pp. 1-9. https://doi.org/10.1016/j.jfs.2009.05.008

Jiménez, Gabriel, Luc Laeven, David Martínez-Miera, and José-Luis Peydró. (2023). "Public guarantees and private banks' incentives: Evidence from the COVID-19 crisis". Documentos de Trabajo, 2318, Banco de España. https://doi.org/10.53479/30812

Kalemli-Özcan, Sebnem, Luc Laeven and David Moreno. (2022). "Debt Overhang, Rollover Risk, and Corporate Investment: Evidence from the European Crisis". *Journal of the European Economic Association*, 20, pp. 2353-2395. https://doi.org/10.1093/jeea/jvac018

Kim, Jihyun. (2024). "Government-backed financing and aggregate productivity". https://jhkim2687.github.io/JMP_Jihyun.pdf

Lelarge, Claire, David Sraer and David Thesmar. (2010). "Entrepreneurship and credit constraints: Evidence from a French loan guarantee program". In *International differences in entrepreneurship*, National Bureau of Economic Research, pp. 243-273. https://conference.iza.org/EntreRes2011/lelarge_c6865.pdf

Micucci, Giacinto, and Paola Rossi. (2017). "Debt restructuring and the role of banks' organizational structure and lending technologies". *Journal of Financial Services Research*, 51, pp. 339-361. https://doi.org/10.1007/s10693-016-0250-5

Mullins, William, and Patricio Toro. (2018). "Credit guarantees and new bank relationships". Central Bank of Chile Working Paper, 820, Central Bank of Chile. https://www.bcentral.cl/documents/33528/133326/DTBC_820.pdf

Myers, Stewart C. (1977). "Determinants of corporate borrowing". *Journal of Financial Economics*, 5, pp. 147-175, https://doi.org/10.1016/0304-405x(82)90033-2

Nash, Jhon. (1953). "Two-person cooperative games". *Econometrica: Journal of the Econometric Society*, 21(1), pp. 128-140. https://doi.org/10.2307/1906951

Önder, Yasir Kürsat, Mauricio Villamizar-Villegas and Jose Villegas. (2024). "Debt Moratoria and Macroeconomics". https://josevillegas.io/files/Debt_Moratorium.pdf

Peters, Michael. (1984). "Bertrand Equilibrium with Capacity Constraints and Restricted Mobility". *Econometrica*, 52, pp. 1117-1127. https://doi.org/10.2307/1910990

Philippon, Thomas, and Philipp Schnabl. (2013). "Efficient recapitalization". *The Journal of Finance*, 68, pp. 1-42. https://doi.org/10.2139/ssrn.1361197

Philippon, Thomas, and Vasiliki Skreta. (2012). "Optimal interventions in markets with adverse selection". *American Economic Review*, 102, pp. 1-28. https://doi.org/10.1257/aer.102.1.1

Roth, Alvin E. (1979). "Axiomatic models of bargaining". *Mathematical Social Sciences*, 1(4), pp. 437-438. https://doi.org/10.1016/0165-4896(81)90024-x

Segura, Anatoli, and Alonso Villacorta. (2023). "Firm-bank linkages and optimal policies after a rare disaster". *Journal of Financial Economics*, 149, pp. 296-322. https://doi.org/10.1016/j.jfineco.2023.05.002

Smith, Bruce D., and Michael J. Stutzer. (1989). "Credit rationing and government loan programs: A welfare analysis". *Real Estate Economics*, 17, pp. 177-193. https://doi.org/10.1111/1540-6229.00483

Stiglitz, Joseph, and Andrew Weiss. (1981). "Credit rationing in markets with imperfect information". *American Economic Review,* 71, pp. 393-410. https://doi.org/10.2139/ssrn.1010965

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. 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, which are winsorized at 1%, 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. Bargaining power is the ratio of credit owed by a given firm to a given bank over the the firm's total debt (including bank credit and all other liabilities).

Panel A. Descriptive statistics at the firm level.

	Units	Obs	Mean	Median	SD	10th %ile	90th %ile
ICO/Total	%	232705	70.4	100	40.3	0	100
Risky (PD > 1%)	%	232705	26.5	0	44.2	0	100
High liquidity needs	%	232705	40.6	0	49.1	0	100
Firms w/no bank debt	%	232705	20.8	0	40.6	0	100
SME	%	232705	97.8	100	14.7	100	100
Equity / TA	%	232705	30.8	33.1	42	-1	76.3
Cash / TA	%	232705	14.5	6.7	18.8	0.1	41
Log (TA)	-	232705	5.9	5.7	1.6	3.9	8
ROA	%	232705	3.1	2.6	19.4	-10.3	20.1

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

	Units	Obs	Mean	Median	SD	%ile	%ile
ICO/Total	%	386847	67.7	100	44.1	0	100
Captive firm	%	386847	26.7	0	44.2	0	100
Bargaining power	%	386847	17.6	7.9	25.5	0	49.6

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..

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

	ICO Credit	No ICO Credit
With no previous bank relationships	15.5	20.3
From the main bank	31.8	24.1
From other banks with credit outstanding	44.3	45.2
From a new bank	8.4	10.4

Table 2: **Firms' access to ICO loans.** This table reports the results obtained from the estimation of equation (28) in which the dependent variable is the ratio of the total amount of new ICO loans with a maturity at origination above six months 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) with similar maturity obtained during the same period and it is regressed on two 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% (i.e., solvency risk). Column (2) 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 (3) we use the two risk measures jointly. All columns are estimated with a set of explanatory variables that enable us to control for firm profitability, size, leverage, and liquidity; and with industry-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.

	(1)	(2)	(3)
Risky ($PD > 1\%$)	0.041***		0.040***
	[0.005]		[0.005]
High liquidity needs		0.023***	0.021***
		[0.004]	[0.004]
Observations	71,596	71,596	71,596
R-squared	0.404	0.404	0.404
Firm Controls	YES	YES	YES
Industry-Location-Size FE	YES	YES	YES

Table 3: **Credit supply to captive borrowers.** 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 with a maturity at origination above six months 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) with similar maturity 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). In column (2) we report the results obtained from a variation of equation (29) 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. In column (3) we examine the role of bargaining power and extend equation (29) by incorporating the proxy for bargaining power and its interaction with a dummy variable indicating whether the firm is captive and controlling for the existence of a previous relationship. All columns are estimated with a set of explanatory variables that enable us to control for the firm profitability, size, leverage, and liquidity; and with fixed effects at the industry-location-size-risk (with the exception of column (2) which does not considers risk in the set of fixed-effects) and at the bank level. Standard errors (in brackets) are clustered by firm and bank. *, **, and *** denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

	(1)	(2)	(3)
Captive borrower [Risky x Rel] (b,f)	0.060***	0.043***	0.036***
	[0.021]	[0.008]	[0.010]
Rel (b,f)		0.019	0.016
		[0.021]	[0.015]
Risky (f) [$PD > 1\%$]		-0.002	
		[0.011]	
Captive x Bargaining power (b,f)			0.028*
			[0.015]
Bargaining power (b,f)			0.030**
			[0.012]
Observations	217,291	238,790	217,291
R-squared	0.543	0.511	0.544
ILSR FE	YES	NO	YES
ILS FE	NO	YES	NO
Bank FE	YES	YES	YES
Firm controls	YES	YES	YES

Table 4: **Pass-through of credit guarantees: Captive vs non-captive.** This table reports the results obtained from the estimation of equation (30) 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 (30) whereas column (1) corresponds to a variation of equation (30) in which we remove the term captive and its interaction with the dummy denoting ICO loans. Results in column (3) are obtained from a variation of equaiton (30) in which we consider the two characteristics that define a captive borrower (risk and bank relationships) separately and their interaction. All columns are estimated with a set of explanatory variables that enable us to control for the firm's profitability, size, leverage, and liquidity and for the loan characteristics; and with fixed effects at the bank-industry-location-size-risk-time level (Bank-ILSRT). Note that in column (3) we use fixed effects at the bank-industry-location-size-time (Bank-ILST) instead of at the Bank-ILSRT level given we use the risk as an explanatory variable. Standard errors (in brackets) are clustered by firm and bank. *, **, and *** denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

	(1)	(2)	(3)
ICO loan	-0.295*	-0.332*	-0.333**
	[0.174]	[0.177]	[0.144]
Captive × ICO loan		0.166***	0.200***
		[0.036]	[0.051]
Captive		0.009	-0.118*
		[0.045]	[0.062]
Risky			0.191***
			[0.054]
Relation			0.174
			[0.112]
Risky × ICO loan			-0.010
			[0.059]
Relation × ICO loan			0.026
			[0.122]
Observations	131,976	131,976	174,693
R-squared	0.888	0.888	0.839
Bank-ILSR-Time FE	YES	YES	NO
Bank-ILS-Time FE	NO	NO	YES
Firm Controls	YES	YES	YES
Loan Controls	YES	YES	YES

Table 5: **Pass-through of credit guarantees: The Role of Bargaining Power.** 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 variablesare: (i) a dummy variable for Risky (its PD is above 1%) , (ii) an indicator of previous credit relationship (Rel), (iii) a dummy variable which denotes whether the firm is captive for the bank, (iv) a dummy variable to indicate if ICO loan, (v) a proxy for the bank's bargaining power over a firm, and (vi) the interaction terms. Column (1) reports the results for our baseline definition of bargaining power: ratio of the outstanding amount of credit of firm f with bank b as of February 2020 relative to firm's total liabilities. In column (2) we use instead the fraction of a bank's credit to a firm relative to the firm's total liabilities, but when the bank is the firm's primary lender. In column (3) we use instead the bargaining power when the main bank's share of the firm's outstanding credit exceeds 50%. All columns are estimated with a set of explanatory variables that enable us to control for the firm's profitability, size, leverage, and liquidity and for the loan characteristics; and with fixed effects at the bank-industry-location-size-risk-time level (Bank-ILSRT). Standard errors (in brackets) are clustered by firm and bank. *, **, and *** denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

	(1)	(2)	(3)
ICO loan	-0.334**	-0.335**	-0.336**
	[0.145]	[0.145]	[0.145]
Captive × ICO loan	0.161***	0.155***	0.151***
	[0.046]	[0.045]	[0.045]
Captive × ICO loan × BargPower	0.178**	0.237**	0.259*
	[0.079]	[0.091]	[0.131]
Captive	-0.030	-0.049	-0.054
	[0.060]	[0.063]	[0.061]
Risky	0.200***	0.197***	0.197***
	[0.051]	[0.052]	[0.052]
Rel	0.164*	0.149	0.146
	[0.086]	[0.105]	[0.106]
Risky × ICO loan	-0.012	-0.009	-0.007
	[0.056]	[0.058]	[0.058]
Rel x ICO loan	0.048	0.069	0.081
	[0.090]	[0.117]	[0.121]
BargPower × ICO loan	-0.077	-0.194**	-0.273**
	[0.141]	[0.097]	[0.118]
Captive × BargPower	-0.448***	-0.453***	-0.491***
	[0.063]	[0.136]	[0.170]
Bargaining power	0.043	0.131***	0.167**
	[0.119]	[0.049]	[0.065]
Observations	174,693	174,693	174,693
R-squared	0.839	0.839	0.839
Bank-ILS-Time FE	YES	YES	YES
Firm Controls	YES	YES	YES
Loan Controls	YES	YES	YES

Table 6: **Impact of ICO credit on real outcomes based on firms' bank captivity.** This table presents the results from estimating a variation of equation (28), where the dependent variable is the change in various balance-sheet items or ratios between 2019 and 2020. Specifically, columns (1) to (3) examine changes in non-current assets (NC A.), tangible assets, and intangible assets, respectively, while column (4) analyzes the change in the leverage ratio (total liabilities over total assets). The key explanatory variables are: (i) the fraction of ICO loans from the bank to which firms are captive (captor banks), and (ii) the fraction of ICO loans from banks to which they are not captive. All columns include the set of explanatory variables used in Table 2, which control for a firm's probability of default, liquidity needs, profitability, size, leverage, and liquidity, along with industry-location-size fixed effects. Additionally, we use deciles of the total credit obtained over the sample period by each firm relative to total assets to define an additional set of fixed effects in our regression. Our analysis focuses on a sample of profitable firms that obtained new credit between March 2020 and February 2021. Standard errors (in brackets) are clustered by firm. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tailed), respectively.

	(1)	(2)	(3)	(4)
VARIABLES	Δ NC Assets	Δ Tangibles	Δ Intangibles	Δ Liabilities/TA
ICO from Captor / TC	0.007	0.006	0.093	0.029***
	[0.015]	[0.016]	[0.057]	[0.005]
ICO from Non-Captor / TC	0.127***	0.115***	0.083	0.003
	[0.032]	[0.034]	[0.166]	[0.011]
Observations	39,251	37,342	5,128	41,930
R-squared	0.403	0.403	0.428	0.438
Firm Controls	YES	YES	YES	YES
Industry-Location-Size FE	YES	YES	YES	YES
LoanSize/TA FE	YES	YES	YES	YES

Table 7: **Impact of ICO credit on NPL based on firms' bank captivity.** This table presents the results from estimating a variation of equation (28), where the dependent variable is a dummy variable indicating whether the firm incurred a non-performing loan (NPL) in the ICO credit (1) or if the ICO credit remains performing (0). In column (1), the dependent variable equals 1 if the credit with public guarantees is non-performing at any month up to one year after the program's origination (i.e., March 2020 – February 2021). In column (2), the dependent variable equals 1 if the credit with public guarantees is non-performing at any month up to two years after the program's origination (i.e., March 2020 – February 2021). The key explanatory variables are: (i) the fraction of ICO loans from the bank to which firms are captive, and (ii) the fraction of ICO loans from banks to which they are not captive. All columns include the set of explanatory variables used in Table 2, which control for a firm's probability of default, liquidity needs, profitability, size, leverage, and liquidity, along with industry-location-size fixed effects. Additionally, we use deciles of the total credit obtained over the sample period by each firm relative to total assets to define an additional set of fixed effects in our regression. Our analysis focuses on a sample of profitable firms that obtained new credit with public guarantees between March 2020 and February 2021. Standard errors (in brackets) are clustered by firm. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tailed), respectively.

	(1)	(2)
VARIABLES	1Y-NPL	2Y-NPL
ICO from Captor / TC	0.010***	0.023***
	[0.003]	[0.006]
ICO from Non-Captor / TC	0.003	0.006
	[0.004]	[0.009]
Observations	29,119	29,119
R-squared	0.369	0.378
ILSR FE	YES	YES
Firm Controls	YES	YES

B Proofs

Proof of Proposition 1. Consider those entrepreneurs with $\overline{p}_A \cdot \overline{B}_A \geq k+b$. By construction, if these entrepreneurs borrow to repay their debts b and to invest k to continue their projects, they would have (more than) enough cash flows to compensate banks for their cost of funds, that is, they can repay $\frac{b+k}{p_A}$ in $t=1$, where p_A solves

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

As these entrepreneurs generate enough surplus to borrow from any bank, and banks have deep pockets, competition will drive the market interest rate down to the banks' marginal cost of funds, i.e., $R_A = \frac{1}{p_A} \Rightarrow B_A = \frac{b+k}{p_A(B_A)}$. For these entrepreneurs, it is inmediate that no bank (creditor or not) has an incentive to set the interest rate below, nor above, its marginal costs of funds.

Second, consider those entrepreneurs with $\overline{p}_A \cdot \overline{B}_A \leq \lambda + k$. For these entrepreneurs, there is no credit contract that allows the entrepreneur to continue her project and can give the bank more than λ in expectation. As liquidation ensures that the creditor bank obtains λ, their projects are liquidated.

Finally, consider those entrepreneurs with $\overline{p}_A \cdot \overline{B}_A \in [\lambda + k, \lambda + b)$. On the one hand, these entrepreneurs cannot not generate enough cash flows to compensate banks for their cost of granting a loan of size $b+k$, that is, they cannot repay a market interest rate of one. As a result, these entrepreneurs cannot obtain funding from competitive banks. One the other hand, the creditor bank can grant a loan of size k with repayment $\overline{B}_A$ and obtain more than liquidation value λ. Thus, there is room for renegotiation, which we model as follows.

Nash Barganing. Let $\gamma \in [0,1]$ denote the bank's bargaining power in the negotiation. The credit contract with repayment B_A results from the maximization of an asymmetric version of the Nash product (Binmore (1980); Nash (1953); Roth (1979)), i.e., the product of each agent's surplus computed as the payoff from the credit contract minus their outside option:

$$\begin{aligned} \max_B \left(p_A(B) \cdot (A-B) - c\left(p_A(B)\right)\right)^{1-\gamma} \cdot \left(p_A(B) \cdot B - \lambda - k\right)^{\gamma} & \\ s.t. \quad p_A(B) \cdot (A-B) - c\left(p_A(B)\right) \geq 0 & \\ p_A(B) \cdot B - \lambda - k \geq 0 & \end{aligned}$$

If the entrepreneur rejects the contract, then she obtains zero, as no other bank would be willing to grant her credit, and $\lambda > b$, that is, the bank gets the full liquidation value. This is reflected in the first term. If the bank rejects the contract, then it has funds $k + \lambda$ that can be saved or lent to other entrepreneurs. This is reflected in the second term. Each term is adjusted by the bargaining power of the relevant agent. The participation constraints ensure that the outcome of the renegotiation gives each agent non-negative surplus. As we are focusing on entrepreneurs with $\bar{p}_A \cdot \bar{B}_A \geq \lambda + k$, then the solution to the relaxed problem (no constraints) is also the solution to the constrainted problem for $\gamma \in (0,1)$. Thus, consider the following relaxed problem

$$\max_B \left(p_A(B) \cdot (A - B) - c\left(p_A(B)\right)\right)^{1-\gamma} \cdot \left(p_A(B) \cdot B - \lambda - k\right)^{\gamma}$$

After some algebra, the first-order-condition with respect to B is:

$$\frac{1-\gamma}{\gamma} = \frac{p_A(B) \cdot (A - B) - c\left(p_A(B)\right)}{p_A(B) \cdot B - \lambda - k} \cdot \frac{p_A(B) + B \cdot p_A'(B)}{p_A(B)} \tag{33}$$

In the absence of moral hazard, $p_A'(B) = 0$, the ratio of the surpluses must equal the ratio of the bargaining powers. When effort is non contractible, however, the solution reflects the fact that reducing B is not just a transfer of $p_A(B)$ from the bank to the entrepreneur, but that it also increases total surplus by $B \cdot p_A'(B)$.

When $\gamma = 1$, $B_A = \bar{B}_A$, as the solution maximizes the bank's surplus as stated in Definition 1. When $\gamma = 0$, $B_A = \underline{B_A}$, as the solution that maximizes the entrepreneurs' surplus is the one that makes the participation constraint of the bank bind, as stated in Definition 1 as well. Finally, to show that the solution can be expressed as a weighted sum between $\bar{B}_A$ and $\underline{B_A}$, it remains to show that B_A increases in γ. This follows from the LHS of (33) being decreasing in γ and constant in B, and the RHS being decreasing in B (see below) and constant in γ.

To see that the RHS of the expression is decresing in B note that: (i) the first term is decreasing in B as the solution B must be in the increasing part of $p_A(B) \cdot B$ – there is no benefit of increasing repayments if this worsens the bank's and the entrepreneur's expected payoffs–; (ii) the second term decreases in B as $p_A'' = \frac{1}{c'''(p_A)} \frac{dp_A}{dB} < 0$, as $c''' \geq 0$.

Thus, the solution B_A can be expressed as a weighted sum between $\underline{B}_A$ and $\bar{B}_A$, with weight $\omega_A(\gamma)$ increasing in γ, $\omega_A(0) = 0$, and $\omega_A(1) = 1$, and dependent on A. As A increases, both the solution and the maximum and minimum debt capacity increase, making the dependence of ω on A hard to characterize. □

Proof of Proposition 2. Consider first entrepreneurs with $b \geq \lambda$. These entrepreneurs receive zero in the event of liquidation, so they (weakly) prefer to continue their projects if they can obtain credit. As a result, the threshold for investment is the thresholds for access to credit implied by Proposition 1. Moreover, as $\bar{p}_A \cdot \bar{B}_A$ increases in A, the unique thresholds for investment and for access to competitive credit markets are those stated explicitely in Equations (8) and (9) in the main text and explained in the corresponding section.

Consider now those entreprenerus with $b < \lambda$. These entrepreneurs do obtain a surplus in the event of liquidation. Moreover, these entrepreneurs are never captive, so there is only one relevant threshold to determine: investment. These entrepreneurs will continue their projects if and only if the surplus from doing so exceeds that of liquidation:

$$p_A(B_A) \cdot (A - B_A) - c(p_A(B_A)) \geq \lambda - b \tag{34}$$

$$p_A(B_A) \cdot A - c(p_A(B_A)) \geq \lambda + k \tag{35}$$

where we have used the result that $p_A(B_A) \cdot B_A = k + b$. The resulting threshold is the one stated in Equation (10). □

Proof of Lemma 1. Consider first entrepreneurs with $b \leq \lambda$. When effort is contractible, competitive banks can offer loan $b+k$ at an interest rate contingent on effort choice p, $R = \frac{1}{p}$ (or equavalently, require repayment $B(p) = \frac{b+k}{p}$). The entrepreneur accepts such contract and continues her project if and only if the gains from doing so exceed those she would obtain after project liquidation:

$$\max_p \quad p \cdot (A - B(p)) - C(p) \geq \lambda - b \tag{36}$$

by plugging in $B(p)$ we see that the entrepreneur's problem becomes

$$\begin{aligned} \max_p \quad p \cdot A - C(p) - b - k \geq& \lambda - b \\ \underbrace{p_A^{fb} \cdot A - C(p_A^{fb}) - k}_{=y_A^{fb}} \geq& \lambda \end{aligned} \tag{37}$$

Thus, effort levels and the investment threshold are as in the first-best.

Consider instead those entrepreneurs with $b \geq \lambda$. If $y_A^{fb} \geq b$, then these entrepreneurs are solvent and receive credit contract from competitive banks with $B(p) = \frac{b+k}{p}$ and excert first-best effort levels. If instead $y_A^{fb} \in [\lambda, b]$, these entrepreneurs are captive to their creditor bank, and negotiate loan ℓ with repayment $B(p) = \frac{\ell}{p}$ so that

$$\begin{aligned} \max_p \quad p \cdot A - C(p) - \ell \geq& 0 \\ p_A^{fb} \cdot A - C(p_A^{fb}) - k \geq& \ell - k \end{aligned} \tag{38}$$

As the credit bank is willing to offer loan $\ell \in [\lambda + k, b + k)$, it is inmediate that the outcome of the Bargaining problem will result in effort levels and investment threshold as in the first-best. The reason is that the creditor bank (weakly) prefers to grant credit $\ell = \lambda + k$ at interest rate $\frac{1}{p}$ than to liquidate the project, and thus all projects with $y_A^{fb} \geq \lambda$ receive enough credit to be continued. The actual determination of ℓ solves the Bargaining problem but it is not relevant for the statements of the Lemma.

Finally, those entrepreneurs with $y_A^{fb} < \lambda$ are liquidated by their creditor bank. $\square$

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 notions of maximum and minimum debt capacities must be adjusted as in 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 lower interest rate).

Consider first solvent entrepreneurs, which are those for which

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

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

$$\max_{B_A} \quad p_A(B_A) \cdot (A - B_A) - C(p_A(B_A)) \tag{39}$$

$$s.t. \quad p_A(B_A) \cdot B_A + (1 - p_A(B_A) - \rho) \cdot x_A \geq k + b \qquad \forall A, (\gamma_A) \tag{40}$$

$$0 \leq x_A \leq k \qquad \forall A, (\upsilon_A, \mu_A) \tag{41}$$

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 B_A is given by the binding participation constraint of the bank ($\gamma_A > 0$).

Consider now captive entrepreneurs, which are those for which

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

Recall that these entrepreneurs are captive as non-creditor banks are not willing to lend to them, so they must negotiate with their creditor bank through Nash Barganing. The outcome of the negotiation is now given by the solution to the following problem:

$$\begin{aligned}
&\max_B \left(p_A(B) \cdot (A - B) - c(p_A(B))\right)^{1-\gamma} \cdot \left(p_A(B) \cdot B + (1 - p_A(B) - \rho) \cdot x_A - \lambda - k\right)^{\gamma} \\
s.t. \quad & 0 \leq p_A(B) \cdot (A - B) - c(p_A(B)) \\
& 0 \leq p_A(B) + (1 - p_A(B) - \rho) \cdot x_A \cdot B - \lambda - k \qquad (\psi_A) \\
& 0 \leq x_A \leq k \qquad (\upsilon_A, \mu_A)
\end{aligned}$$

For captive firms, we can focus on the solution to the relaxed problem where participation contraints do not bind for $\gamma \in (0, 1)$. The FOCs of a this relaxed problem boil down to:

$$B_A \; : \; \frac{p_A(B) \cdot (A - B) - c(p_A(B))}{p_A(B) \cdot B + (1 - p_A(B) - \rho) \cdot x_A - \lambda - k} \cdot \frac{p_A(B) + (B - x_A) \cdot p_A'(B)}{p_A(B)} = \frac{1-\gamma}{\gamma} \tag{42}$$

$$x_A \; : \; (1 - p_A - \rho)(1 + \psi_A) - \mu_A + \upsilon_A = 0. \tag{43}$$

The first FOC is isomorphic to the one discussed in the proof of Proposition 1, where guarantees introduce two important adjustments: (i) the surplus to the bank increases by $(1 - p_A(B) - \rho) \cdot x_A$ and the marginal value of effort to the bank falls from B to $B - x$.

The second FOC says that a full guarantee will be allocated as long as $1 - p_A > \rho$, and the marginal revenue of doing so is $1 - p_A$. Moreover, the solution is either $x_A = 0$ or $x_A = k$. To find the lower bound on captives on whom banks allocate guarantees, we just need to check the lowest productivity A for which

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

For those entrepreneurs with no guarantees, the negotiated contract is as the one described in Proposition 1. For those entrepreneurs that receive a full guarantee, the solution B_A^g can again be expressed as a weighted average between the minimum and the maximum debt capacity with guarantees of the entrepreneur from Definition 2. To see this, note that for $\gamma = 1$ the solution is the maximum debt capacity with guarantees, $\bar{B}_A^g$, while for $\gamma = 0$ it is the minimum debt capactiy with guarantees, $\underline{B_A}^g$. With the same arguments as those in the proof of Proposition 1, we have that B_A increases in γ, which concludes the argument.

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

$$\int x_{A,b}(\rho) \cdot dF(A) \cdot dG(b) = \bar{X}. \tag{44}$$

It follows that if guarantees are scarce, i.e. $\int_{A_{\ell(0)}}^{\bar{A}} k \cdot dF(A) > \bar{X}$, then $\rho > 0$.

Suppose $\rho > 0$. Next, we show that 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. The bank, however, does not have idle guarantees to offer, and thus this deviation requires that it transfers some of the guarantee from existing borrowers (from whom it is obtaining ρ) to the new borrowers attracted by the deviation (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 re-defined for the case of guarantees as follows: For those entrepreneurs with $b > \lambda$, investment thresholds are those implied by access the credit contracts, i.e.,

$$A_h^*(b,\rho) \quad \equiv \{A : \bar{p}_A \cdot \bar{B}_A + \max\{1 - \bar{p}_A - \rho, 0\} \cdot k = b + k\} \tag{45}$$

$$A_\ell^*(b,\rho) \quad \equiv \{A : \bar{p}_A \cdot \bar{B}_A + \max\{1 - \bar{p}_A - \rho, 0\} \cdot k = \lambda + k\} \tag{46}$$

For those entrepreneurs with $b \leq \lambda$, as they are never captive, they continue their projects only when doing so is better than liquidating:

$$A_h^*(b,\rho) = A_\ell^*(b,\rho) \equiv \{A : p_A(B_A^g) \cdot A - C(p_A(B_A^g)) = \lambda + k\}. \tag{47}$$

where the dependence of the threshold on b and ρ is implicit through B_A^g which may vary with both as stated in the Proposition. □

Proof of Proposition 4. The determinants of B_A^p follow immediately from observation of the planner's problem and the first-order condition 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 $\frac{dp_A^2}{d^2x_A} > 0$.

$$\frac{dp_A^2}{d^2x_A} = -\frac{2 \cdot p_A + [C'''(p_A) \cdot p_A^2 + 2 \cdot p_A \cdot C''(p_A)] \cdot \frac{dp_A}{dx_A}}{p_A \cdot (1 - p_A)} \cdot \left(\frac{dp_A}{dx_A}\right)^2 < 0. \tag{48}$$

□

C Robustness of modeling choices

C.1 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 $b + k$ 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 $\bar{p}_A \cdot \bar{B}_A - k < b$, 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 5. *For an entrepreneur with productivity A there are three possibilities in equilibrium:*

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

$$B^*_{A,b} = \frac{b + k}{p_A(B^*_{A,b})} \tag{49}$$

2. $\bar{p}_A \cdot \bar{B}_A \in [\lambda + k, b + k)$*: 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*

$$B^*_{A,b} = w_A(\gamma) \cdot \bar{B}_A + (1 - w_A(\gamma)) \cdot \underline{B}_A,$$

where $\gamma \in [0, 1]$ is the bank's bargaining power and $w_A(0) = 0$, $w'_A > 0$, $w_A(1) = 1$.

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

$$A - \frac{b+k}{p_A} = C'(p_A). \tag{50}$$

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

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

Finally, consider those entrepreneurs with $\overline{p}_A \cdot \overline{B}_A - k \in [\lambda, B)$. As the creditor bank can extract more than λ from these entrepreneurs if their projects are continued, it is immediate that the bank strictly prefers to continue the project. These entrepreneurs, however, do not generate enough cash flows to repay $\frac{b+k}{p_A}$, and thus cannot access competitive markets for loans of size $b + k$. As a result, these entrepreneurs must renegotiate their existing debts. The proof is as the one presented in the Proof of Proposition 1. □

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. For renegotiation, what is important are the net transfers between the entrepreneur and her creditor bank at different points in time, and these are always: k from the bank to the entrepreneur at $t = 0$, and $B_{A,b}$ from the entrepreneur to the bank in the success scenario in $t = 1$. Whether the reduction in repayments, $b + k - p_A \cdot B_{A,b}$, needed to continue the projects of captive entrepreneurs occurs through a downwards renegotiation of existing debt b or through a roll-over of b at a subsidized rate $R_{A,b} < 1$ has no impact on outcomes.

C.2 Long-term debt

In our baseline model of Section 3 we suppose that debt b 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 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.

Our main Proposition 1 is adjusted as follows

Proposition 6. *For entrepreneur $\{A, b\}$ there are three possibilities in equilibrium:*

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

$$B^*_{A,b} = \frac{b + k}{p_A(B^*_{A,b})}. \tag{51}$$

2. $\bar{p}_A \cdot \bar{B}_A \in [\lambda + k, \bar{p}_A \cdot b + k)$*: 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 obligation at $t = 1$ is*

$$B^*_{A,b} = w_A(\gamma) \cdot \bar{B}_A + (1 - w_A(\gamma)) \cdot \underline{B}_A,$$

where $\gamma \in [0, 1]$ is the bank's bargaining power and $w_A(0) = 0$, $w'_A > 0$, $w_A(1) = 1$.

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 6 is isomorphic to the one of Proposition 5, where b is now replaced by $\bar{p}_A \cdot b$. 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 Robustness Exercises

Table A1: **Descriptive Statistics.** Panel A contains descriptive statistics on firms' characteristics used in the regression analysis in equation (28). 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. 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, which are winsorized at 1%, 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 used in the regression analysis in equation (29). 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. Bargaining power is the ratio of credit owed by a given firm to a given bank over the the firm's total debt (including bank credit and all other liabilities).

Panel A. Descriptive statistics at the firm level.

	Units	Obs	Mean	Median	SD	10th %ile	90th %ile
ICO/Total	%	71596	71.6	100	39.8	0	100
Risky (PD > 1%)	%	71596	17.9	0	38.4	0	100
High liquidity needs	%	71596	31.8	0	46.6	0	100
Firms w/no bank debt	%	71596	23.7	0	42.5	0	100
SME	%	71596	98.7	100	11.2	100	100
Equity / TA	%	71596	37	36.7	35	4.9	78.7
Cash / TA	%	71596	17	8.7	20.5	0.2	47.7
Log (TA)	-	71596	5.7	5.6	1.5	4	7.7
ROA	%	71596	10.5	5.4	13.3	0.7	27.5

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

	Units	Obs	Mean	Median	SD	10th %ile	90th %ile
ICO/Total	%	217291	66.8	100	44.1	0	100
Captive firm	%	217291	27	0	44.4	0	100
Bargaining power	%	217291	15.6	7.7	22.5	0	41.7

Table A2: **Firms' access to ICO loans depending on their profitability.** This table reports the results obtained from the estimation of equation (28) for alternative samples of firms and measures of risk. The dependent variable in all columns is the ratio of the total amount of new ICO loans with a maturity at origination above six months 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. In column (1) we consider all firms regardless of profitability whereas we split the sample in columns (2) and (3) depending on whether firms have negative or zero and positive profits, respectively. The explanatory variables of interest are two measures of firms' risk. The first measure refers to solvency risk which is proxied through 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% (i.e., solvency risk) according to their financial statments as of December 2019. The second measure refers to liquidity risk which is proxied through 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 focus on profitable firms and consider the one-year probability of default as of December 2020, rather than before COVID-19. All columns are estimated with a set of explanatory variables that enable us to control for firm profitability, size, leverage, and liquidity; and with industry-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.

	(1)	(2)	(3)	(4)
Risky ($PD > 1\%$)	0.027***	0.006	0.040***	
	[0.004]	[0.008]	[0.005]	
High liquidity needs	0.018***	-0.000	0.021***	0.021***
	[0.003]	[0.009]	[0.004]	[0.004]
Risky ($PD_{2020} > 1\%$)				0.021***
				[0.005]
Observations	108,978	16,787	71,596	62,821
R-squared	0.374	0.416	0.404	0.412
Firm Controls	YES	YES	YES	YES
Industry-Location-Size FE	YES	YES	YES	YES
Sample	All firms	Firms wiht losses	Firms wiht profits	Firms wiht profits

Table A3: **Firms' access to ICO loans. Dealing with rollovers/renovations.** This table reports the results obtained from the estimation of equation (28) but using different sample of loans to define the dependent variable. Column (1) is similar to column (3) of Table (2) and the dependent variable is the ratio of the total amount of new ICO loans with a maturity at origination above six months 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) with similar maturity obtained during the same period. In column (2) we use all loans with a maturity at origination above one year to obtain the dependent variable whereas in column (3) we exclude loans that are renovated over our sample period. Finally, in column (4) we use the full loan sample of loans without accounting for renovation or rolling-over issues. All columns are estimated with a set of explanatory variables that enable us to control for firm profitability, size, leverage, and liquidity; and with industry-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.

	(1)	(2)	(3)	(4)
	Mat $> 6m$	Mat $> 12m$	Exc Renov	All
Risky ($PD > 1\%$)	0.027***	0.045***	0.050***	0.047***
	[0.004]	[0.005]	[0.005]	[0.005]
High liquidity needs	0.018***	0.025***	0.011***	0.013***
	[0.003]	[0.004]	[0.004]	[0.004]
Observations	108,978	67,308	71,496	74,520
R-squared	0.374	0.415	0.411	0.407
Firm Controls	YES	YES	YES	YES
Industry-Location-Size FE	YES	YES	YES	YES

Table A4: **Credit supply to captive borrowers depending on their profitability.** This table reports the results obtained from the estimation of equation (29) for alternative samples of firms and fixed-effects. The dependent variable in all columns is the ratio of the total amount of new ICO loans with a maturity at origination above six months 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) with similar maturity obtained during the same period from the same bank. In column (1) we consider all firms regardless of profitability whereas we split the sample in columns (2) and (3) depending on whether firms have negative or zero and positive profits, respectively. 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. Columns (1) - (3) are estimated with a set of explanatory variables that enable us to control for firm profitability, size, leverage, and liquidity; and with fixed effects at the industry-location-size-risk. Column (4) is analogous to column (3) but instead of industry-location-size-risk (ILSR) fixed effects, we apply firm fixed effects to the sample of profitable firms. Standard errors (in brackets) are clustered by firm and bank. *, **, and *** denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

	(1)	(2)	(3)	(4)
Captive	0.050**	0.030	0.060***	0.059***
	[0.022]	[0.023]	[0.021]	[0.019]
Observations	275,951	48,816	217,291	190,908
R-squared	0.538	0.570	0.543	0.570
ILSR FE	YES	YES	YES	NO
Firm FE	NO	NO	NO	YES
Bank FE	YES	YES	YES	YES
Firm controls	YES	YES	YES	-
Sample	All firms	$<$ 0 Profits	$>$ 0 Profits	$>$ 0 Profits

Table A5: **Credit supply to captive borrowers. Dealing with rollovers/renovations.** This table reports the results obtained from the estimation of equation (29) but using different sample of loans to define the dependent variable. Column (1) is similar to column (1) of Table (3) and the dependent variable is the ratio of the total amount of new ICO loans with a maturity at origination above six months 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) with similar maturity obtained during the same period from the same bank. In column (2) we use all loans with a maturity at origination above one year to obtain the dependent variable whereas in column (3) we exclude loans that are renovated over our sample period. Finally, in column (4) we use the full loan sample of loans without accounting for renovation or rolling-over issues. 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. All columns are estimated with a set of explanatory variables that enable us to control for the firm profitability, size, leverage, and liquidity; and with fixed effects at the industry-location-size-risk and at the bank level. Standard errors (in brackets) are clustered by firm and bank. *, **, and *** denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

	(1) Mat $> 6m$	(2) Mat$> 12m$	(3) Exc renov	(4) All
Captive	0.060***	0.053***	0.040**	0.043**
	[0.021]	[0.017]	[0.020]	[0.021]
Observations	217,291	194,526	215,880	233,345
R-squared	0.543	0.558	0.537	0.530
ILSR FE	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES
Firm controls	YES	YES	YES	YES

Table A6: **Pass-through of credit guarantees: Dealing with rollovers/renovations.** This table reports the results obtained from the estimation of equation (29) but using different samples of loans. Column (1) is similar to column (2) of Table 4 such that the dependent variable is the interest rate of a given loan with a maturity at origination above six months granted by bank b to firm f (in %). In column (2) we use all loans with a maturity at origination above one year whereas in column (3) we exclude loans that are renovated over our sample period. Finally, in column (4) we use the full loan sample of loans without accounting for renovation or rolling-over issues. 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. 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. All columns are estimated with a set of explanatory variables that enable us to control for the firm's profitability, size, leverage, and liquidity and for the loan characteristics; and with fixed effects at the bank-industry-location-size-risk-time level (Bank-ILSRT). Standard errors (in brackets) are clustered by firm and bank. *, **, and *** denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

VARIABLES	(1) Mat $> 6m$	(2) Mat $> 12m$	(3) Exc renov	(4) All
ICO loan	-0.332*	-0.293*	-0.385**	-0.241*
	[0.177]	[0.155]	[0.193]	[0.131]
Captive	0.009	0.066	-0.094	-0.001
	[0.045]	[0.046]	[0.170]	[0.108]
Captive x ICO loan	0.166***	0.108**	0.200***	0.204***
	[0.036]	[0.051]	[0.054]	[0.047]
Observations	131,976	80,841	395,244	623,636
R-squared	0.888	0.850	0.843	0.737
Bank-ILSR-Time FE	YES	YES	YES	YES
Firm Controls	YES	YES	YES	YES
Loan Controls	YES	YES	YES	YES

Table A7: **Pass-through of credit guarantees: Alternative fixed effects.** This table reports the results obtained from the estimation of several variations of equation (30) 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 (1) contains the results obtained from the estimation of equation (30) whereas the rest of the columns correspond to alternative sets of fixed effects: (i) bank-industry-location-size-risk and loan contract-time FE (column (2)), (ii) bank-industry-location-size and loan contract-time FE (column (3)), (iii) bank-industry-location-size-time and loan contract-time FE (column (4)), (iv) industry-location-size-risk-time, bank and loan contract-time FE (column (5)), (v) industry-location-size-risk-time, bank-time and loan contract-time FE (column (6)), (vi) firm, bank and loan contract-time FE (column (7)), and (vii) firm-time, bank and loan contract-time FE (column (8)). All columns are estimated with a set of explanatory variables that enable us to control for the firm's profitability, size, leverage, and liquidity and for the loan characteristics. Standard errors (in brackets) are clustered by firm and bank. *, **, and *** denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	hc_tedr	hc_tedr	hc_tedr	hc_tedr	hc_tedr	hc_tedr	hc_tedr	hc_tedr
VARIABLES				win frac .01				
ICO loan	-0.332*	-0.326**	-0.311**	-0.313**	-0.276**	-0.285**	-0.360***	-0.232**
	[0.177]	[0.153]	[0.151]	[0.156]	[0.128]	[0.126]	[0.109]	[0.098]
Captive	0.009	0.140***	0.145***	0.084*	0.062	0.046	0.002	-0.011
	[0.045]	[0.043]	[0.044]	[0.049]	[0.049]	[0.046]	[0.045]	[0.051]
Captive x ICO loan	0.166***	0.173***	0.204**	0.206***	0.196***	0.190***	0.222***	0.145***
	[0.036]	[0.060]	[0.082]	[0.078]	[0.056]	[0.049]	[0.045]	[0.049]
Observations	131,976	274,984	319,384	174,693	244,158	243,946	329,539	163,708
R-squared	0.888	0.768	0.712	0.838	0.777	0.789	0.756	0.858
Bank-ILSR-Time FE	YES	NO	NO	NO	NO	NO	NO	NO
Bank-ILSR FE	NO	YES	NO	NO	NO	NO	NO	NO
Bank-ILS FE	NO	NO	YES	NO	NO	NO	NO	NO
Bank-ILS-Time FE	NO	NO	NO	YES	NO	NO	NO	NO
ILSR-Time FE	NO	NO	NO	NO	YES	YES	NO	NO
Bank FE	NO	NO	NO	NO	YES	NO	YES	YES
Bank-Time FE	NO	NO	NO	NO	NO	YES	NO	NO
Firm FE	NO	NO	NO	NO	NO	NO	YES	NO
Firm-Time FE	NO	NO	NO	NO	NO	NO	NO	YES
Firm Controls	YES	YES	YES	YES	YES	YES	-	-
Loan Controls	YES	YES	YES	YES	YES	YES	YES	YES

Table A8: **Additional characteristics of ICO loans: Captive vs Non-captive.** This table reports the results obtained from a variation of equation (30) in which we estimate whether the characteristics of ICO loans for captive firms differ from those for non-captive firms. To this aim, we restrict the sample to ICO loans and estimate the coefficient associated to the dummy variable which denotes whether the firm is captive for the bank that grants the loan in equation (30). 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 (1) contains the results obtained when the dependent variable is the interest rate of a given loan granted by bank b to firm f. The dependent variable in column (2) is the logarithm of loan size whereas in column (3) the dependent variable is the time-to-maturity at origination (in years). All columns are estimated with a set of explanatory variables that enable us to control for the firm's profitability, size, leverage, and liquidity and for the loan characteristics; and with fixed effects at the bank-industry-location-size-risk-time level (Bank-ILSRT). Standard errors (in brackets) are clustered by firm and bank. *, **, and *** denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

VARIABLES	(1) Rates	(2) log(Q)	(3) Maturity
Captive	0.169***	0.748***	-0.019
	[0.056]	[0.270]	[0.019]
Observations	56,809	60,207	60,207
R-squared	0.778	0.677	0.516
Bank-ILSR-Time FE	YES	YES	YES
Firm Controls	YES	YES	YES
Loan Controls	YES	YES	YES

Table A9: **Fees of loans with credit guarantees: Captive vs Non-Captive.** Column (1) of this table reports the results obtained from a variation of equation (30) 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 (30) that involve the dummy variable that is equal to one for ICO loans. Column (1) is estimated with a set of explanatory variables that enable us to control for the firm's profitability, size, leverage, and liquidity and for the loan characteristics; and with fixed effects at the bank-industry-location-size-risk-time level (Bank-ILSRT). Standard errors (in brackets) are clustered by firm and bank. *, **, and *** denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

	Fees (%)
Captive borrower	0.015
	[0.010]
Observations	92,969
R-squared	0.665
Bank-ILSR-Time FE	YES
Firm Controls	YES
Loan Controls	YES

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