Banks vs. Firms: Who Benefits from Credit Guarantees?

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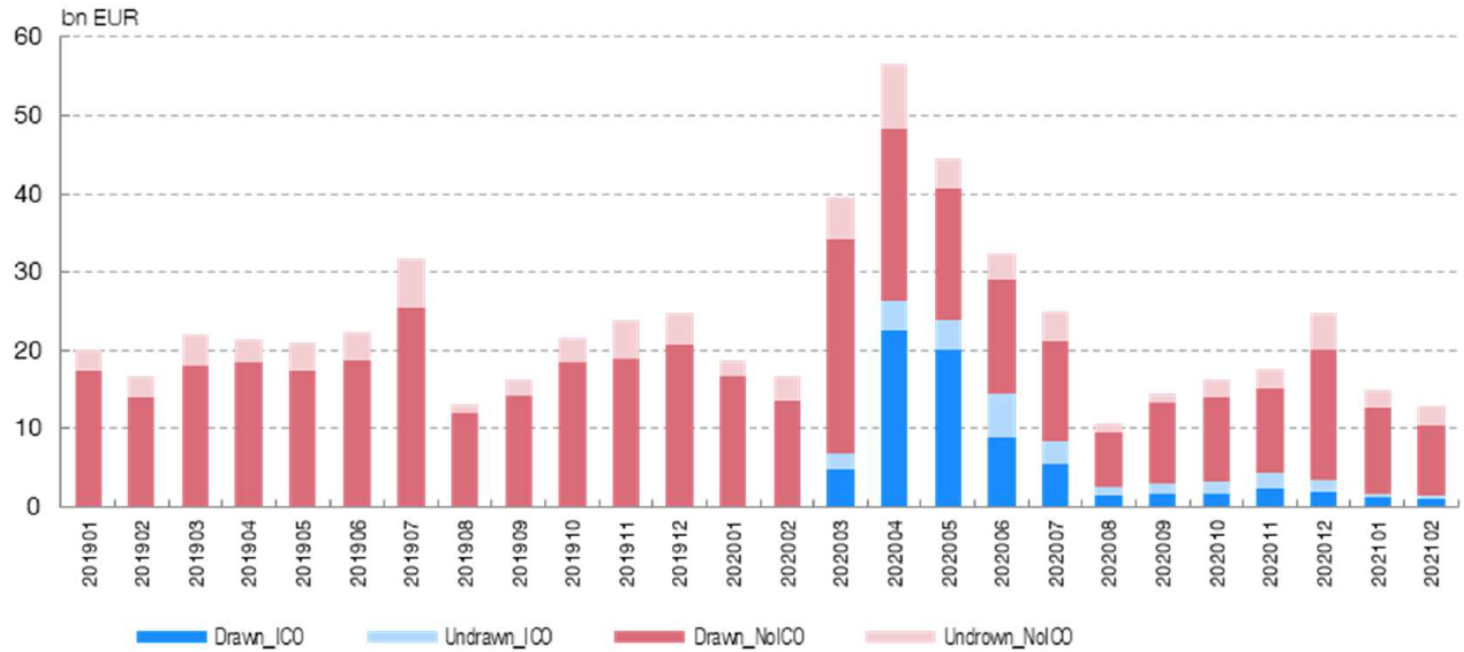
Introduction

- Public credit guarantee schemes are widely used to support private credit.
- On March 2020, Spain implemented the ICO COVID19 loan guarantee program:
  - Coverage up to 60-80% of financing losses for creditors.
  - Maturity: up to 5 years with grace up to 12 months (later extended).
  - Eligibility: new loans, excluding firms in arrears, delinquency, or bankruptcy.
  - Allocated through banks.
- Motivation? Help firms cover liquidity needs during the pandemic.
  - Prevent inefficient firm closures/liquidations.

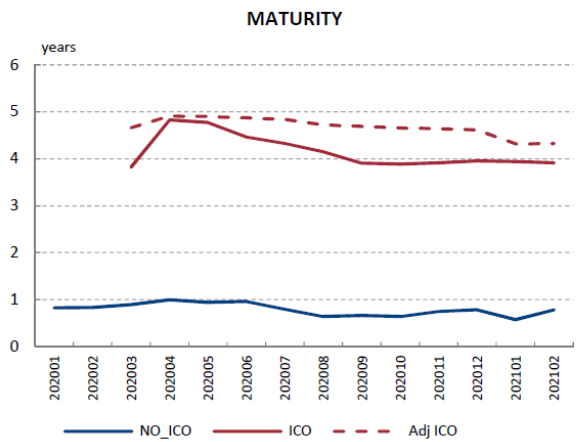
ICO program was significant...

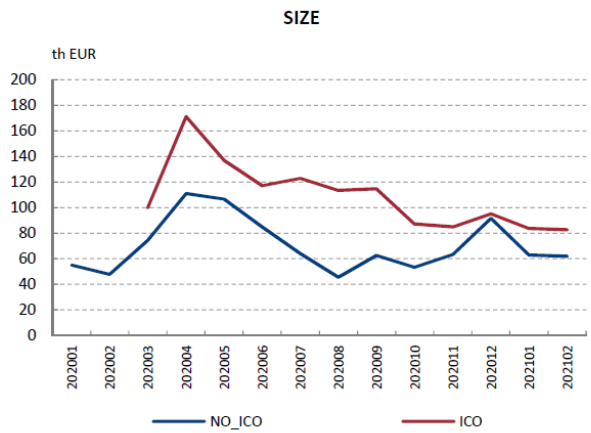
- New credit granted in March-July 2020 doubled that of March-July 2019.
  - 40% of this new credit had guarantees.
  - By mid-2022, almost 18% of the total stock of credit had guarantees.

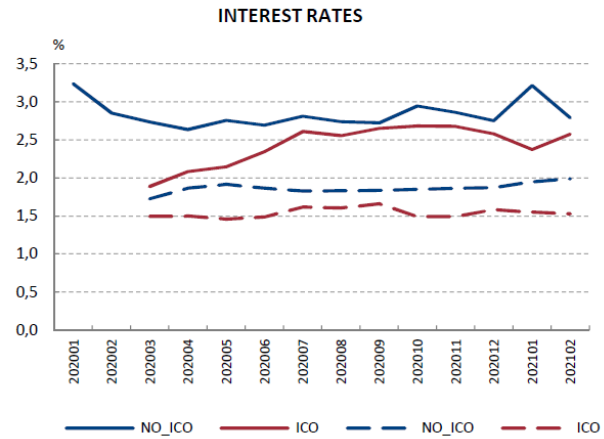


Size and maturity of ICO loans

- On average, ICO loans are longer, larger and have lower interest rates.







This paper

- Questions: when banks are in charge of allocating public credit guarantees ...
  - Which firms are most likely to obtain guaranteed loans?
  - How are the benefits of guarantees split between firms and banks?
  - How (in)efficient is the bank allocation of guarantees?
- What we do:
  - Propose a stylized model to think about these questions.
  - Test predictions with the ICO program using Spanish data.

The model in one slide

- Two periods, $t = \{0, 1\}$, and one consumption good.
- Mass one of risk-neutral entrepreneurs indexed by $\{A, b\}$.
  - At $t = 0$, legacy debt $b \sim G$ and an investment project.
    - Project requires k units of investment, otherwise liquidated at λ.
  - At $t = 1$, project yields $A \sim F$ with probability p (and zero otherwise).
    - p determined by non-contractible cost $C(p)$ with $C'(\cdot), C''(\cdot) > 0$.
- Continuum of competitive risk-neutral banks that provide $t = 0$ credit at $R_f = 1$.
  - If banks grant credit $b + k$, project A continues.
  - Otherwise, project A is liquidated and banks obtain $\max\{\lambda, b\}$.

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First-best allocation

- All productive projects are continued:

$$\max_{p} \quad p \cdot A - C(p) - k \geq \lambda \iff A \geq A_{\ell}^{fb}$$

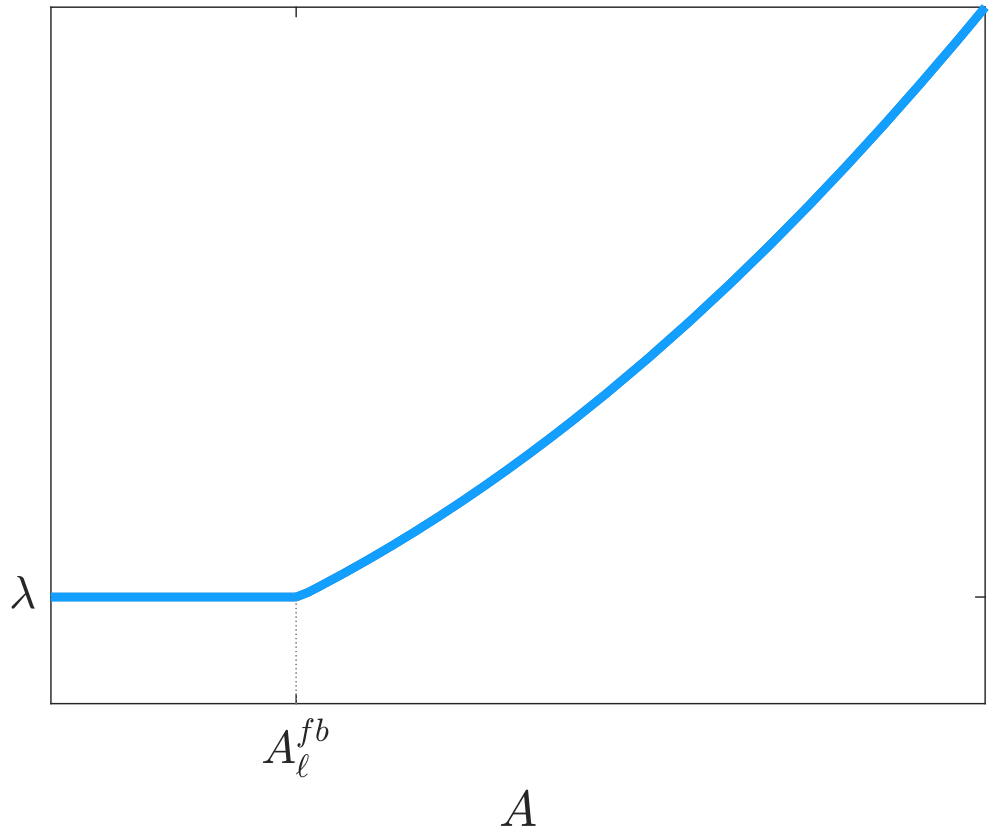
- Success probabilities p_A^{fb} implicitly given by:

$$A = C'(p_A^{fb}), \text{ for } A \geq A_{\ell}^{fb}$$

  and increasing in project productivity A.

- Legacy debts, b, are irrelevant.

First-best allocation: surplus



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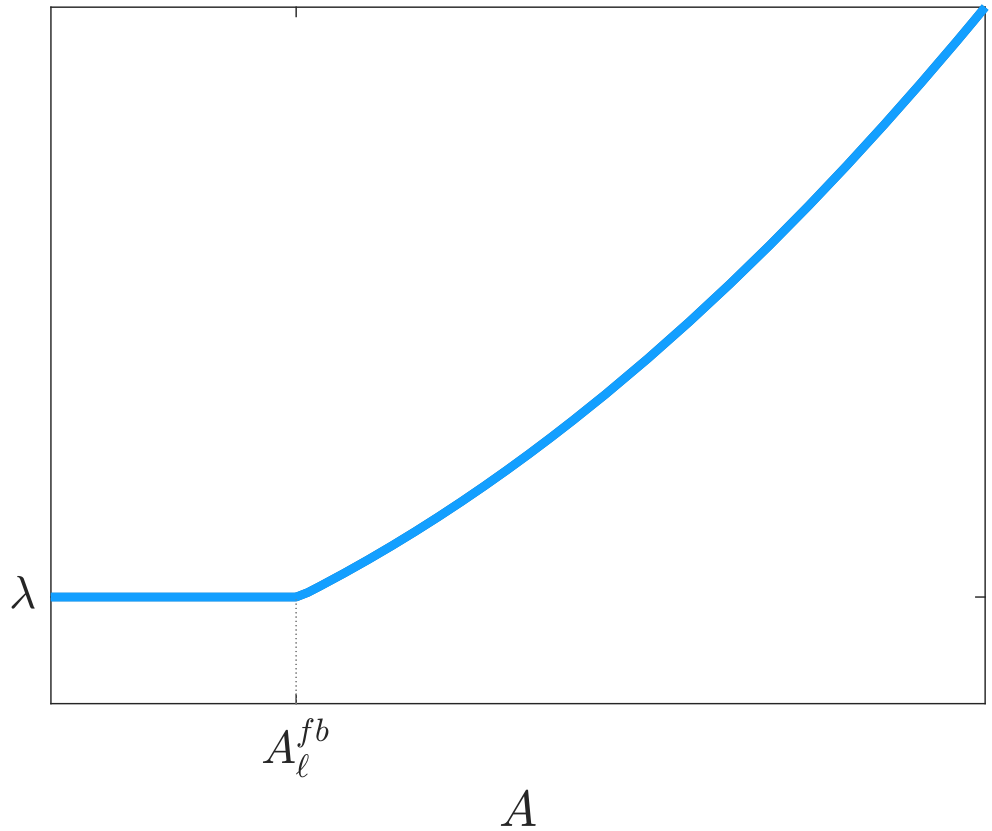
  - Legacy debt obligations, b.
  - Investment, k.

First-best allocation: surplus



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Credit market equilibrium

- A credit contract for an entrepreneur of type $\{A, b\}$ stipulates a repayment $B_{A,b}$ to be paid in the event of success for a loan of $b + k$.
- The bank's expected revenue from such contract equals

$$p_A(B_{A,b}) \cdot B_{A,b}$$

where $p_A(B_{A,b})$ is the incentive compatible effort given the offered contract, i.e.:

$$A - B_{A,b} = C'(p_A)$$

- We can think of contract $B_{A,b}$ as providing loan $b + k$ at interest rate

$$R_{A,b} = \frac{B_{A,b}}{b + k}.$$

- For simplicity, suppose entrepreneurs owe b to one bank.

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Credit market equilibrium

- Competition is modeled as follows:
  1. Competitive banks post contracts for each type of entrepreneur $\{A, b\}$.
  2. Entrepreneurs can renegotiate their debts with their creditor bank.
     - Nash bargaining, with bank bargaining power $\gamma \in [0, 1]$.
  3. Entrepreneurs choose a contract from competitive banks or creditor bank.
     - If an entrepreneur fails to obtain credit, she is liquidated.

Two useful concepts

- The maximum debt repayment of entrepreneur with productivity A, denoted by $\bar{B}_A$, is defined as

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

with $\bar{p}_A \equiv C'^{-1}\left(A - \bar{B}_A\right)$.

- The minimum debt repayment of entrepreneur with productivity A, denoted by $\underline{B}_A$, is defined as

$$\underline{B}_A : \quad \max_{B,p} \quad p \cdot (A - B) - c(p)$$
$$s.t. \quad p \cdot B \geq \lambda + k$$

with $\underline{p}_A \equiv C'^{-1}(A - \underline{B}_A)$.

Equilibrium contracts and allocations

There exist thresholds $A_\ell(b)$ and $A_h(b)$, both weakly increasing in b, such that an entrepreneur of type $\{A, b\}$ is:

1. Solvent: $\bar{p}_A \cdot \bar{B}_A \geq b + k \iff A \geq A_h(b)$, borrows $b + k$ from competitive banks, with

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

2. Captive: $\bar{p}_A \cdot \bar{B}_A \in [\lambda + k, b + k) \iff A \in [A_\ell(b), A_h(b))$, borrows $b + k$ from creditor bank, with

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

where w is increasing in γ, which reflects bank bargaining power.

3. Insolvent: $\bar{p}_A \cdot \bar{R}_A < \lambda + k$, projects are liquidated.

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Equilibrium Surplus

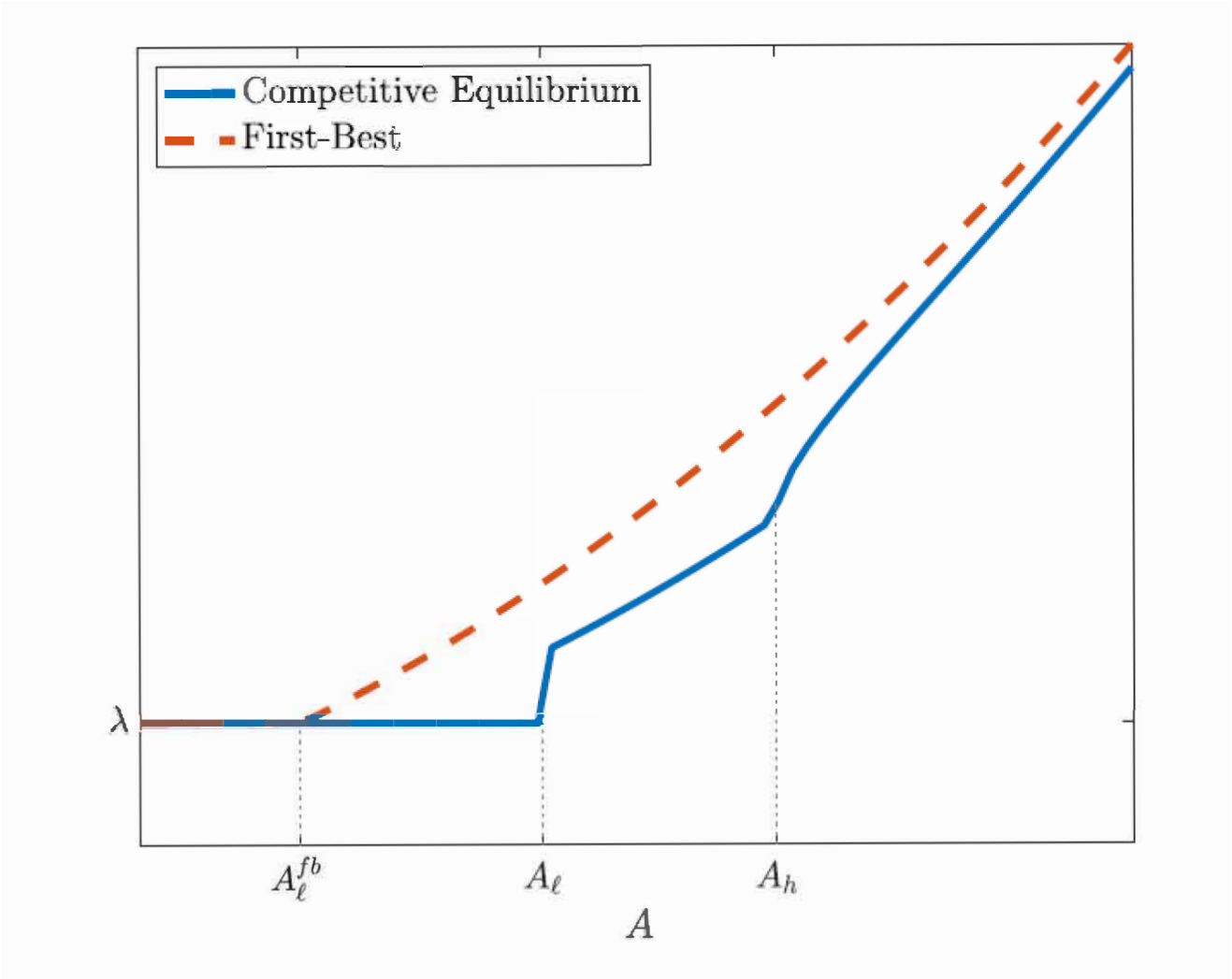

Figure: Social surplus of entrepreneur with productivity A. Competitive equilibrium vs. first-best ($\gamma = 1$)

Equilibrium allocations

- Competitive equilibrium is inefficient along two margins:
  - Too many liquidations ($A_\ell(\cdot) > A_\ell^{fb}$).
  - Conditional on continuation, too little effort ($p_A < p_A^{fb}$, $\forall A \geq A_\ell(\cdot)$).
- Along both margins, inefficiency is increasing in b.
- What do credit guarantees do in this setting?

Government guarantees

- Guarantees (x): cover loan capital in case of entrepreneurial failure.
- Simplifying assumption: cannot be applied to rolled-over debt, $x \in [0, k]$.
- Total $\bar{X}$ guarantees allocated through banks.
- How do banks allocate guarantees? They can ....
  - Include in renegotiation with captive entrepreneurs.
  - Offer to solvent entrepreneurs in the competitive credit market.

The role of credit guarantees

- A credit contract is a pair $\{B_{A,b}, x_{A,b}\}$, which generates expected revenue:

$$p_A(B_{A,b}) \cdot B_{A,b} + (1 - p_A(B_{A,b})) \cdot x_{A,b},$$

- It is useful to define the shadow price of guarantees, ρ.
  - Captures banks' opportunity cost of granting guarantees.
  - For now, take as given, but it is an equilibrium object (more below)
  - Entrepreneurs with $1 - p_A(B_{A,b}) \geq \rho$ receive full guarantee, $x_{A,b} = k$.

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Equilibrium contracts and allocations

Given shadow price of guarantees ρ, there exist thresholds $A^g_\ell(b,\rho)$ and $A^g_h(b,\rho)$, both weakly increasing in b and ρ, such that entrepreneurs with:

1. $A \geq A^g_h(b,\rho)$ are solvent and borrow $b+k$ from competitive banks, with

$$B^g_{A,b} = \frac{b + \min\{p_A(B^g_{A,b}) + \rho, 1\} \cdot k}{p_A(B^g_{A,b})}, \qquad x^g_{A,b} = k \cdot \mathcal{I}(1 - p_A(B^g_{A,b}) \geq \rho)$$

2. $A \in [A^g_\ell(b,\rho), A^g_h(b,\rho))$ are captive and borrow $b+k$ from creditor bank with

$$B^g_{A,b} = w^g(\gamma) \cdot \bar{B}^g_A + (1 - w^g(\gamma)) \cdot \underline{B}^g_A, \qquad x^g_{A,b} = k \cdot \mathcal{I}(1 - p_A(B^g_{A,b}) \geq \rho)$$

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

Equilibrium pass-through

- Banks do not pass on the full benefits of guarantees to entrepreneurs.
- Expected payments of solvent entrepreneurs fall by $1 - p - \rho$.
- If bank has some bargaining power ($\gamma > 0$), expected payments of captive entrepreneurs fall by *less* than $1 - p - \rho$.
  - Bank appropriates higher share of guarantees.
  - Pass-through may even be negative when $\gamma = 1$, as $\bar{B}_A^g > \bar{B}_A$!
- In equilibrium, banks follow a pecking order:
  - Grant guarantees to riskier borrowers and, among these, to captive ones.
  - Banks may keep alive projects with NPV < 0!
  - Allocation of guarantees is distorted relative to social planner (not today)

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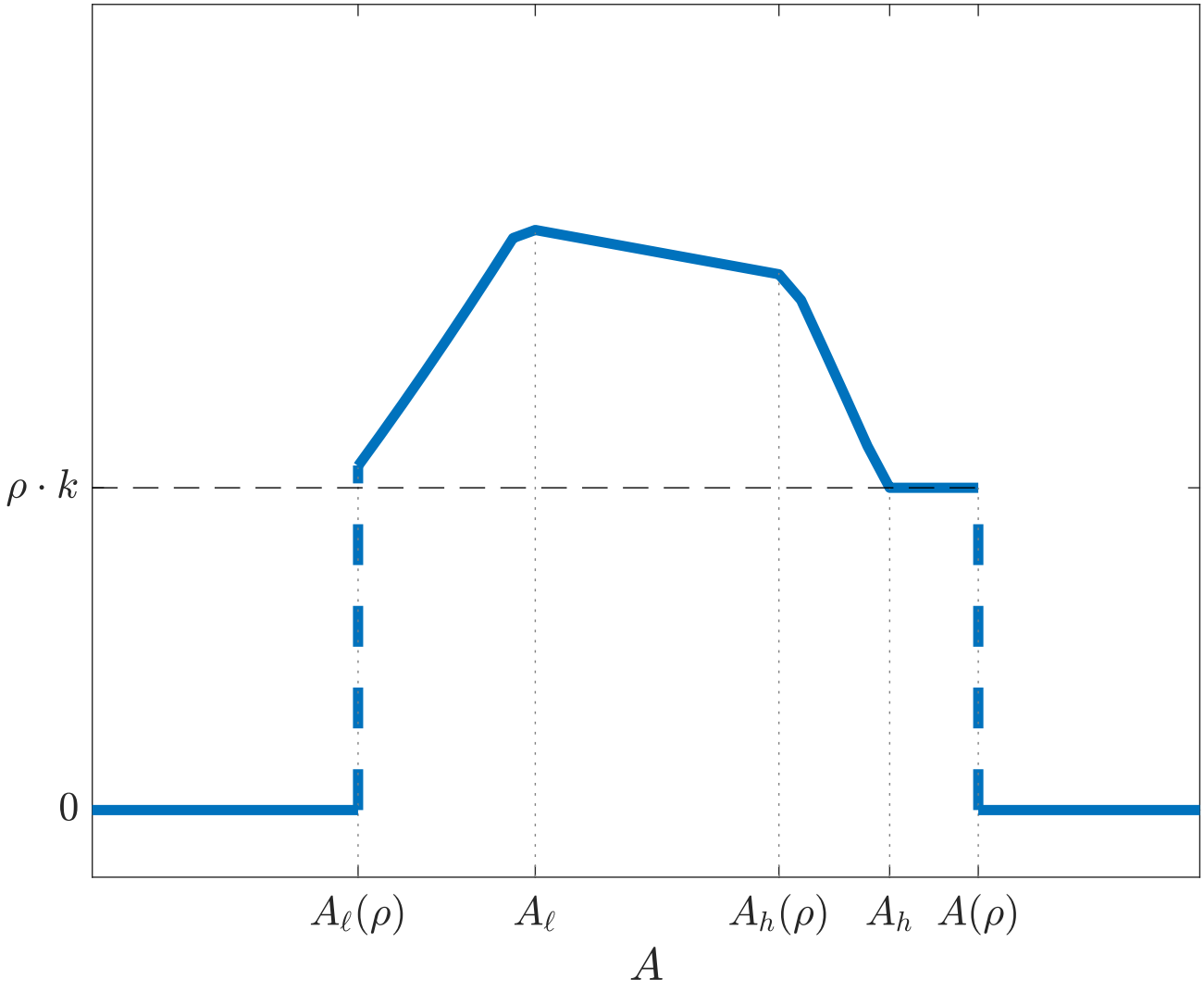
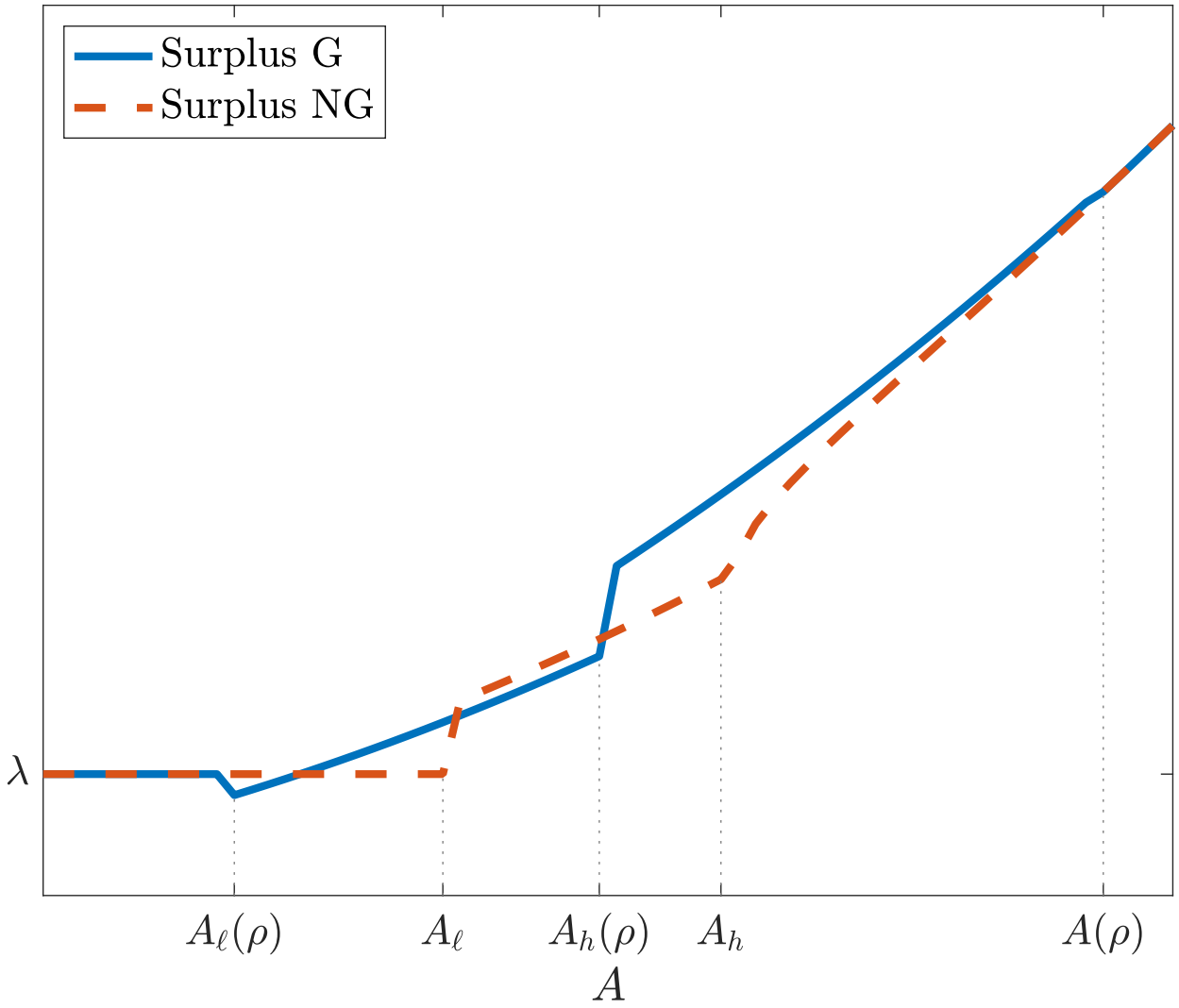
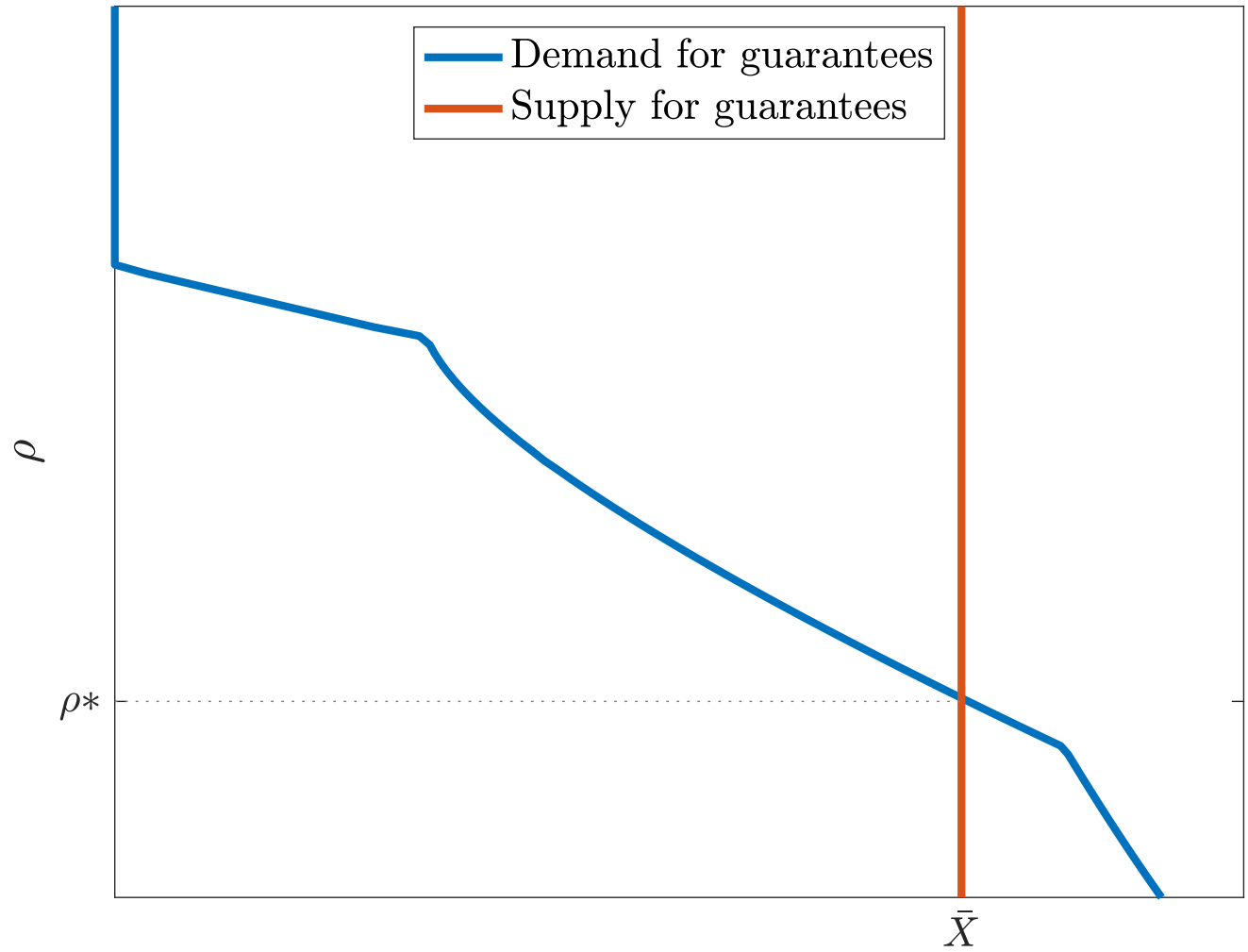


Figure: **Banks' extra revenues from granting guaranteed credit in equilibrium ($\gamma = 1$).**

Mixed effect of guarantees on surplus



How is ρ determined?



Social Planner's Problem

- Let $\pi^*_{A,b}$ denote bank surplus from lending to entrepreneur $\{A, b\}$ with $x = 0$.
- The planner's problem is as follows:

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

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

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

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

Sources of inefficiency

- The **social mg benefit** of granting guarantee $x^p_{A,b}$ to entrepreneurs A, b

$$MB_{A,b}(x^p_{A,b}) \equiv (A - C'(p_A(B^p_{A,b}))) \cdot \underbrace{\frac{1 - p_A(B^p_{A,b})}{C''(p_A(B^p_{A,b})) \cdot p_A(B^p_{A,b}) + x^p_{A,b} - B^p_{A,b}}}_{= \frac{dp_A}{dx^p_{A,b}}}.$$

- The planner's solution highlights the distortions in the CE,
  1. Banks prioritize the size of the transfer (high $1 - p_A$) and how much they can extract from it (captive entrepreneurs/market power).
  2. Planner prioritizes reductions in repayments and thus increased effort, $\frac{dp_A}{dx_{A,b}}$, of entrepreneurs with high social marginal surplus, $A - C'(A) > 0$.

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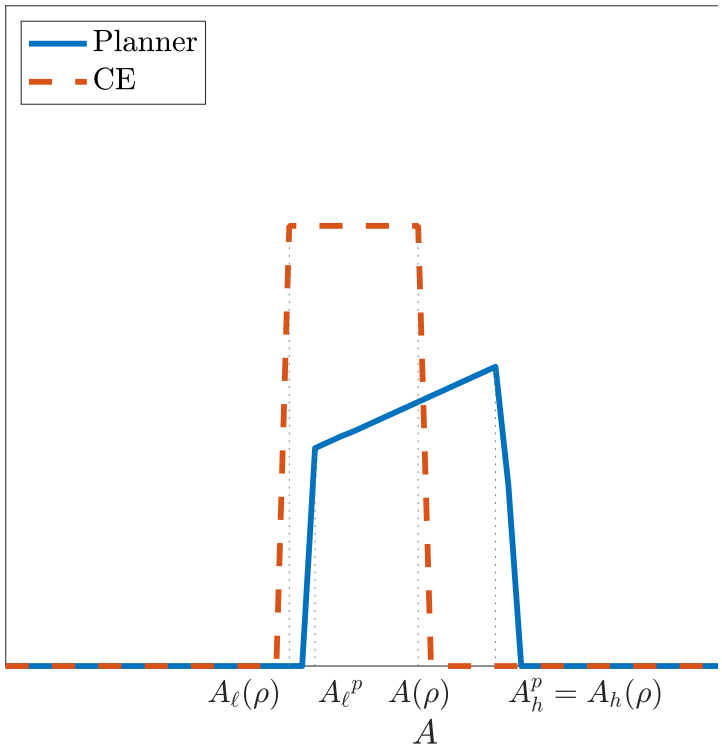
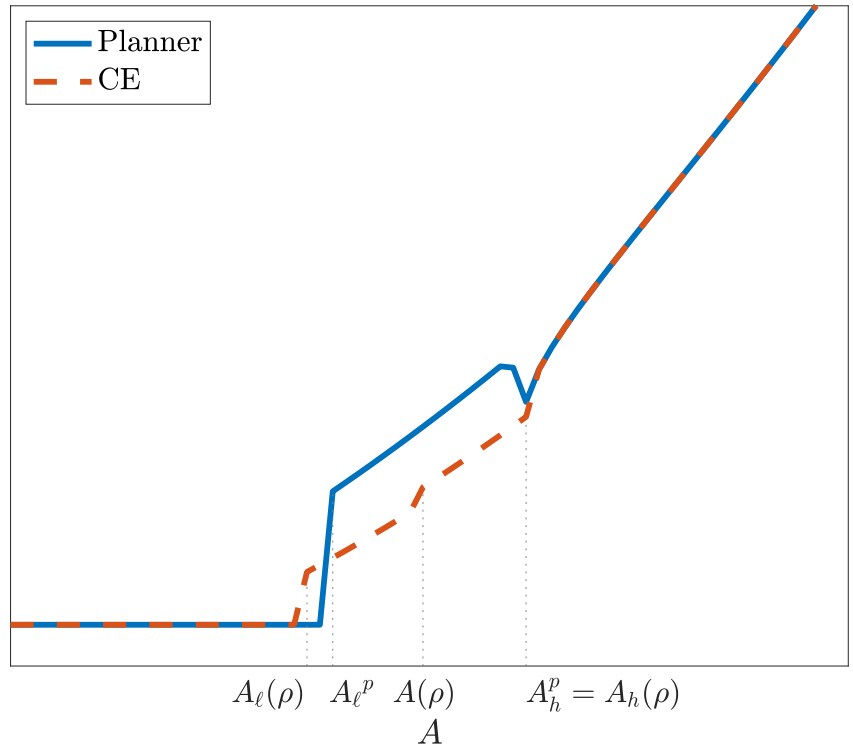
Allocation of guarantees: planner vs CE



(a) Allocation of guarantees



(b) Total surplus

Empirical Predictions

Are the implications of the model consistent with data?

- Riskier firms are more likely to receive ICO credit.
- Allocation of ICO credit to "captive" and non-captive firms.
  - Especially when banks have high bargaining power.
- Terms of access to ICO credit by captive firms.
  - Lower pass-through than for solvent firms.

Data

- Banco de España Central Credit Register
- Central Balance Sheet Data Office Survey
- Sample
  - Consists of 233,796 eligible NFC.
  - Obtained new credit over the period March 2020 – February 2021.
  - Around 1M of loans with information on various characteristics.
  - 384,581 bank – firm relationships

Fact 1: ICO credit went primarily to risky firms

- Dependent variable: new credit with guarantees as a share of total new credit

Dep var: ICO/Total credit	(1)	(2)	(3)	(4)
Risky (PD>1%)	0.048***			0.037***
	[0.003]			[0.003]
Affected sector		0.072***		0.072***
		[0.002]		[0.002]
High liquidity needs			0.020***	0.009***
			[0.002]	[0.002]
Observations	233,796	233,796	233,796	233,796
R-squared	0.104	0.106	0.102	0.109
Firm Controls	YES	YES	YES	YES
Location-Size FE	YES	YES	YES	YES

Table: **Firms' access to ICO loans.** The dependent variable is the ratio of the total amount of new ICO loans obtained by a given firm during the period March 2020 to February 2021 over the total amount of new loans (ICO and non-ICO loans) obtained during the same period and it is regressed on a series of variables that proxy for firms' risk.

Fact 2: allocation of ICO credit to captive firms

- A firm is captive of a given bank if:
  - It has a relationship with that bank immediately before the pandemic.
  - It is risky: $PD > 1\%$ on 12/19 (i.e., loans not accepted by Eurosystem as eligible collateral).
- 20% of firms in our sample are captive according to this definition.

Fact 2: allocation of ICO credit to captive firms

Dep var: ICO/Total credit	(1) All	(2) Profitable	(3) NonProfitable
Captive firm	0.035***	0.038***	0.024
	[0.005]	[0.012]	[0.015]
Observations	295,080	117,798	21,478
R-squared	0.525	0.548	0.571
ILSR FE	YES	YES	YES
Bank FE	YES	YES	YES

Fact 3: interest rate pass-through on ICO credit

- Lower pass-through on ICO loans for captive firms

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

What have we done?

- Develop model to study how banks allocate guarantees/split surplus with firms
  - Banks allocate guarantees to their riskier borrowers first.
  - Among these, allocate guarantees first to "captive" borrowers first.
  - Not all borrowers benefit equally from guarantees (captives benefit less!).
  - Banks' allocation of guarantees is constrained-inefficient.
- Spanish data is consistent with the model:
  - Captive firms in affected sectors receive higher share of ICO credit...
  - ... yet they benefit less from rate reduction of ICO loans.

Credit to captive borrowers

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

Role of risk and relationship lending

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