Banks vs. Firms: Who Benefits from Credit Guarantees?

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November 23, 2026

Abstract

Governments support private credit through guarantee schemes whose allocation is delegated to banks. We study an economy where entrepreneurs differ in productivity and legacy debt, and non-contractible effort creates debt overhang. A guarantee is an expected public transfer that improves efficiency only insofar as banks pass it through as lower repayments. Banks, however, retain a scarcity rent on every guarantee and even more from their *captive* borrowers—those whose legacy debt requires a concession—toward whom they tilt allocation. We discuss how program design affects efficiency and present evidence consistent with our mechanism from Spain's COVID-19 guarantee program.

JEL Codes: G10, G18, G21, G28

Keywords: Credit guarantees, debt overhang, liquidations.

* Martin and Vanasco – CREi, UPF and BSE. Mayordomo – Banco de España. We thank Fred Malherbe, Sonny Biswas, Dong Yan, Luigi Iovino, Rafael Repullo, Anatoli Segura, and participants at CREI, Banco de España, MADBAR Workshop 2022, BI Norwegian Business School, Asia Joint-School Macro Seminar, University of Bonn, 5th Endless Summer Conference, and the 2022 EEA Annual Conference. The views expressed are those of the authors and not of the Banco de España or the Eurosystem. Martin and Vanasco acknowledge financial support from the European Research Council under Horizon Europe (101052964–MACROTRENDS&FINANCE) and Horizon 2020 (948432–INFOMAK), the Spanish Ministry of Economy and Competitiveness through the Severo Ochoa Programme for Centres of Excellence in R&D (SEV-2015-0563 and CEX2019-000915-S), and the Generalitat de Catalunya through CERCA and the SGR Programme (2021 SGR 01123). Gerard Martín Escofet, Marios Tsoukis, Sandeep Achary Pothedar, and Davide Busnelli provided excellent research assistance.

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, France, Germany, Italy, and Spain had committed €2 trillion to guarantee private credit.

A defining feature of these programs is their reliance on private lenders. Typically, governments set the volume of guarantees, while banks determine which borrowers receive guaranteed loans and on what terms.[1] 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, anchored in a single standard friction in corporate finance, non-contractible entrepreneurial effort, 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 carry legacy debt with their bank, but can seek credit from any bank: their own or the competitive market. Access to competitive banks is universal; what varies in equilibrium is whether banks are willing to lend. The only friction is that entrepreneurial effort, which increases project success probability, is non-contractible. The non-contractibility of effort

[1]Bank discretion over allocation and pricing is the norm. In the US, lenders originate and price FHA- and VA-guaranteed mortgages, and negotiate rates on SBA 7(a) loans subject to caps. Among COVID-era schemes, banks selected borrowers and set rates in Spain (ICO), France (PGE, freely negotiated after the first year), Italy (Fondo di Garanzia), and the UK (CBILS), as they do in permanent SME schemes such as the UK's Growth Guarantee Scheme. Fixed-rate designs—the US PPP, UK Bounce Back Loans, Germany's KfW Schnellkredit—are the exception, and are paired with full coverage.

introduces a moral hazard problem: debt repayments reduce effort incentives, leading to higher default probability, lower expected output and liquidations (debt overhang, as in Myers (1977)).[2]

In equilibrium, entrepreneurs sort into three categories based on their productivity and legacy debt. Solvent entrepreneurs are those that generate enough surplus to borrow from any bank at market rates, repay their legacy debt and invest. Insolvent entrepreneurs generate too little surplus to obtain credit from any bank, and are thus liquidated. In between, captive entrepreneurs generate enough surplus to continue their projects, but not enough to raise market funding given their legacy debt.

A key insight of our model is that, even though the banking market is perfectly competitive, some entrepreneurs become captive to their legacy bank. These entrepreneurs have high legacy debts relative to their output, and can only continue if their bank grants a concession on the legacy debt through renegotiation, a stage where the bank holds some bargaining power. The bank is willing to grant such a concession — funding them at a rate below the bank's break-even rate — as it understands that lower repayments boost effort and improve debt recovery.[3] Thus, whether firms are captive and the bargaining position of banks vis-à-vis these firms are both equilibrium outcomes.

In this context, we examine how bank-allocated public credit guarantees can improve the allocations of the competitive equilibrium. Namely, we consider a government that provides some volume of guarantees to banks for them to allocate among entrepreneurs.[4]

We show that guarantees give banks an indirect channel to shift expected losses on their vulnerable legacy borrowers to the taxpayer. More precisely, banks use the guarantee to

[2]A substantial body of empirical work documents the detrimental effects of debt repayments on firm performance; see, e.g., Kalemli-Özcan et al. (2022), Micucci and Rossi (2017), and Önder et al. (2024).

[3]Note that, conditional on the probability of success, captive entrepreneurs pay *lower* interest rates than solvent ones: an unproductive entrepreneur with no legacy debt pays more than an equally risky, more productive one whose legacy debt makes her captive.

[4]Rather than characterizing the optimal policy, our goal is to assess the prevailing design of guarantee programs, where the government delegates the allocation and pricing of guarantees to banks (Footnote 1).

substitute the repayment concessions they would otherwise grant to sustain their captive borrowers. In equilibrium, all borrowers above a risk threshold receive guarantees, but the terms of those guarantees vary across borrowers. Each guarantee entails an expected transfer from the government; what varies across borrowers is how this transfer is split between bank and firm. When guarantees are scarce, banks retain a scarcity rent on every unit they allocate. From their captive borrowers they keep an even larger share, as they hold bargaining power at the renegotiation stage. We refer to this second margin as capture. Solvent entrepreneurs thus benefit the most from guarantees, while captive entrepreneurs could even be harmed by them.[5] 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 direct guarantees to the entrepreneurs that generate the largest expected transfer from the government, and from whom they can capture more.

We contrast the competitive equilibrium with the allocation of guarantees chosen by a planner who weighs, for each entrepreneur, the effect of coverage on effort, and thus output and liquidations, against its expected fiscal cost. The exercise highlights the central distortion present in the competitive equilibrium: while the planner cares about the effect of guarantees on effort valued at its social marginal benefit and about their fiscal costs, banks do not. Banks aim to maximize government transfers by allocating to risky entrepreneurs, and to appropriate as much of the guarantee as possible. In contrast to banks, the planner gives full pass-through of guarantees through lower repayments, and its allocation need not be monotonic in risk. In particular, the planner has higher incentives to allocate guarantees to entrepreneurs closer to the liquidation threshold (riskier captives) and to the solvency threshold (safer captives) to prevent liquidations and to bring captive entrepreneurs to the competitive market.

[5]If banks have significant bargaining power vis-à-vis their captive borrowers at the debt-renegotiation stage, guarantees actually raise the interest rate faced by these borrowers, as they weaken banks' incentives to encourage repayment through concessions.

We then study how guarantee programs can be designed to bring the equilibrium allocations closer to the planner's. Four results emerge. First, fees charged to banks for access to the program recoup the scarcity rents, but do not affect equilibrium contracts or entrepreneurial effort. Second, at equal expected fiscal cost, an ample supply of partial guarantees eliminates scarcity rents and disciplines capture, at the cost of extending guaranteed credit to entrepreneurs where it has low social return or is outright wasteful. Third, an interest rate cap on guaranteed credit is an imperfect instrument: it limits what banks extract from captives whose legacy bank keeps the guarantee at the cap, but all other borrowers bound by the cap lose the guarantee and return to their outcome without the program. Finally, replacing guarantees with direct transfers, allocated by banks at equal fiscal cost, trades off reach for pass-through: transfers implement a higher pass-through, but guarantees target fiscal resources toward riskier borrowers for whom coverage is more valuable. No guarantee design dominates across all settings. Their relative merits depend on the cost of public funds, banks' bargaining positions, and, most importantly, the social value of directing guaranteed credit to particular entrepreneurs.

We test the predictions of the model on the large guarantee program that Spain implemented in 2020 (ICO program), which was endowed with €140 billion and guaranteed roughly 40% of all credit to non-financial corporations granted during the worst months of the COVID-19 lockdown, March to June 2020. Institutional details of the program are in the Online Appendix.

The data support the model's predictions. Guarantees flow to riskier borrowers and, conditional on risk, to captive ones. The share of guaranteed credit rises with a firm's probability of default. Conditional on that risk, it is higher for firms that entered the pandemic vulnerable *and* had a pre-existing relationship with the bank,[6] our measure of

[6] A firm is vulnerable if its probability of default in 2019 exceeded 1% or its current assets fell short of its estimated 2020 liquidity needs, both measured with pre-pandemic information. Default risk, by contrast, is measured in 2020, after the shock.

captivity, while neither vulnerability nor the relationship alone raises it. This tilt toward vulnerable borrowers grows with the bank's bargaining strength, measured by the share of the firm's debt it holds. Moreover, we show that the pass-through of guarantees varies across borrowers, and that it is weaker where the model predicts: guaranteed loans carry an interest-rate discount of about 44 basis points for non-captive firms, and about 19 basis points less for captive ones. The weaker pass-through comes from the combination of vulnerability and a pre-existing relationship. The relationship alone has no significant effect, contrary to informational theories of relationship lending. Finally, consistent with weaker pass-through, guaranteed credit from captor banks is uncorrelated with firms' asset growth, and correlated with higher subsequent leverage and non-performing loans.

Literature review. Our paper relates to the theoretical literature on loan guarantees in the presence of credit frictions. Under adverse selection (Stiglitz and Weiss, 1981), guarantees improve the allocation of credit (Gale, 1990), raise welfare (Smith and Stutzer, 1989), and emerge as the optimal intervention to support investment at least fiscal cost (Philippon and Skreta, 2012); other rationalizations rely on credit-constrained banks and firms (Elenev et al., 2020), debt overhang in the financial sector (Philippon and Schnabl, 2013), or strategic renegotiation in debt chains (Glode and Opp, 2021). Closest to us, Segura and Villacorta (2023) compare alternative government interventions in the presence of liquidity needs and debt overhang. We contribute the study of banks' incentives to allocate government guarantees across heterogeneous borrowers, and of the terms at which they do so.[7]

On the empirical side, loan guarantees have been found to expand credit (Bachas et al., 2021) and to support employment and growth (Brown and Earle, 2017; Hancock et al., 2007; Lelarge et al., 2010). Closest to us are studies of Europe's COVID-19 programs, which focus on the substitution of non-guaranteed by guaranteed credit: in Spain, substitution was

[7]Within the policy literature spawned by COVID-19 (Gourinchas et al., 2020; Guerrieri et al., 2022; Brunnermeier and Krishnamurthy, 2020; Blanchard et al., 2020), we study the efficiency of the COVID-19 guarantee program design.

stronger for risky firms to which banks were heavily exposed and for weakly capitalized banks (Jiménez et al., 2023), with similar findings across the euro area (Altavilla et al., 2021) and, for Italy, for the loans with the highest coverage (Cascarino et al., 2022). We complement this evidence by focusing on the terms at which different firms accessed credit guarantees, i.e., the division of surplus between banks and firms. Finally, our captive borrowers resemble the zombie firms documented by Caballero et al. (2008); Peek and Rosengren (2005); Acharya et al. (2019); Schivardi et al. (2022); Blattner et al. (2023): low-profitability firms that keep borrowing from their relationship bank at below-market rates. There, the low rate reflects the incentives of weak banks; here, it is the concession a healthy bank grants to a viable firm, and the one that guarantees crowd out.

2 Bank lending with debt overhang

We study an economy with heterogeneous entrepreneurs that have legacy 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. If not continued, the project is liquidated at $t = 0$, yielding a liquidation value $\lambda > 0$.[8] We assume that $A \sim F(A)$, with full support in $\left[0, \bar{A}\right]$. The

[8]We suppose that λ is common across projects for simplicity. This can be easily relaxed, as discussed in

second source of heterogeneity is the stock of legacy debt b, where $b \sim G(b)$ with full support in $\left[\underline{b}, \overline{b}\right]$. 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 legacy debts are independently distributed, (ii) an entrepreneur's legacy debt is owed to one bank (henceforth, her *legacy bank*) at $t = 0$, and (iii) legacy debts are equally distributed across banks.[9]

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 $C(0) = 0$, $C' > 0$, $C'' > 0$, $C''' \geq 0$. 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 $\{A, b\}$, where lending zero is a feasible contract. After contracts are posted, entrepreneurs are given the chance to negotiate a credit contract with their legacy bank through Nash bargaining.[10] Entrepreneurs then choose a credit contract, either from the market or from their legacy bank. If an entrepreneur fails to obtain sufficient credit to continue, her project is liquidated, in which case she obtains $\max\{\lambda - b, 0\}$ and her legacy bank $\min\{\lambda, b\}$.

Efficient allocation. In the first best, effort solves $C'(p) = A$ and a project is continued 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

Section 3.4.

[9] While the single legacy-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. Section 5 discusses how the single-legacy-bank assumption maps into the data when firms borrow from several banks: the relevant legacy bank for our mechanism is the firm's dominant legacy lender.

[10] This timing implies that outside options are known with certainty at the renegotiation stage: entrepreneurs negotiate holding the posted market offers in hand.

their legacy debts b.

We now characterize the equilibrium allocation of credit by banks, which determines investment and surplus.

2.1 Credit access and bank captivity

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 $R_{A,b} = \frac{B_{A,b}}{b+k}$.[11] The bank's expected revenue from offering contract B to an entrepreneur of type $\{A, b\}$ is

$$p_A(B) \cdot B \tag{1}$$

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

$$A - B = C'(p_A) \tag{2}$$

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 (2), it is clear that the equilibrium effort level is suboptimal compared to the first-best level. 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 bank.

For what follows, we define an entrepreneur's maximum and minimum debt capacity.

[11] 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 $b + k$.

Definition 1. *For an entrepreneur type A we define the maximum debt capacity $\bar{B}_A$ as the repayment that maximizes the bank's expected revenue, and the minimum debt capacity $\underline{B}_A$ as the lowest repayment that, in expectation, yields the project's liquidation value. Formally:*

$$\bar{B}_A \equiv \arg\max_B \; p_A(B) \cdot B, \qquad \underline{B}_A \equiv \min\left\{B : \; p_A(B) \cdot B = \lambda + k\right\}. \tag{3}$$

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 legacy debt b. Given Definition 1, the following proposition characterizes equilibrium credit contracts.

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*

$$B^*_{A,b} = \frac{b+k}{p_A(B^*_{A,b})} \qquad R^*_{A,b} = \frac{1}{p_A(B^*_{A,b})}, \tag{4}$$

   where $B^*_{A,b}$ is the lowest repayment that satisfies this condition.

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

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

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

3. *Otherwise, she is insolvent and receives no credit offers.*

Solvent entrepreneurs have sufficient repayment capacity to refinance their legacy debt and investment at competitive rates. Insolvent entrepreneurs, at the other extreme, cannot

generate enough expected repayment to obtain credit. Captive entrepreneurs lie in between: continuation generates more for their legacy bank than liquidation, but not enough to repay their claims in full. Continuation therefore requires a concession from the legacy bank, creating joint gains from renegotiation.[12]

Nash bargaining. For captive entrepreneurs, repayment is determined by asymmetric Nash bargaining between the entrepreneur and her legacy bank:

$$(p_A(B) \cdot (A - B) - C(p_A(B)))^{1-\gamma} \cdot (p_A(B) \cdot B - k - \lambda)^{\gamma},$$

where $\gamma \in [0, 1]$ is the bank's bargaining power and each term is the corresponding party's surplus relative to their outside option upon disagreement: the entrepreneur is liquidated and obtains nothing, while the legacy bank obtains the liquidation value λ. When $\gamma = 1$ the negotiated repayment is the entrepreneur's maximum debt capacity $\bar{B}_A$, when $\gamma = 0$ it is her minimum debt capacity $\underline{B}_A$, and it increases monotonically in γ, which underlies the weight $w_A(\gamma)$ in Proposition 1.

Renegotiation is relevant only for captive entrepreneurs. First, note that solvent entrepreneurs cannot use renegotiation to extract concessions from their legacy bank.

Lemma 1 (No renegotiation threat)**.** *Solvent entrepreneurs do not benefit from renegotiating with their legacy bank, even when* $\gamma < 1$.

A solvent entrepreneur's outside option is not liquidation, but borrowing in the competitive market and repaying her legacy debt in full. Any negotiated contract acceptable to the legacy bank must therefore deliver at least the expected repayment $b + k$ that it obtains under the market contract. Hence there is no surplus for renegotiation to divide.

Second, captive entrepreneurs cannot obtain the same concession from another bank.

[12] A necessary condition for an entrepreneur to be captive is that her legacy debt exceed the liquidation value, $b > \lambda$. Otherwise, the bank can recover its claim through liquidation.

Lemma 2 (No takeover)**.** *Unless her legacy debt is renegotiated, lending to a captive entrepreneur is unprofitable for any bank.*

Absent renegotiation, an outside bank must finance the full obligation $b + k$, while the maximum expected repayment from a captive entrepreneur is strictly below $b+k$. Nor can an outside bank profitably purchase the legacy claim: its holder will sell only at its continuation value, which the buyer cannot improve upon. The strength of a bank's bargaining position therefore arises endogenously. The gains from continuation require a concession on the legacy claim, and only the bank holding that claim can grant it.

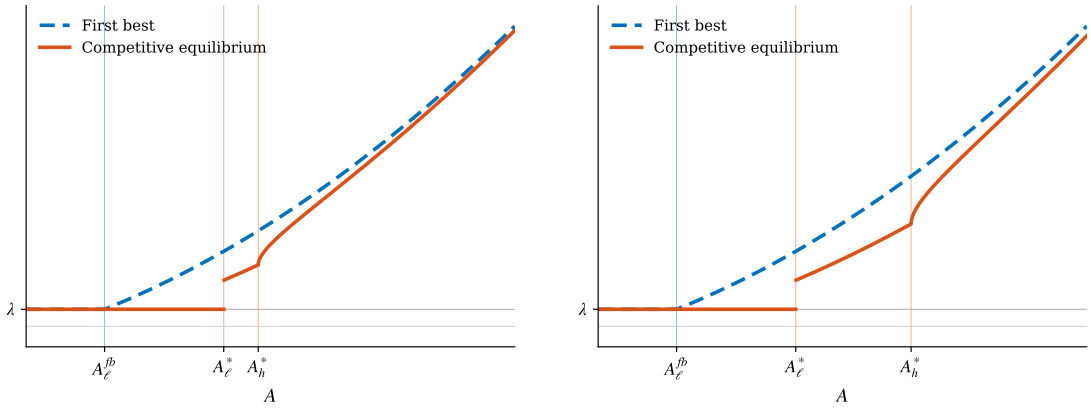
2.2 Investment and inefficiency

The following proposition characterizes which projects continue in equilibrium.

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

1. *$A \geq A^*_h(b)$ is solvent: she borrows from competitive banks and continues her project;*
2. *$A \in [A^*_\ell(b), A^*_h(b))$ is captive: negotiates with her legacy bank and continues her project;*
3. *$A < A^*_\ell(b)$ is insolvent: her project is liquidated and she obtains $\max\{0, \lambda - b\}$.*

The competitive equilibrium is inefficient on both the extensive and intensive margins (Figure 1). Some projects that should continue are liquidated, $A^*_\ell(b) > A^{fb}_\ell$, while entrepreneurs who continue exert too little effort, $p_A < p^{fb}_A$ for all $A \geq A^*_\ell(b)$. Both distortions reflect debt overhang: repayments to legacy banks reduce entrepreneurs' incentives to exert effort and, in turn, the surplus from continuation. This is why, comparing both panels, the surplus falls with legacy debt. Renegotiation mitigates this friction by allowing legacy banks to concede part of their claims, but it cannot eliminate it unless effort is contractible.



(a) Low debt level

(b) High debt level

Figure 1: **First-best vs. competitive equilibrium surplus.** Surplus per entrepreneur in the first best (dashed) and in the competitive equilibrium (solid). Panel (a): $b = 0.04$. Panel (b): $b = 0.08$. Parameters in all figures: $C(p) = p^2/2$, $\gamma = 1$, A uniform on $[0, 1]$, $k = 0.06$, $\lambda = 0.025$, $\bar{X} = 0.03$.

Lemma 3 (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 $p_A^* = p_A^{fb}, \forall A$.*

3 Credit guarantees and bank incentives

Given that the underlying problem is one of debt overhang, a credit guarantee program may be useful to enable productive but indebted entrepreneurs to continue. To allow for this possibility, 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.

3.1 Bank allocation of guarantees

A guarantee $x \in [0, k]$ commits the government to repay x to the bank when the entrepreneur defaults.[13] For a contract (B, x), the bank's expected repayment is therefore

$$p_A(B) \cdot B + (1 - p_A(B)) \cdot x, \tag{5}$$

Guarantees relax entrepreneurs' borrowing constraints by increasing the repayment a bank can obtain without raising B.

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 (5) 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., $1 - p_A(B_{A,b}) \geq \rho$. 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, $x \in \{0, k\}$.[14]

It is useful to redefine entrepreneurs' debt capacities in the presence of a full guarantee.

Definition 2. *The debt capacities with guarantees, $\bar{B}^g_A$ and $\underline{B}^g_A$, are defined as follows:*

$$\bar{B}^g_A \equiv \arg\max_B \; p_A(B) \cdot B + \underbrace{(1 - p_A(B) - \rho) \cdot k}_{guarantee}, \tag{6}$$

$$\underline{B}^g_A \equiv \min \left\{ B : \; \lambda + k = p_A(B) \cdot B + \underbrace{(1 - p_A(B) - \rho) \cdot k}_{guarantee} \right\}. \tag{7}$$

[13] 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 legacy debts. What is important for our findings is that $x < b + k$, i.e., debt cannot be fully insured by public guarantees.

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

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

It is immediate from comparing Definitions 1 and 2 that guarantees simultaneously increase the maximum and reduce the minimum debt capacity of entrepreneurs. The maximum rises because the guarantee reduces the bank's exposure to the entrepreneur's success: since the guarantee pays k in default, the marginal value of inducing effort for the bank falls from B to $B - k$. Discouraging effort through a higher repayment thus costs the bank less, and its maximal extraction rises. Conversely, the minimum debt capacity falls because the guarantee relaxes the bank's participation constraint.

3.2 Pass-through and real effects

The following Proposition characterizes equilibrium contracts and investment decisions in the presence of guarantees.

Proposition 3 (Credit contracts with guarantees)**.** *Given ρ, there exist thresholds $A_\ell^g(b,\rho) \leq A_h^g(b,\rho)$, both weakly increasing in b and ρ, such that an entrepreneur with:*

1. *$A \geq A_h^g(b,\rho)$ is solvent and obtains contract*

$$B_{A,b}^g = \frac{b + \left(p_A(B_{A,b}^g) + \rho\right) \cdot k}{p_A(B_{A,b}^g)} \tag{8}$$

   in the credit market to continue her project, where $B_{A,b}^g$ is the lowest repayment that satisfies this condition;

2. *$A \in [A_\ell^g(b,\rho), A_h^g(b,\rho))$ is captive and negotiates contract*

$$B_{A,b}^g = w_A^g(\gamma) \cdot \bar{B}_A^g + (1 - w_A^g(\gamma)) \cdot \underline{B}_A^g \tag{9}$$

   with her legacy bank to continue her project, where $w_A^g(0) = 0$, $w_A^{g'} > 0$, $w_A^g(1) = 1$;

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

An entrepreneur receives a full guarantee if $1 - p_A \geq \rho$. Contracts (8) *and* (9) *apply to entrepreneurs who receive one; all others obtain the contracts in Proposition 1.*

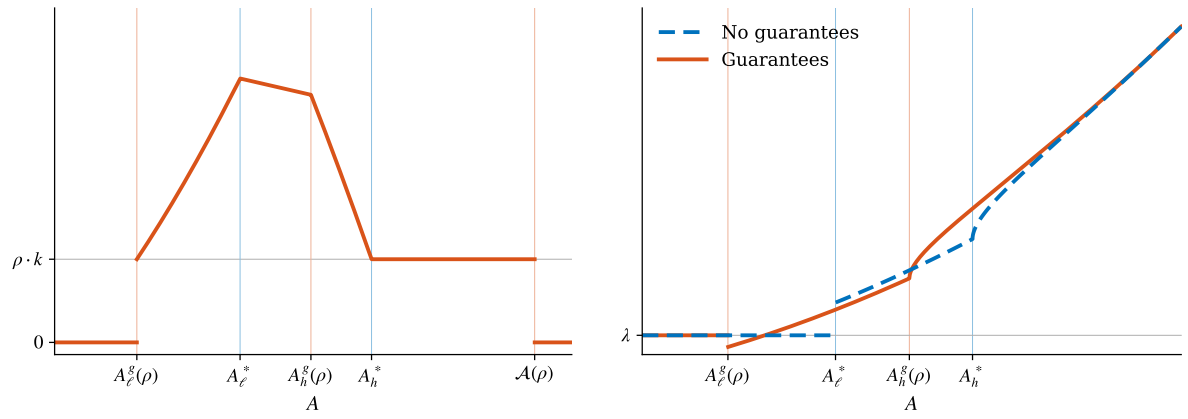
As in the economy without guarantees, two productivity thresholds separate liquidated, captive, and solvent entrepreneurs. Both thresholds increase with the shadow value of guarantees, ρ, and converge to their no-guarantee counterparts, $A^*_\ell(b)$ and $A^*_h(b)$, as guarantees become sufficiently scarce. Proposition 3 also determines how the transfers generated by guarantees are split between banks and entrepreneurs. Entrepreneurs receive a full guarantee whenever its expected value exceeds its shadow cost, $1 - p_A > \rho$; among solvent entrepreneurs, these are those with productivity below $\mathcal{A}(\rho)$, at which $1 - p_A = \rho$. The guarantee, however, need not be fully passed through to them.[15]

First, when guarantees are scarce, banks retain a scarcity rent $\rho \cdot k$. Second, banks can retain an even higher share from their captive borrowers in renegotiation. Two opposing forces determine the extent to which captive entrepreneurs benefit. On the one hand, the guarantee lowers the bank's cost of continuation, reducing the minimum debt capacity, $\underline{B}^g_A < \underline{B}_A$. On the other hand, by insuring the bank against failure, the guarantee reduces the value of inducing effort and raises the maximum repayment the bank can extract, $\overline{B}^g_A > \overline{B}_A$. The first force dominates when bank bargaining power is low; the second becomes stronger as bargaining power rises. With sufficiently high bargaining power, a captive entrepreneur may therefore benefit less from a guarantee than an otherwise identical solvent entrepreneur—and may even repay more than she would without the guarantee. These results are formalized next.

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

1. If $\rho > 0$, no entrepreneur receives a full pass-through of credit guarantees.

[15] We define the pass-through of a credit guarantee as the reduction in the entrepreneur's expected repayment, $p_A \cdot B_{A,b}$, as a share of the expected transfer from a full guarantee, $(1 - p_A) \cdot k$.



(a) Banks' extra revenues

(b) Social surplus

Figure 2: **The competitive equilibrium with credit guarantees.** Panel (a): banks' extra revenue from guaranteed credit. Panel (b): surplus per entrepreneur with (solid) and without (dashed) guarantees. $b = 0.08$, $\rho = 0.228$; other parameters as in Figure 1.

2. *If $\gamma > 0$, the pass-through of credit guarantees is lower for captive than for solvent entrepreneurs, conditional on risk.*

3. *If γ is sufficiently large, captive entrepreneurs are worse off with a guarantee: their repayment increases and their effort falls.*

Figure 2 illustrates these results for the case in which banks hold full bargaining power, $\gamma = 1$, and $b > \lambda$. Panel (a) shows the bank revenue from allocating a guarantee to a given entrepreneur. It is immediate that banks benefit more from allocating guarantees to riskier borrowers. The maximum revenue is for marginal entrepreneurs, A^*_ℓ, as these are the riskiest entrepreneurs from whom the bank can fully appropriate the guarantee: 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 $A > A^*_\ell$, risk and thus the size of the transfer fall in A. Panel (b) depicts the effects on surplus. Guarantees raise surplus when they prevent inefficient liquidations (near A^*_ℓ) or alleviate debt overhang (near A^*_h), but may lower it when they are allocated to captive or unprofitable entrepreneurs.

Finally, the value of ρ is determined by guarantee-market clearing:[16]

$$\int \int x_{A,b}(\rho) \cdot dF(A) \cdot dG(b) = \bar{X}. \tag{10}$$

Since the left-hand side of Equation (10), which denotes the total guarantees allocated by banks, is decreasing in ρ, there is a unique value $\rho \equiv \rho^g$ that satisfies Equation (10). It is immediate that ρ^g is decreasing in the supply of guarantees, and is strictly positive only when guarantees are scarce, i.e., as long as $\bar{X} < \int \int x_{A,b}(0) \cdot dF(A) \cdot dG(b)$.

3.3 The efficient allocation of guarantees

The market allocation suffers from two distortions. First, banks do not fully pass through the benefits of guarantees to entrepreneurs, which limits their effectiveness. Second, banks tilt coverage toward risky and captive borrowers, from whom they can extract larger benefits, instead of internalizing the effects of guarantees on entrepreneurial effort or their fiscal cost.

To characterize these distortions, consider a planner that allocates the same amount $\bar{X}$ of guarantees to maximize productive surplus net of fiscal costs, subject to entrepreneurial incentives and bank participation. Let $\mu > 0$ denote the unit social cost of fiscal resources.[17] The planner solves:

$$\max_{\{\mathcal{I},B,x\}_{\{A,b\}}} \int \int [(p_A \cdot A - C(p_A) - k - \mu \cdot (1 - p_A) \cdot x_{A,b}) \cdot \mathcal{I}_{A,b} + \lambda \cdot (1 - \mathcal{I}_{A,b})] \cdot dF(A) \cdot dG(b) \tag{11}$$

$$s.t. \qquad A - B_{A,b} = C'(p_A), \quad \forall A, b \tag{12}$$

$$[p_A \cdot B_{A,b} + (1 - p_A) \cdot x_{A,b} - k] \cdot \mathcal{I}_{A,b} + \lambda \cdot (1 - \mathcal{I}_{A,b}) \geq \pi^*_{A,b}, \quad \forall A, b \tag{13}$$

[16] The proof of Proposition 3 formally shows how ρ is determined in equilibrium.

[17] We assume μ is small enough, relative to the response of effort to coverage, for the planner's objective to be concave in coverage for each type. Appendix B states the exact condition.

$$\int\int x_{A,b} \cdot dF(A)dG(b) = \bar{X} \tag{14}$$

where $\mathcal{I}_{A,b}$ is an indicator function that takes value one when the planner grants a loan to entrepreneurs of type $\{A, b\}$, and $\pi^*_{A,b}$ denotes banks' equilibrium payoff from entrepreneur $\{A, b\}$ in the absence of guarantees, characterized in Proposition 1.

It is immediate that banks' participation constraints bind in the planner allocation: that is, an assigned guarantee is accompanied by a proportional reduction in repayments—a full pass-through. This allows us to express the planner's marginal benefit and marginal cost of granting guarantees to an entrepreneur of type $\{A, b\}$ as follows:

$$MB_{A,b}(x^p_{A,b}) \equiv \Big[A - C'(p_{A,b}) + \mu \cdot x^p_{A,b}\Big] \cdot \frac{dp_{A,b}}{dx^p_{A,b}} \tag{15}$$

$$MC_{A,b}(x^p_{A,b}) \equiv \mu \cdot (1 - p_{A,b}) \tag{16}$$

where $\frac{dp_{A,b}}{dx^p_{A,b}} > 0$ can be derived from Equations (12)-(13). Equation (15) shows that by reducing entrepreneurial payments, guarantees raise effort and thus productive and fiscal surplus. Equation (16) reflects that guarantees entail a fiscal cost μ with probability $(1 - p_{A,b})$.

The difference between how the planner and banks value guarantees is particularly transparent when we isolate the marginal effect on productive surplus. This effect is given by the term on the left-hand side below, which can be rewritten as

$$\big[A - C'(p_{A,b})\big] \cdot \frac{dp_{A,b}}{dx^p_{A,b}} = (1 - p_{A,b}) \cdot \frac{\eta^{A,b}_{p,B}}{1 - \eta^{A,b}_{p,B} \cdot \left[1 - \frac{x^p_{A,b}}{B^p_{A,b}}\right]}. \tag{17}$$

where $\eta^{A,b}_{p,B}$ denotes the absolute value of the elasticity of effort with respect to repayment. Banks value a guarantee by the expected transfer it generates, $1 - p_{A,b}$. The planner instead values the effect of that transfer on entrepreneurial effort: its productive benefit equals $1 - p_{A,b}$ times a multiplier that increases with $\eta^{A,b}_{p,B}$. Thus, even absent fiscal costs, the planner and banks need not rank entrepreneurs in the same way.

Let $\rho^p \geq 0$ denote the multiplier on the aggregate supply of guarantees. The planner allocates

coverage until its marginal benefit equals its fiscal cost plus this scarcity value. The following proposition characterizes the resulting allocation.

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

$$B^p_{A,b} = \frac{\pi^*_{A,b} - (1 - p_A(B^p_{A,b})) \cdot x^p_{A,b} + k}{p_A(B^p_{A,b})}, \tag{18}$$

$$x^p_{A,b} \begin{cases} = k & \text{if} \quad MB_{A,b}(k) > \rho^p + MC_{A,b}(k) \\ = 0 & \text{if} \quad MB_{A,b}(0) < \rho^p + MC_{A,b}(0) \\ : MB_{A,b}(x^p_{A,b}) = \rho^p + MC_{A,b}(x^p_{A,b}) & o.w. \end{cases} \tag{19}$$

if and only if

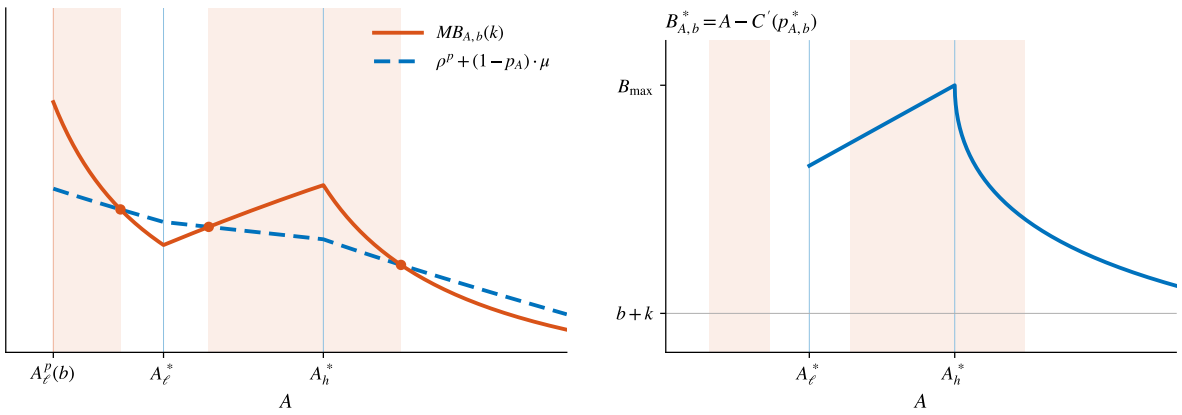
$$p_{A,b} \cdot A - C(p_{A,b}) - [\mu \cdot (1 - p_{A,b}) + \rho^p] \cdot x^p_{A,b} \geq \lambda + k \tag{20}$$

where ρ^p *ensures feasibility constraint* (14) *binds, and* $\rho^p = 0$ *if it is slack. Otherwise, entrepreneurs obtain no credit and their projects are liquidated. We denote by* $A^p_\ell(b)$ *the lowest productivity the planner keeps alive, that is, the* A *at which* (20) *holds with equality.*

Proposition 4 highlights two differences between the planner and the market allocation. First, banks' participation constraints bind under the planner, so guarantees are fully passed through to entrepreneurs. Even though what banks retain is a transfer rather than a direct source of welfare loss in the planner problem, it does have indirect effects on welfare through the lower effort and inefficient liquidations they induce.[18]

Second, the planner's allocation of guarantees is not monotone in productivity. Every captive entrepreneur receives some coverage, but full guarantees are concentrated where coverage has the largest effect on productive surplus. For captives, the marginal benefit of the first unit of coverage is unbounded when the bank has full bargaining power: since the negotiated contract satisfies $\eta^{A,b}_{p,B} = 1$, effort is maximally responsive to repayment relief. By contrast, full coverage is optimal

[18]This conclusion is unchanged in a dynamic setting in which what banks retain increases bank capital and is eventually competed away through future lending. What banks retain remains a transfer, while the contemporaneous effort and liquidation distortions are deadweight losses.



(a) Marginal benefit and its cost

(b) Equilibrium repayments

Figure 3: **The planner's marginal benefit of coverage and its fiscal cost.** Panel (a): $MB_{A,b}(k)$ (solid) and $\rho^p + MC_{A,b}$ (dashed), for $\mu = 0.4$ ($\rho^p = 0$). Panel (b): equilibrium repayment without guarantees, $B^*_{A,b}$. Shaded in both panels: entrepreneurs who receive full coverage in the planner's allocation.

only if $MB_{A,b}(k) > \rho^p + MC_{A,b}(k)$. In the example of Figure 3(a), the marginal benefit $MB_{A,b}(k)$ is non-monotone in productivity: it is highest at the planner's liquidation threshold, where guarantees prevent socially inefficient liquidations; falls toward the bank's liquidation threshold, where equilibrium repayment B – and thus the distortion on effort – is minimized; and rises again toward the solvency threshold, where equilibrium repayment B is maximized (see Figure 3(b)).

Figure 3 illustrates the planner allocation, taking into account also the fiscal cost of guarantees μ. In this example, when μ is low, full coverage extends from the planner's liquidation threshold through the captive region and into the solvent region; only the safest entrepreneurs, whose effort responds little to repayment relief, receive no coverage. When μ is high, which is the case depicted in the figure, full coverage instead concentrates in two regions: risky entrepreneurs whose liquidation is at stake and captive entrepreneurs close to the solvency threshold.

Taken together, our results highlight a fundamental drawback of delegating the allocation of guarantees to banks: banks allocate guarantees according to the private benefits they can extract from them rather than their contribution to social surplus. This leads to incomplete pass-through and a tilt toward risky and captive borrowers, distorting both entrepreneurial effort and continua-

tion decisions. In Section 4 we discuss how programs can be designed to address these distortions.

3.4 Robustness and interpretation

Non-contractible effort. Moral hazard arising from non-contractible effort is the key friction in our model: by linking debt repayments to output, it creates debt overhang and scope for renegotiation. If effort were contractible, the first best would obtain, renegotiation would be unnecessary, and guarantees could not improve efficiency (Lemma 3). Banks might still appropriate some of their benefits, but this would be purely redistributive. The mechanism is not specific to effort, however, and extends to other environments in which debt repayments affect output, as documented in Micucci and Rossi (2017); Kalemli-Özcan et al. (2022); Önder et al. (2024).

Aggregate-demand externalities. We motivate guarantees through debt overhang rather than aggregate-demand externalities. Adding a social value of continuation would leave our positive analysis unchanged, but would affect the planner's allocation by adding this value to the marginal benefit of coverage. If the externality operates primarily through avoiding liquidations, it would tilt optimal coverage toward riskier entrepreneurs, whose continuation is at stake; if instead it operates through sustaining productive investment, it would tilt coverage toward safer ones. In either case, the inefficiencies identified in Section 3.3 remain.

Renegotiation as debt forgiveness. We model renegotiation as the legacy bank granting a loan of $b+k$ on concessional terms. Online Appendix Section OA.2.1 shows that the same allocation obtains if the bank instead forgives part of the entrepreneur's legacy debt b. The reason is that both parties care about the expected $t = 1$ repayment, pB, associated with providing k at $t = 0$; whether the concession takes the form of a lower interest rate or a reduction in the face value of legacy debt is therefore immaterial.

Long-term debt. We assume that legacy debt b is due at $t = 0$. Online Appendix Section OA.2.2 shows that our results are unchanged when b is instead due at $t = 1$. What matters for debt overhang is the entrepreneur's total repayment obligation at $t = 1$, whether it reflects

short-term debt rolled over at $t = 0$ or long-term debt coming due at $t = 1$. Accordingly, renegotiation operates by reducing that obligation, through either a lower interest rate on new lending or a reduction in the face value of legacy debt.

Heterogeneous liquidation values. We assume a common liquidation value λ across projects. Allowing for firm-specific λ_i would preserve our mechanism: liquidation values affect the parties' outside options, and hence the boundaries between solvent, captive, and insolvent entrepreneurs and the bargaining outcome, but not the entrepreneur's incentive constraint. Entrepreneurs with higher liquidation values are less likely to be captive, since their legacy bank can recover more upon liquidation. Heterogeneity in λ would therefore introduce a second, orthogonal determinant of captivity alongside productivity and legacy debt.

Dynamics. We take legacy debt b as given, but the mechanism extends to dynamic settings in which banks and firms choose debt ex ante. All that is required is that some borrowers become captive in some states of nature. For example, with uncertainty about productivity A or funding needs k and non-contingent debt repayments, sufficiently adverse productivity or funding shocks make some firms captive relative to their pre-existing debt obligations. Thus, captivity can arise endogenously even when debt is optimally chosen ex ante.

Sources of banks' bargaining position. In our model, banking is competitive and information symmetric: the bank's bargaining position arises because only the legacy bank can renegotiate its claim. In practice, legacy banks may also benefit from geographic proximity (Petersen and Rajan, 1995, 2002; Degryse and Ongena, 2005) or private information (Sharpe, 1990; Rajan, 1992; von Thadden, 2004). These forces complement ours, but have different implications for guarantees. Our theory implies that the pass-through of guarantees should be lower for *captive* relative to non-captive borrowers. An information-based view would instead imply a lower pass-through for *relationship* than for new borrowers. We test these different implications empirically in Section 5.

4 Designing guarantee programs

We now explore whether institutional features of guarantee programs can help mitigate the inefficiencies identified above. We consider fees charged to banks, the choice between limited-full and ample-partial guarantees, caps on guaranteed-loan repayments, and the use of direct transfers instead of guarantees. Throughout this section, we focus on the case in which banks hold full bargaining power vis-à-vis their captive borrowers ($\gamma = 1$), where the capture distortion is starkest.

4.1 Guarantee fees

Suppose banks pay a fee $\phi \geq 0$ per unit of guarantee. A contract $\{B, x\}$ then generates expected bank revenue

$$p_A(B) \cdot B + (1 - p_A(B) - \rho - \phi) \cdot x.$$

Proposition 5 (Guarantee fees)**.** *Let ρ^0 denote the equilibrium shadow value of guarantees when $\phi = 0$. For any $\phi \in [0, \rho^0]$, the equilibrium allocation of guarantees, credit contracts, effort, and liquidations is unchanged. The fee reduces banks' scarcity rent one-for-one, from ρ^0 to $\rho^0 - \phi$. If $\phi > \rho^0$, the volume constraint becomes slack, guarantee allocation falls, and scarcity rents disappear.*

The result follows because banks allocate guarantees whenever $1 - p_A \geq \rho + \phi$, so the allocation depends only on their total opportunity cost, $\rho + \phi$. As long as the volume constraint binds, market clearing fixes this sum at ρ^0: each euro of fees therefore reduces the scarcity rent by one euro, without changing guarantee allocation or pass-through. At $\phi \geq \rho^0$, the fee fully recoups the scarcity rents that banks would otherwise retain, and the equilibrium is the one in Proposition 3 with $\rho = \phi$.

Risk-based fees can additionally make banks internalize fiscal costs, but cannot correct how they value guarantees. With $\phi_A = \mu(1 - p_A)$, a bank allocates a guarantee whenever $(1 - p_A)(1 - \mu) \geq \rho$. Banks therefore continue to rank borrowers by the expected transfer $1 - p_A$, whereas the planner ranks them by the guarantee's contribution to productive surplus net of fiscal costs. Moreover, fees cannot eliminate the additional revenues extracted from captive entrepreneurs in renegotiation.

Pricing guarantees can thus recoup scarcity rents and internalize fiscal costs, but cannot implement the planner's allocation or ensure pass-through.

4.2 Ample vs. limited guarantees

We next compare programs characterized by $\langle \bar{X}, \alpha \rangle$, where $\bar{X}$ is the aggregate supply of guarantees and $\alpha \in (0, 1]$ is the maximum share of new lending that can be guaranteed, so that $x \leq \alpha k$. The program studied thus far is *limited-full*, $\langle \bar{X}, 1 \rangle$: coverage can be complete but is rationed. We compare it with an *ample-partial* program, $\langle \infty, \alpha \rangle$: every originated loan can receive coverage, but only up to αk.[19]

The ample-partial design requires no information about borrowers: the government sets a single coverage rate, and banks only decide whom to lend to. The comparison therefore measures the value of delegating the allocation of guarantees to banks, which observe borrowers' types while the government does not.

We compare the two designs at equal expected fiscal cost. For any allocation, this cost is

$$\mathcal{C} = \int \int (1 - p_{A,b}) \cdot x_{A,b} \cdot dF(A) \cdot dG(b). \tag{21}$$

Since the cost of an ample-partial program is continuous and strictly increasing in α, there exists a unique $\alpha^* < 1$ that matches the fiscal cost of any limited-full program with a binding volume constraint. The following proposition summarizes the comparison.

Proposition 6 (Ample-partial vs. limited-full guarantees)**.** *Consider a limited-full design $\langle \bar{X}, 1 \rangle$ with shadow value $\rho^0 > 0$, and the ample-partial design $\langle \infty, \alpha^* \rangle$ of equal expected fiscal cost. Under the latter, every originated loan carries coverage $x_{A,b} = \alpha^* k$, and the equilibrium has the threshold structure of Proposition 3, with thresholds $A_\ell(b; \alpha^*)$ and $A_h(b; \alpha^*)$ decreasing in the coverage rate. Relative to the limited-full design:*

[19] We thank an anonymous referee for suggesting this comparison. The Spanish program offered partial coverage, but its aggregate volume was limited; our baseline results extend immediately to a limited-partial design.

1. ***Scarcity rents disappear.*** *The shadow value of guarantees is zero, and solvent borrowers receive a full pass-through of the guarantee.*

2. ***Captive borrowers obtain higher surplus.*** *Captive entrepreneurs covered under both designs obtain strictly higher surplus under the ample-partial design.*

3. ***Solvent borrowers may obtain lower surplus.*** *Conditional on receiving coverage under both designs, a solvent entrepreneur obtains less repayment relief under the ample-partial design whenever* $\rho^0 < (1-\alpha^*) \cdot (1 - p_A(\alpha^*))$ *where* $p_A(\alpha^*)$ *denotes her effort under the ample-partial design.*

The proposition exposes the central trade-off entailed by the program design. With no aggregate rationing, scarcity rents disappear and competition passes the value of guarantees through to solvent borrowers. Partial coverage also leaves banks exposed to a fraction $1 - \alpha^*$ of default losses, limiting their ability to substitute guarantees for the concessions they would otherwise grant captive borrowers. The ample-partial design therefore reduces both scarcity rents and capture.

The cost is weaker targeting, and this is the value of delegation. Under limited-full guarantees, banks use their information to concentrate scarce coverage on risky borrowers, for whom the expected transfer $1 - p_A$ is largest. The same delegation creates scarcity rents and capture. Under ample-partial guarantees, the same fiscal resources are spread across all loans banks choose to originate, including safer borrowers, and each covered borrower receives less coverage. Thus neither design generally dominates: ample-partial guarantees improve pass-through, while limited-full guarantees concentrate resources on the riskiest borrowers.

Figure 4 illustrates this trade-off. In this example, the pass-through gains dominate: at equal fiscal cost, the ample-partial design raises aggregate surplus relative to limited-full guarantees. The one dimension where the ample-partial design exacerbates inefficiencies is at the bottom: absent scarcity, banks extend guaranteed credit to entrepreneurs whose continuation is socially wasteful.

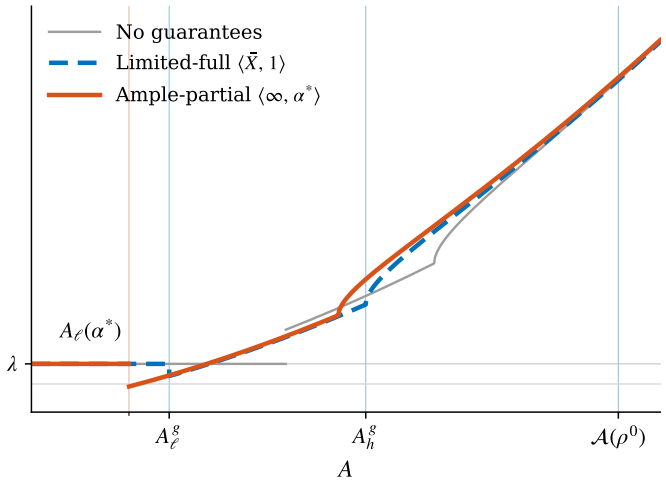


Figure 4: **Limited-full vs. ample-partial guarantees at equal fiscal cost.** Surplus per entrepreneur without guarantees (thin), with limited-full guarantees $\langle \bar{X}, 1 \rangle$ (dashed), and with ample-partial guarantees $\langle \infty, \alpha^* \rangle$ (solid). $b = 0.08$, $\rho^0 = 0.228$, $\alpha^* = 0.891$; other parameters as in Figure 1.

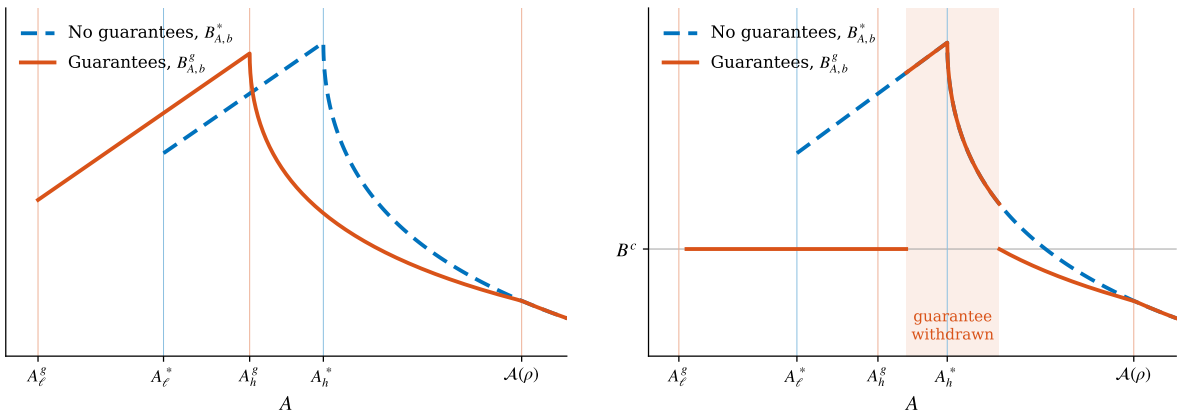
4.3 Rate caps

Several guarantee programs regulated the price of guaranteed credit directly: France's PGE was extended at cost in its first year, while the US PPP fixed the interest rate on guaranteed loans. In our framework, we represent such restrictions as a cap B^c on the repayment of a guaranteed loan.

A cap does not bind monotonically in borrower risk because guaranteed repayments $B^g_{A,b}$ are hump-shaped in productivity. They rise through the captive region, as legacy banks grant smaller concessions to more productive borrowers, and fall among solvent borrowers, who obtain competitive terms. A sufficiently tight cap therefore binds on an interval around the solvency threshold $A^g_h(b, \rho)$, covering the safest captives and the riskiest solvent borrowers. Its effects on these two groups are sharply different.

Proposition 7 (Repayment caps)**.** *Consider a scheme with a cap B^c on guaranteed-loan repayments, below the highest guaranteed repayment. The cap binds on an interval around $A^g_h(b, \rho)$, which widens as B^c falls. Among entrepreneurs bound by the cap:*

1. *Those whose legacy bank still gains at least ρ from the guarantee at the cap keep it and repay B^c: the cap reduces capture, and their effort and surplus increase.*



(a) No cap

(b) With a cap

Figure 5: **Repayments with and without a rate cap.** Repayment $B_{A,b}$ with guarantees (solid) and without them (dashed). Panel (a): no cap. Panel (b): cap $B^c = 0.22$; shaded: guarantee withdrawn. $b = 0.08$, $\rho = 0.228$; other parameters as in Figure 1.

2. All others lose the guarantee and return to their outcome without the program.

The intuition is that a cap can reduce repayment only when the bank is earning more than its participation value. Captive borrowers satisfy this condition, so their legacy bank concedes rather than lose them. Solvent borrowers, by contrast, already receive competitive terms; no bank can profitably provide guaranteed credit at the capped repayment, so the guarantee is withdrawn. Since $A^g_h(b,\rho) < A^*_h(b)$, some of these borrowers were solvent only because of the guarantee, so the cap returns them to captivity.

Repayment caps thus improve pass-through for captive borrowers at the cost of excluding some borrowers from guaranteed credit. They are therefore an imperfect instrument for limiting bank capture. Figure 5 illustrates both mechanisms.

4.4 Guarantees vs. transfers

We finally compare guarantees with direct transfers. A guarantee of x to an entrepreneur of type $\{A,b\}$ costs the government $(1-p_{A,b})x$ in expectation, while a transfer of the same amount relaxes the bank's participation constraint by exactly as much. To isolate the difference between the two

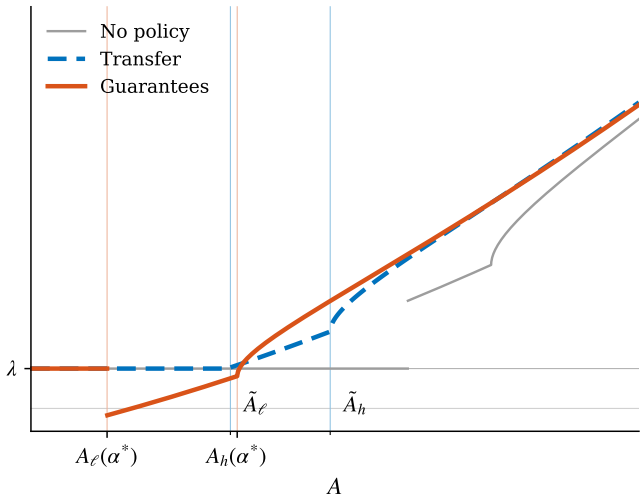


Figure 6: **Transfers vs. guarantees, allocated through banks.** Surplus per entrepreneur with no policy (thin), with transfers up to $\tilde{t}$ (dashed), and with ample-partial guarantees $\langle \infty, \alpha^* \rangle$ (solid), at equal fiscal cost. $b = 0.04$, $\alpha^* = 0.904$, $\tilde{t} = 0.028$; other parameters as in Figure 1.

instruments rather than how they are allocated, we delegate the allocation of both to banks and compare them at equal fiscal cost. Specifically, we compare the ample-partial guarantee program of Section 4.2 with a program in which banks allocate transfers $t_{A,b} \leq \tilde{t}$ to entrepreneurs they finance, where $\tilde{t}$ is chosen to equate the fiscal cost of the two programs.

The instruments differ because guarantees are contingent on failure whereas transfers are not. For captive entrepreneurs, a bank with full bargaining power captures both the transfer and the guarantee. The difference is that transfers avoid the effort distortion that guarantees create for these borrowers, because transfers do not result in a higher repayment.[20]

Guarantees, however, have a targeting advantage. For solvent entrepreneurs, competition fully passes through either instrument, so their relative value is determined by $(1 - p_A) \cdot \alpha^* \cdot k$ versus $\tilde{t}$. Guarantees therefore provide larger effective transfers to riskier borrowers and can prevent more liquidations and free more entrepreneurs from captivity, while transfers benefit safer borrowers relatively more. Figure 6 illustrates this trade-off.

[20]Because guarantees pay only upon default, they reduce the bank's return to inducing entrepreneurial effort. A state-independent transfer does not affect this margin.

Neither instrument generally dominates. Transfers avoid the effort distortion created by guarantees for captive borrowers, while guarantees target fiscal resources toward riskier borrowers for whom coverage is more valuable. Their ranking therefore depends on the distribution of borrower types and on banks' bargaining power.

4.5 Lessons for program design

Viewed through the lens of our model, actual guarantee programs differ in the scope they leave for banks to appropriate the benefits of the intervention. The Spanish program combined high coverage rates (up to 80%), a limited aggregate volume, and fees that—judging by the positive excess revenues estimated below in Section 5.5—fell short of the scarcity value of guarantees. The latter two features generate and leave scarcity rents with banks, while high coverage leaves scope for additional capture from borrowers who remain captive. At the other extreme, ample volume and partial coverage eliminate scarcity rents and limit capture, but at the cost of weaker targeting. France's PGE, for example, combined partial coverage (70% to 90%) with a €300 billion envelope that never bound: banks granted about €145 billion.

More generally, the analysis highlights two shortcomings of delegating guarantee allocation to banks. First, banks value guarantees according to their private returns, rather than their contribution to productive surplus net of fiscal costs. Second, they appropriate part of their benefits through scarcity rents and renegotiation with captive borrowers. Simple design features can mitigate individual distortions—fees can recoup scarcity rents and price fiscal risk, ample volume eliminates scarcity rents, partial coverage limits capture, repayment caps increase pass-through, and transfers avoid the adverse incentive effects of guarantees—but none addresses all of them at once. Effective program design must therefore exploit banks' ability to target resources while limiting their ability to appropriate them.

5 Empirical Evidence on Bank Capture

We test the main predictions of the model using Spain's COVID-19 credit-guarantee program (ICO). The setting is particularly well suited to our mechanism: the pandemic generated large liquidity needs among firms with pre-existing bank debt, while banks were given substantial discretion over the allocation and pricing of guarantees.[21] Institutional details of the ICO program are provided in Section OA.3 of the Online Appendix.

Our empirical analysis focuses on the model's central implication: banks have stronger incentives to direct guarantees toward borrowers from whom they can appropriate a larger share of the guarantees' benefits. This prediction has two parts. First, guarantees should be allocated disproportionately to borrowers that generate high expected transfers for banks and, conditional on risk, to borrowers that are captive to the allocating bank. Second, the benefits of guarantees should be passed through less to captive borrowers. The latter prediction is especially informative about our mechanism because, when the legacy bank has a strong enough bargaining position, the guarantee can substitute for repayment concessions that the bank would otherwise make.

We proceed in three steps. We first examine how guarantees are allocated across firms and bank–firm relationships. We then study their pass-through into loan rates, which provides our main test of bank capture. Finally, we relate the empirical findings to firm outcomes and to the revenues banks obtain from guaranteed lending.

5.1 Data and Samples

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. We study credit originated between March 2020 and February 2021, the first year of the ICO program, during which most guarantees were issued. The CCR provides information on loan amounts, origination and maturity dates, contractual interest rates, reference rates, and the presence of public and private guarantees.

We merge these data with firm balance-sheet information from the Central Balance Sheet Data

[21] Section OA.1 in the Online Appendix shows that, in the model, adverse funding and productivity shocks push some solvent firms into captivity to their legacy banks and some captive firms into liquidation.

Office Survey (CBSDO), a quasi-census constructed from accounts filed with the Spanish Commercial Register. We exclude financial firms, public and non-market entities, holding companies, and other firms whose accounts are not comparable to those of operating non-financial corporations. We use firm characteristics measured in December 2019, before the pandemic and the introduction of the ICO program. Our controls include profitability, cash, size, and leverage.

Different predictions require different units of observation, and hence different samples. For the firm-level analysis of access to guarantees and subsequent outcomes, we use the 232,705 eligible firms that obtained new bank financing during our sample period. The main characteristics of firms in this sample are reported in Panel A of Table 1. For the analysis of guarantee allocation across captive and non-captive borrowers, we construct a bank–firm sample that records the credit extended by each bank to each firm during our sample period. Panel B of Table 1 provides information on the distribution of ICO credit and borrower captivity at the firm-bank level. Finally, the pass-through analysis uses loan-level observations, which allow us to compare the interest rates on guaranteed and non-guaranteed loans within otherwise similar bank–firm relationships.

In our baseline samples we restrict attention to loans with an origination maturity above six months. This makes guaranteed and non-guaranteed credit more comparable: about 80% of non-ICO loans have maturities below six months, compared with less than 2% of ICO loans. After the restriction, average maturities are 4.4 and 3.5 years for ICO and non-ICO loans, respectively. The Online Appendix shows that our results are robust to alternative maturity restrictions.

We distinguish default risk from vulnerability. Our measure of default risk is an indicator equal to one if the firm's estimated one-year probability of default (PD) in 2020 exceeds 1%; as robustness, we use the PD in 2019, or in either 2019 or 2020.[22] We classify firm f as *vulnerable* if either its PD in 2019 exceeds 1% or its current assets at the end of 2019 are insufficient to meet its estimated 2020 liquidity needs.[23] Vulnerability measures the conditions under which a firm

[22]The expected default probability captures both formal default and delinquency risk and is estimated following Blanco et al. (2023) using balance-sheet information as of the end of 2020, and extended to incorporate sectoral and global factors. Results are similar when risk is measured with 2019 balance sheets (Online Appendix Tables OA.3 and OA.6).

[23]We estimate the funding shortfall as the amount by which gross operating income plus financial income falls short of financial expenses, corporate taxes, fixed-asset investment, and maturing short-term debt, using 2019 balance sheets. A firm has liquidity needs when its current assets fall below this shortfall. These

becomes captive in the model: limited repayment capacity relative to its legacy debt, together with a new funding need. We define firm f as *captive* to bank b when it is vulnerable and has a pre-existing relationship with bank b, which thus holds part of the firm's legacy claims. Approximately 52.9% of bank–firm relationships in our baseline sample are classified as captive. Guarantees were not confined to existing relationships: about a quarter of ICO credit (24%) went to firms with no prior credit relationship with the lending bank, although guaranteed credit came disproportionately from firms' main banks (32% of ICO credit against 24% of non-guaranteed credit; Online Appendix Table OA.1).

We also construct a continuous measure of the strength of the bank's bargaining position. For each bank–firm pair, $BargStrength_{fb}$ is the ratio of bank b's credit to firm f to the firm's total liabilities.[24] A larger value therefore captures a larger exposure of the borrower to the bank and, in the spirit of the model, a weaker position of the firm in the bank–firm relationship. Alternative definitions of captivity, including definitions based exclusively on default probabilities, yield similar conclusions.

5.2 The Allocation of Guarantees

We begin by testing the prediction that, all else equal, banks are more likely to grant guaranteed credit to riskier borrowers (Prediction 1). Since the government guarantee pays in states in which the borrower defaults, its expected value to the lending bank increases with borrower risk. This prediction is not unique to our mechanism, but it is important to verify that it holds in our sample. At the firm level, we estimate

liquidity needs were computed by the Banco de España with information on the COVID-19 shock to design the ICO program.

[24] Although the model features a single legacy bank for tractability, its logic pins down who the relevant lender is when a firm borrows from several banks: the *captor* is the bank whose concession the firm needs to continue — in practice, the holder of the dominant share of the firm's debt. Lenders with small claims are not pivotal in a renegotiation, as their exposure can be repaid or rolled over without concessions. This mapping is why we proxy a bank's bargaining position with the share of the firm's total debt that it holds. Empirically, the captive indicator includes every bank with which a vulnerable firm had a relationship; our bargaining-strength measure, the bank's share of the firm's debt, identifies its main legacy lender. Note also that captivity does not preclude borrowing from multiple banks ex post: once the captor bank grants that concession, lending to the firm becomes viable for outside banks as well (see Online Appendix Section OA.2.1).

$$\frac{ICO_f}{Total_f} = \beta Risk_f + \delta X_f + \gamma_{ils} + \varepsilon_f, \tag{22}$$

where $ICO_f/Total_f$ denotes the share of new credit obtained by firm f through ICO-guaranteed loans, $Risk_f$ is our indicator of default risk, in its baseline and robustness versions. X_f contains pre-pandemic profitability, size, leverage, and liquidity, and γ_{ils} denotes industry–location–size fixed effects. Industry corresponds to the 4-digit NACE code, location is defined at the zip-code level, and size corresponds to four categories of firms according to the EC definition of size (micro, small, medium-sized, and large firms).

Table 2 shows a strong relationship between borrower risk and the use of guaranteed credit. Firms whose PD in 2020 exceeded 1% obtained an ICO share 3.2 percentage points (pp) higher than otherwise similar firms (column (1)). The robustness measures give similar estimates: 4.9 pp when risk is defined by the 2019 PD (column (2)), and 4.3 pp when it is defined by the PD in either 2019 or 2020 (column (3)). All three coefficients are highly statistically significant. Table OA.2 in the Online Appendix shows that these findings are robust to a longer maturity cutoff, to excluding renewed loans, and to using all new credit.

Next, we test a more distinctive prediction of our model, that, conditional on risk, banks allocate more guarantees to borrowers that are captive to them (Prediction 2). We therefore move to the bank–firm level sample and estimate

$$\frac{ICO_{fb}}{Total_{fb}} = \beta_1 Captive_{fb} + \delta X_f + \gamma_{ilsr} + \gamma_b + \varepsilon_{fb}, \tag{23}$$

where $ICO_{fb}/Total_{fb}$ is the share of new credit extended by bank b to firm f that carries an ICO guarantee, $Captive_{fb}$ indicates that firm f is captive to bank b, γ_{ilsr} denotes industry–location–size–risk fixed effects, and γ_b denotes bank fixed effects to capture unobserved shocks to bank credit supply. Industry, location, and size are defined as in equation (22). The risk component of the fixed effects is defined using Credit Quality Step (CQS) categories based on firms' one-year probability of default as of the end of 2020.[25] The fixed effects therefore control for default

[25]We construct the risk categories using the Credit Quality Step (CQS) classification and firms' estimated one-year probabilities of default. CQS1–CQS2 correspond to a PD below 0.1%, CQS3 to a PD between 0.1%

risk, while $Captive_{fb}$ is built on vulnerability: we compare firms with similar default risk in 2020 that differ in whether they entered the pandemic vulnerable and tied to the allocating bank. The specification therefore compares the allocation of guarantees by the same bank across firms with similar observable characteristics and similar post-pandemic credit risk.

Table 3 provides strong support for this prediction. In column (1), captive borrowers receive a 4.1 pp larger share of guaranteed credit. Column (2) decomposes captivity into vulnerability and a pre-existing relationship. The relationship alone is close to zero and insignificant, and vulnerability alone is negative and only marginally significant, while their interaction is positive and significant: captive borrowers receive a 4.2 pp larger share of guaranteed credit. What drives the allocation is the combination of vulnerability and a pre-existing relationship, not either one alone.

Column (3) replaces the relationship dummy with our continuous measure of bargaining strength, interacted with vulnerability. The interaction is positive and significant: a one-unit increase in $BargStrength_{fb}$ is associated with a 4.7 pp larger share of guaranteed credit among vulnerable borrowers, while bargaining strength and vulnerability on their own are insignificant. Column (4) drops the bank fixed effects, which may absorb meaningful cross-bank variation in bargaining strength; the interaction remains positive and significant. Table OA.3 in the Online Appendix shows that these findings are robust to alternative measures of vulnerability and fixed-effect structures.

5.3 Pass-Through and Bank Capture

We next turn to the prediction that distinguishes our mechanism: the pass-through of guarantees into lower interest rates should be weaker for captive borrowers (Prediction 3). Any theory in which legacy banks have a strong bargaining position predicts weaker pass-through. What is specific to ours is the source of that power. A firm becomes captive to its legacy bank when its debt overhang makes lending to the firm unprofitable for outside lenders. The legacy bank's bargaining position therefore arises from the combination of vulnerability and a pre-existing relationship. In informational theories, by contrast, the relationship bank's advantage comes from the relationship itself

and 0.4%, CQS4 to a PD between 0.4% and 1%, CQS5 to a PD between 1% and 1.5%, CQS6 to a PD between 1.5% and 3%, CQS7 to a PD between 3% and 5%, and CQS8 to a PD above 5%.

and grows with its length, regardless of the borrower's vulnerability (Sharpe, 1990; Rajan, 1992). Our test exploits this difference: weaker pass-through should be concentrated among vulnerable firms with a pre-existing relationship, not among relationship borrowers in general.[26]

We test this using loan-level data, comparing ICO and non-ICO loans while controlling flexibly for borrower, bank, and contract characteristics.

Our baseline specification is

$$\begin{aligned} i_{fbjt} = \beta_1 ICO_{fbjt} + \beta_2 Captive_{fb} + \beta_3 Captive_{fb} \times ICO_{fbjt} \\ + \delta X_f + \gamma_{bt} + \gamma_{ilsr} + \gamma_c + \varepsilon_{fbjt}, \end{aligned} \tag{24}$$

where i_{fbjt} is the interest rate paid by firm f to bank b on loan j originated in month t, and ICO_{fbjt} indicates whether the loan is publicly guaranteed. The specification includes bank–time fixed effects (γ_{bt}), industry–location–size–risk fixed effects γ_{ilsr}, loan-contract fixed effects γ_c, and firm controls. The γ_c fixed effects interact maturity buckets, interest-rate structure (fixed or floating), and origination month, allowing us to compare guaranteed and non-guaranteed loans with similar contractual characteristics. Standard errors are two-way clustered at the bank and firm levels.

Table 4 shows that guarantees lower borrowing costs, but less so for captive borrowers. ICO loans carry an average interest-rate discount of about 33 basis points (bp) (column (1)). The discount is about 44 bp for non-captive borrowers and about 19 bp smaller for captive ones, while captivity by itself does not affect loan rates (column (2)).[27] The results are robust to alternative measures of captivity, to longer maturities, to the exclusion of refinancing operations, to alternative fixed effects (Table OA.6, column (7)), and to alternative PD thresholds (Tables OA.4–OA.7 in the Online Appendix). Guaranteed loans to captive borrowers are also larger (Table OA.8).

To see where the captive effect comes from, we decompose captivity into vulnerability and a

[26] When the bank's advantage is informational, the availability of guarantees may erode it: by protecting outside lenders against adverse selection, guarantees improve borrowers' outside options (see Section 3.4).

[27] Loan-level fees are available only for ICO loans. The difference in fees between comparable captive and non-captive firms is negligible (about 0.4 bp), and fees are higher on non-ICO loans (Figure OA.4 in the Online Appendix), so accounting for fees does not change these conclusions.

pre-existing relationship, and let each interact with the guarantee:

$$\begin{aligned} i_{fbjt} = \beta_1 ICO_{fbjt} + \beta_2 Vul_f + \beta_3 Rel_{fb} + \beta_4 Vul_f \times Rel_{fb} \\ + \beta_5 ICO_{fbjt} \times Vul_f + \beta_6 ICO_{fbjt} \times Rel_{fb} \\ + \beta_7 ICO_{fbjt} \times Vul_f \times Rel_{fb} + \delta X_f + \Gamma + \varepsilon_{fbjt}, \end{aligned} \tag{25}$$

where Γ collects the relevant bank–time, borrower-group, and contractual fixed effects. If the bank's advantage came from the relationship itself, as in informational theories, weaker pass-through would load on $ICO_{fbjt} \times Rel_{fb}$. In our model, it arises from the legacy debt of a vulnerable firm, so it should load on the triple interaction: $\beta_7 > 0$. Table 5 supports this prediction. The triple interaction is positive and significant at the 10% level in both specifications: the guarantee lowers interest rates by about 8.5 bp less when a vulnerable firm borrows from its legacy bank. The interaction with the relationship alone is not significant. The interaction with vulnerability alone is also positive, consistent with vulnerable firms having weak outside options whichever bank they borrow from.

Columns (3) and (4) of Table 4 replace the relationship indicator with our continuous measure of the legacy bank's bargaining strength. A stronger bargaining position is associated with a smaller discount on guaranteed loans to vulnerable borrowers when we exploit variation across banks (column (4)), but not within banks (column (3)). Bank–time fixed effects absorb much of this variation, since banks differ systematically in their lending strategies and in how much of firms' debt they hold.

5.4 Real Effects

If the pass-through of credit guarantees is limited for captive borrowers, then guarantees should have a weaker effect on the real outcomes of these borrowers. We examine this implication at the firm level using the sample of firms that obtained new credit with public guarantees between March 2020 and February 2021, distinguishing guaranteed credit obtained from banks to which the firm is captive from that obtained from other banks. For outcome Y_f, we estimate

$$\Delta Y_f = \beta_C \frac{ICO_f^C}{Total_f} + \beta_N \frac{ICO_f^N}{Total_f} + \delta X_f + \gamma_{ils} + \gamma_q + \varepsilon_f, \tag{26}$$

where ICO_f^C and ICO_f^N denote guaranteed credit from captor and other banks, respectively. X_f contains the controls of equation (22) and the PD in 2019, and γ_q denotes fixed effects for deciles of total new credit relative to pre-pandemic assets, so that we compare firms that receive similar amounts of new financing from different types of banks.

Table 6 shows that guaranteed credit from captor banks raises leverage without raising investment. Its share is not associated with growth in non-current, tangible, or intangible assets (columns (1)–(3)),[28] but it is associated with a significant increase in total liabilities relative to non-current assets (column (4)). Guaranteed credit from other banks, by contrast, is associated with growth in tangible and hence non-current assets, without a significant increase in leverage. Guaranteed credit from captor banks is also followed by more repayment difficulties: a larger share is associated with a higher probability that the firm's guaranteed credit becomes non-performing, both in the first year of the program and through February 2022 (Table 7). These estimates are descriptive rather than a causal evaluation, but their pattern is consistent with our pass-through results.

5.5 Bank Revenues

Finally, we quantify the benefits banks obtain from guaranteed lending to captive borrowers. For each ICO loan to a captive borrower, we compute an upper bound on the bank's adjusted expected revenue relative to a comparable non-ICO loan to a non-captive borrower: one made by the same bank in the same month, to a firm in the same industry and zip code with similar risk and size, and of the same loan type. This relative revenue has three components: the interest-rate spread, weighted by the probability that the loan is repaid; the expected payment from the guarantee in case of default, on the covered share of the loan (80% for SMEs and 70% for other firms); and, with a negative sign, the guarantee fee. The annual revenue computed in this way is sizable, approximately 2% of the total credit granted to captive borrowers per year and, consistent with

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

the model, about 85% of it comes from the guarantee's coverage in case of default.

5.6 Taking Stock

Taken together, the evidence supports our bank-capture mechanism. Guarantees are allocated to risky borrowers and, conditional on risk, to borrowers that are captive to the allocating bank; this tendency strengthens with the bank's bargaining position. Yet these are precisely the borrowers for whom pass-through is weakest. This weaker pass-through loads on the combination of firm vulnerability and a pre-existing relationship, not on the relationship alone, as our mechanism predicts. In the model, guarantees do not simply transfer resources to banks: by insuring legacy claims, they crowd out the repayment relief that banks would otherwise provide and can leave captive borrowers worse off. Consistent with this mechanism, guaranteed credit from captor banks is associated with higher leverage and subsequent repayment difficulties rather than greater investment. The evidence underscores the central message of the paper: delegating guarantees to banks shapes both who receives public support and how much of its value ultimately reaches firms.

6 Conclusions

Governments frequently support private credit through guarantees that compensate lenders when borrowers default, while delegating their allocation to banks. This paper shows that such delegation matters. Banks determine not only which firms receive guarantees, but also how much of their value ultimately reaches borrowers. When guarantees are scarce, banks retain part of their value and have particularly strong incentives to allocate them to captive borrowers, for whom guarantees can substitute for concessions that banks would otherwise provide.

Evidence from Spain's COVID-19 guarantee program is consistent with this mechanism. Guarantees were disproportionately allocated to captive firms, but pass-through was substantially weaker for these borrowers. Through the lens of the model, guarantees crowd out the concessions banks would otherwise grant their captive borrowers. Our policy analysis shows that program design features – such as fees, size, coverage, and rate caps – can mitigate individual distortions, but none

addresses all of them at once.

The broader lesson is that the effectiveness of a credit-guarantee program cannot be assessed solely by how much guaranteed credit it generates or by which firms receive it. What ultimately matters is incidence: how the public support embedded in a guarantee is divided between lenders and borrowers, and how that division affects firms' incentives and real outcomes. Guarantee programs are therefore not simply a way of using public balance sheets to expand private credit. Their design determines who ultimately benefits from that support.

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A Figures and Tables

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, except Risky (PD20 > 1%), a dummy variable equal to one when the 1-year probability of default (PD) estimated from financial statements as of December 2020 exceeds 1%, and zero otherwise. Vulnerable (PD19 > 1% or Liq Needs20) is an indicator equal to one if the firm's PD in 2019 exceeds 1% or its available current assets are insufficient to cover its estimated 2020 liquidity needs, 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 its PD in 2019 exceeds 1% or its available current assets are insufficient to cover its estimated 2020 liquidity needs (i.e., PD19 > 1% or Liq Needs20 equals 1) and had a previous credit relationship with that bank. Bargaining strength is the ratio of credit owed by a given firm to a given bank over 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 (PD20 > 1%)	%	211857	54.1	0	49.8	0	100
Vulnerable (PD19 > 1% or Liq Needs20)	%	211857	59.6	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	10th %ile	90th %ile
ICO/Total	%	386847	67.7	100	44.1	0	100
Captive firm	%	351365	52.9	0	49.9	0	100
Bargaining strength	%	386847	17.6	7.9	25.5	0	49.6

Table 2: **Firms' access to ICO loans.** This table reports the results obtained from the estimation of equation (22) 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 alternative dimensions of firm risk. Column (1) uses our baseline measure of default risk: an indicator equal to one if the firm's probability of default (PD) in 2020 exceeds 1%. In column (2), risk is measured by an indicator equal to one if the firm's PD in 2019 exceeds 1%. Column (3) uses an indicator equal to one if the firm's PD exceeds 1% in either 2019 or 2020. Column (4) repeats column (1) without firm-level controls. Columns (1)–(3) include firm-level controls for profitability, size, leverage, and liquidity, and all specifications include industry-location-size fixed effects. 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). Standard errors (in brackets) are clustered by firm. *, **, and *** denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

	(1) Baseline	(2)	(3)	(4) No controls
PD20 > 1%	0.032***			0.032***
	[0.004]			[0.003]
PD19 > 1%		0.049***		
		[0.004]		
PD19 > 1% or PD20 > 1%			0.043***	
			[0.004]	
Observations	95,370	108,978	95,370	95,370
R-squared	0.384	0.376	0.384	0.383
Firm Controls	YES	YES	YES	NO
Industry-Location-Size FE	YES	YES	YES	YES

Table 3: **Credit supply to captive borrowers.** This table reports estimates of equation (23). The dependent variable is the ratio of the amount of new ICO-guaranteed loans with a maturity at origination above six months obtained by firm f from bank b between March 2020 and February 2021 to the total amount of new credit (ICO and non-ICO loans) with comparable maturity obtained by the firm from the same bank over the same period. The explanatory variable of interest Captive firm denotes whether a given firm f can be considered as captive by bank b. In columns (1) and (2) a firm is considered a captive borrower for a given bank if its PD in 2019 exceeds 1% or its available current assets are insufficient to cover its estimated 2020 liquidity needs and had a previous credit relationship with that bank. Column (2) considers separately the two components of this definition, vulnerability and the existence of a previous bank relationship, together with their interaction. Columns (3) and (4) examine an alternative notion of captivity based on bargaining strength. Captive is defined as the interaction between firm vulnerability and bargaining strength, where bargaining strength is measured as the ratio of the credit granted by bank b to the firm's total liabilities. All specifications include controls for pre-pandemic firm profitability, size, leverage, and liquidity and industry–location–size–risk fixed effects. 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). The risk component of the fixed effects is defined using Credit Quality Step (CQS) categories based on firms' one-year probability of default estimated using balance-sheet information as of the end of 2020. Columns (1)–(3) include bank fixed effects, which are removed in column (4). Standard errors, reported in brackets, are clustered at the firm and bank levels. *, **, and *** denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

	(1)	(2)	(3)	(4)
Captive (Vulnerable x Relationship) (b,f)	0.041**	0.042***		
	[0.019]	[0.008]		
Vulnerable (f)		-0.015*	0.003	0.002
		[0.008]	[0.009]	[0.009]
Relationship (b,f)		0.001		
		[0.016]		
Barg. strength (b,f)			0.024	0.174***
			[0.020]	[0.046]
Captive (Vulnerable x Barg. strength) (b,f)			0.047***	0.091***
			[0.014]	[0.021]
Observations	246,600	246,600	246,600	246,612
R-squared	0.545	0.545	0.545	0.397
Firm Controls	YES	YES	YES	YES
Bank FE	YES	YES	YES	NO
Industry-Location-Size-Risk FE	YES	YES	YES	YES

Table 4: **Pass-through of credit guarantees: Captive vs. non-captive borrowers.** This table reports estimates of equation (24), where the dependent variable is the interest rate (in %) on a loan granted by bank b to firm f. Column (1) estimates the average effect of an ICO guarantee on loan rates. Column (2) corresponds to the baseline specification and introduces $Captive_{fb}$, both directly and interacted with ICO_{fbjt}, to examine whether captive borrowers face different loan rates and receive a different pricing benefit from the guarantee. A firm is considered a captive borrower for a given bank if its PD in 2019 exceeds 1% or its available current assets are insufficient to cover its estimated 2020 liquidity needs and had a previous credit relationship with that bank. Columns (3) and (4) examine an alternative notion of captivity based on bargaining strength. Captive is defined as the interaction between firm vulnerability and bargaining strength, where bargaining strength is measured as the ratio of the credit granted by bank b to the firm's total liabilities. All specifications include controls for pre-pandemic firm profitability, size, leverage, and liquidity, industry–location–size–risk fixed effects, and loan contract fixed effects. 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). The risk component of the fixed effects is defined using Credit Quality Step (CQS) categories based on firms' one-year probability of default estimated using balance-sheet information as of the end of 2020. The contract fixed effects interact maturity buckets, interest-rate structure (fixed or floating), and origination month. Columns (1) - (3) additionally include bank–time fixed effects but they are removed in column (4). 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)
ICO loan	-0.333**	-0.447***	-0.331**	-0.826***
	[0.135]	[0.142]	[0.127]	[0.188]
Captive		-0.002		
		[0.048]		
Captive x ICO Loan		0.192***		
		[0.057]		
Captive (Bargaining strength)			0.024	-0.440
			[0.162]	[0.271]
Captive (Bargaining strength) x ICO Loan			-0.016	0.470*
			[0.180]	[0.247]
Observations	374,419	374,419	374,419	374,671
R-squared	0.752	0.753	0.752	0.634
Firm Controls	YES	YES	YES	YES
Bank-Time FE	YES	YES	YES	NO
Industry-Location-Size-Risk FE	YES	YES	YES	YES
Loan Controls	YES	YES	YES	YES

Table 5: **Pass-through of credit guarantees: decomposing the captive effect.** This table examines the components of the captive effect on the pass-through of ICO guarantees. The dependent variable is the interest rate (in %) on a loan granted by bank b to firm f. Rather than combining firm vulnerability and a previous bank relationship into a single measure of captivity as in equation (24), the specifications include Vulnerable and Relationship separately, together with their interactions with each other and with ICO. Vulnerable is a dummy variable that equals one if the firm's PD in 2019 exceeds 1% or its available current assets are insufficient to cover its estimated 2020 liquidity needs. Relationship is a dummy variable that equals one if the firm had a previous credit relationship with bank b, and ICO is a dummy variable that equals one for ICO-guaranteed loans. All specifications include controls for pre-pandemic firm profitability, size, leverage, and liquidity, bank–time fixed effects, and loan contract fixed effects. The contract fixed effects interact maturity buckets, interest-rate structure (fixed or floating), and origination month. Column (1) includes industry–location–size fixed effects, while column (2) includes industry–location–size–risk fixed effects. Industry corresponds to the 4-digit NACE code, location is defined at the zip-code level, and size corresponds to four categories of firms according to the EC definition of size (micro, small, medium-sized, and large firms). The risk component of the fixed effects is defined using Credit Quality Step (CQS) categories based on firms' one-year probability of default estimated using balance-sheet information as of the end of 2020. Standard errors, reported in brackets, are clustered at the firm and bank levels. *, **, and *** denote significance at the 10%, 5%, and 1% level (two-tail), respectively.

	(1)	(2)
ICO loan = 1	-0.524***	-0.514***
	[0.154]	[0.139]
Vulnerable	0.124***	-0.012
	[0.037]	[0.036]
ICO loan x Vulnerable	0.084	0.092**
	[0.053]	[0.047]
Relationship	0.038	0.004
	[0.085]	[0.083]
ICO loan x Relationship	0.111	0.081
	[0.089]	[0.088]
Vulnerable x Relationship	-0.003	0.008
	[0.044]	[0.051]
ICO loan x Vulnerable x Relationship	0.084*	0.086*
	[0.051]	[0.052]
Observations	396,898	374,419
R-squared	0.724	0.753
Firm Controls	YES	YES
Bank-Time FE	YES	YES
Industry-Location-Size FE	YES	NO
Industry-Location-Size-Risk FE	NO	YES
Loan Controls	YES	YES

Table 6: **Impact of ICO credit on real outcomes based on firms' bank captivity.** This table presents the results from estimating Equation (26), where the dependent variable is the change in various balance-sheet items or ratios between 2019 and 2020. The sample is restricted to firms that obtained new credit with public guarantees between March 2020 and February 2021. Specifically, columns (1) to (3) examine changes in non-current assets (NC Assets), tangible assets, and intangible assets, respectively, while column (4) analyzes the change in the leverage ratio (defined as total liabilities to non-current 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 explanatory variables used in Table 2 (profitability, size, leverage, and liquidity), the probability of default in 2019, and 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. 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)
	Δ NC Assets	Δ Tangibles	Δ Intangibles	Δ Liabilities/NC A.
ICO from Captor / TC	0.005	0.017	0.023	0.556***
	[0.011]	[0.011]	[0.039]	[0.110]
ICO from Non-Captor / TC	0.099***	0.120***	0.049	0.157
	[0.015]	[0.017]	[0.044]	[0.156]
Observations	43,437	41,351	6,032	43,437
R-squared	0.392	0.385	0.438	0.381
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 Equation (26), 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., up to February 2022). 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. The sample is restricted to firms that obtained new credit with public guarantees between March 2020 and February 2021. All columns include the explanatory variables used in Table 2 (profitability, size, leverage, and liquidity), the probability of default in 2019, and 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. Standard errors (in brackets) are clustered by firm. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tailed), respectively.

	(1)	(2)
	1Y-NPL	2Y-NPL
ICO from Captor / TC	0.003*	0.025***
	[0.002]	[0.004]
ICO from Non-Captor / TC	-0.005***	-0.003
	[0.002]	[0.004]
Observations	43,437	43,437
R-squared	0.349	0.359
Firm Controls	YES	YES
Industry-Location-Size FE	YES	YES
LoanSize/TA FE	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

$$A - \frac{b+k}{p_A} = C'(p_A). \tag{27}$$

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 immediate that no bank (legacy or not) has an incentive to set the interest rate below, nor above, its marginal costs of funds.

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

Finally, for the cases where $\lambda < b$, consider those entrepreneurs with $\overline{p}_A \cdot \overline{B}_A \in [\lambda + k, b + k]$. On the one hand, these entrepreneurs cannot generate enough cash flows to compensate banks for their cost of granting a loan of size $b + k$, that is, they cannot repay an interest rate of one in expectation. As a result, these entrepreneurs cannot obtain funding from competitive banks. On the other hand, the legacy 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 Bargaining. 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:

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

$$s.t. \quad p_A(B) \cdot (A - B) - C(p_A(B)) \geq 0$$
$$p_A(B) \cdot B - \lambda - k \geq 0$$

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 constrained problem for $\gamma \in (0, 1)$. That is,

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

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

$$\frac{1-\gamma}{\gamma} = \frac{p_A(B) \cdot (A - B) - C(p_A(B))}{p_A(B) \cdot B - \lambda - k} \cdot \frac{p_A(B) + B \cdot p'_A(B)}{p_A(B)} \tag{28}$$

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 (28) 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 decreasing 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 $p''_A = -C'''(p_A)/C''(p_A)^3 \leq 0$, 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 $w_A(\gamma)$ increasing in γ, $w_A(0) = 0$, and $w_A(1) = 1$, and dependent on A. As A increases, the maximum debt capacity increases and the minimum debt capacity decreases, so the effect of A on B_A depends on γ and is in general ambiguous. □

Proof of Lemma 1. Suppose that a solvent entrepreneur, i.e., one with $\overline{p}_A \cdot \overline{B}_A \geq b + k$, triggers a negotiation with her legacy bank. As renegotiation takes place after competitive banks post contracts, the entrepreneur triggering the renegotiation must hold an offer $B^*_{A,b}$ in hand from at least one competitive bank (other than her legacy bank), and this will impact outside options of the negotiations. In particular, upon disagreement, she is better off borrowing $b + k$ from this outside bank and repaying her legacy debt with certainty than liquidating —making her liquidation threat not credible. As a result, her outside option is her market surplus, $p_A(B^*_{A,b}) \cdot (A - B^*_{A,b}) - C(p_A(B^*_{A,b}))$ — not the liquidation payoff $\max\{\lambda - b, 0\}$, which she can always avoid. Consistent with this, the bank's outside option if no agreement is reached is full repayment plus its retained funds, $b + k$. For the bank to weakly prefer a negotiated contract B, it must be that $p_A(B) \cdot B \geq b + k$, i.e., $B \geq B^*_{A,b}$; since the entrepreneur's surplus is strictly decreasing in B, any such contract gives her weakly less than her outside option. The disagreement point thus lies on the Pareto frontier of the negotiation, and the asymmetric Nash solution coincides with it for any $\gamma \in [0, 1]$: the entrepreneur gains nothing from renegotiation. By supposing that market offers are posted before renegotiation, outside options are deterministic at the negotiation stage, simplifying the analysis. Alternative timings would introduce uncertainty about the terms available upon disagreement, without changing the economics. □

Proof of Lemma 2. Consider a captive entrepreneur, i.e., with $\overline{p}_A \cdot \overline{B}_A \in [\lambda + k, b + k)$. Absent a renegotiation of her legacy debt, lending to her requires financing $b + k$, as the legacy claim must be repaid in full. Since effort is the only non-contractible variable and types are observable, the highest expected repayment attainable under any contract is $\overline{p}_A \cdot \overline{B}_A < b + k$: any takeover loan

makes losses. Alternatively, an outside bank could purchase the legacy claim. The legacy bank's continuation value is its payoff in the negotiation of Proposition 1, which exceeds its liquidation payoff λ. It only sells at a price weakly above this value; since the claim commands the same continuation value in the buyer's hands – the buyer inherits an identical bargaining position – the purchase yields no surplus. Takeover is thus never strictly profitable. □

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, investment thresholds are given by access to credit thresholds in 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

$$A_h^*(b) \equiv \{A : \bar{p}_A \cdot \bar{B}_A = b + k\} \tag{29}$$

$$A_\ell^*(b) = A_\ell^* \equiv \{A : \bar{p}_A \cdot \bar{B}_A = \lambda + k\} \tag{30}$$

Consider now those entrepreneurs 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/continuation. These entrepreneurs will continue their projects if and only if they can borrow $b+k$ from a competitive bank, $\bar{p}_A \cdot \bar{B}_A \geq b+k$, and the surplus from doing so exceeds that of liquidation:

$$p_A(B_A) \cdot (A - B_A) - C(p_A(B_A)) \geq \lambda - b \tag{31}$$

$$p_A(B_A) \cdot A - C(p_A(B_A)) \geq \lambda + k \tag{32}$$

where we input $p_A(B_A) \cdot B_A = k + b$. The resulting threshold is the larger of the two at which these conditions hold with equality: $A_h^*(b)$ in (29), and the one at which Equation (32) holds with equality. It is immediate that all thresholds weakly increase in b. □

Proof of Lemma 3. 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 equivalently,

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:

$$\max_{p} \quad p \cdot (A - B(p)) - C(p) \geq \lambda - b \tag{33}$$

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

$$\max_{p} \quad p \cdot A - C(p) - b - k \geq \lambda - b \qquad s.t. \quad \underbrace{p_A^{fb} \cdot A - C(p_A^{fb}) - k}_{=y_A^{fb}} \geq \lambda$$

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 exert first-best effort levels. If instead $y_A^{fb} \in [\lambda, b]$, these entrepreneurs are captive to their legacy bank, and negotiate loan ℓ with repayment $B(p) = \frac{\ell}{p}$ so that

$$\max_{p} \quad p \cdot A - C(p) - \ell \geq 0 \quad s.t. \qquad p_A^{fb} \cdot A - C(p_A^{fb}) - k \geq \ell - k$$

As the legacy bank is willing to offer loan $\ell \in [\lambda + k, b + k)$, it is immediate 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 legacy 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 legacy bank. □

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 are adjusted to Definition 2 when a guarantee is granted to entrepreneur A. Second, the bank must

now decide how to allocate credit guarantees x.

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

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

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

$$\max_{B_A, x_A} \quad p_A(B_A) \cdot (A - B_A) - C(p_A(B_A)) \tag{34}$$

$$s.t. \quad p_A(B_A) \cdot B_A + (1 - p_A(B_A) - \rho) \cdot x_A \geq k + b \qquad \forall A, (\kappa_A) \tag{35}$$

$$0 \leq x_A \leq k \qquad \forall A, (\upsilon_A, \mu_A) \tag{36}$$

The marginal benefit of increasing B_A is

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

where we have used the Envelope Condition, as the derivative of the objective wrt p_A is zero. It follows that $\kappa_A > 0$, 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 $\kappa_A (1 - p_A - \rho) - \mu_A + \upsilon_A = 0$. 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 ($\kappa_A > 0$).

Consider now captive entrepreneurs, which are those for which

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

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

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

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

$$B_A \quad : \quad \frac{p_A\left(B\right) \cdot (A - B) - C\left(p_A\left(B\right)\right)}{p_A\left(B\right) \cdot B + (1 - p_A\left(B\right) - \rho) \cdot x_A - \lambda - k} \cdot \frac{p_A\left(B\right) + (B - x_A) \cdot p_A'\left(B\right)}{p_A\left(B\right)} = \frac{1 - \gamma}{\gamma} \tag{37}$$

$$x_A \quad : \quad \left(1 - p_A - \rho\right)\left(1 + \psi_A\right) - \mu_A + \upsilon_A = 0. \tag{38}$$

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 $(1 - p_A\left(B\right) - \rho) \cdot x_A$ and (ii) 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 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 capacity 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:

$$\int \int x_{A,b}(\rho) \cdot dF(A) \cdot dG(b) = \bar{X}. \tag{39}$$

It follows that if guarantees are scarce, i.e. $\int \int_{A_\ell^g(b,0)}^{\bar{A}} k \cdot dF(A) \cdot dG(b) > \bar{X}$, 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 entrepreneurs 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 than ρ). This deviation generates losses of $f(A) \cdot \epsilon \cdot k$ for the deviating bank. Contradiction.

The existence of thresholds $A_h^g(b,\rho)$ and $A_\ell^g(b,\rho)$ 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 to the credit contracts, i.e.,

$$A_h^g(b,\rho) \equiv \{A : \max\{\bar{p}_A \cdot \bar{B}_A,\, \bar{p}_A^g \cdot \bar{B}_A^g + (1 - \bar{p}_A^g - \rho) \cdot k\} = b + k\} \tag{40}$$

$$A_\ell^g(b,\rho) \equiv \{A : \max\{\bar{p}_A \cdot \bar{B}_A,\, \bar{p}_A^g \cdot \bar{B}_A^g + (1 - \bar{p}_A^g - \rho) \cdot k\} = \lambda + k\} \tag{41}$$

For those entrepreneurs with $b \leq \lambda$, as they are never captive, they continue their projects only

when they can borrow $b + k$, i.e., $A \geq A_h^g(b, \rho)$ as defined in (40), and doing so is better than liquidating:

$$p_A(B_A^g) \cdot A - C(p_A(B_A^g)) \geq \lambda + k. \tag{42}$$

The investment threshold is the larger of the two at which these conditions hold with equality, where the dependence 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 showing that $MB_{A,b}(x) - MC_{A,b}(x)$ 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 $\frac{d^2p_A}{dx_A^2} < 0$.

$$\frac{d^2p_A}{dx_A^2} = -\frac{2 \cdot p_A + [C'''(p_A) \cdot p_A^2 + 2 \cdot p_A \cdot C''(p_A)] \cdot \frac{dp_A}{dx_A}}{p_A \cdot (1 - p_A)} \cdot \left(\frac{dp_A}{dx_A}\right)^2 < 0. \tag{43}$$

With $\mu > 0$, the planner's marginal net benefit is $MB_{A,b} - MC_{A,b} = (B_A + \mu \cdot x_A) \cdot \frac{dp_A}{dx_A} - \mu \cdot (1 - p_A)$, whose derivative in x_A is

$$-C''(p_A) \cdot \left(\frac{dp_A}{dx_A}\right)^2 + (B_A + \mu \cdot x_A) \cdot \frac{d^2p_A}{dx_A^2} + 2\mu \cdot \frac{dp_A}{dx_A}.$$

The first two terms are negative, and the third is positive. We assume that μ is small enough, relative to the response of effort to coverage, for the first two to dominate (footnote 17): $2\mu \cdot \frac{dp_A}{dx_A} \leq C''(p_A) \cdot \left(\frac{dp_A}{dx_A}\right)^2 - (B_A + \mu \cdot x_A) \cdot \frac{d^2p_A}{dx_A^2}$. Hence $MB_{A,b} - MC_{A,b}$ decreases in x, and the allocation rule (19) follows.

Finally, a project can be continued only if some contract satisfies the incentive constraint (12) and the bank's participation constraint (13). Coverage relaxes the participation constraint, so such a contract exists for some $x \in [0, k]$ if and only if it exists at full coverage, $x = k$. For $b > \lambda$, by Proposition 3 evaluated at $\rho = 0$, this is the case if and only if $A \geq A_\ell^g(b, 0)$. For these entrepreneurs, the planner continues the project if and only if its value at the optimal coverage, net of the fiscal

cost and of the shadow value of the guarantees it uses, is at least the value of liquidation, which is condition (20). Which of the two conditions binds depends on parameters.

The planner's problem under an expected-cost constraint. Suppose the feasibility constraint (14) is replaced by

$$\int\int (1 - p_A(B_{A,b})) \cdot x_{A,b} \cdot dF(A) \cdot dG(b) \leq \mathcal{C}^g,$$

with multiplier $\rho^c \geq 0$. The first-order condition for $x_{A,b}$ becomes

$$MB_{A,b}(x_{A,b}) = MC_{A,b} + \rho^c \cdot \left[(1 - p_A) - x_{A,b} \cdot \frac{dp_A}{dx_{A,b}}\right],$$

where the bracketed term is the marginal expected cost of coverage: it is below $1 - p_A$ because guarantees raise effort and thus lower the probability of a payout. Substituting (15) and (16), the condition reads $B_{A,b} \cdot \frac{dp_A}{dx_{A,b}} = (\mu + \rho^c) \cdot \left[(1 - p_A) - x_{A,b} \cdot \frac{dp_A}{dx_{A,b}}\right]$. Using Equation (17), the allocation is thus ranked by

$$\frac{\eta^{A,b}_{p,B}}{1 - \eta^{A,b}_{p,B} \cdot \left[1 - \frac{x_{A,b}}{B_{A,b}}\right]} \cdot \left[1 - \frac{x_{A,b}}{1 - p_A} \cdot \frac{dp_A}{dx_{A,b}}\right]^{-1},$$

in which the factor $1 - p_A$ cancels: relative to the volume-constrained problem, the expected-cost constraint removes the mechanical premium on risk, and the planner targets entrepreneurs by the elasticity of effort to repayment. The characterization of $B^p_{A,b}$ (full pass-through) is unaffected, as banks' participation constraints still bind. The ranking requires the marginal expected cost of coverage to be positive, $x_{A,b} \cdot \frac{dp_A}{dx_{A,b}} < 1 - p_A$; with quadratic effort costs this reduces to $p_A > B^p_{A,b}$, which holds at the planner's contract for any granted coverage. □