The COVID-19 Pandemic, Sovereign Loan Guarantees, and Financial Stability

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01 Introduction

01 Introduction

Motivation and approach

- Sovereign guarantees on firm loans are among the policy measures adopted to counteract the effects of the COVID-19 pandemic outbreak.

Question:

- What is the effect on financial stability of the sovereign loan guarantee scheme?

What we do:

- Extend a commonly used DSGE model to include sovereign loan guarantees.
- Calibrate the COVID-19 shock, the share of guaranteed loans and the loan guarantee fee.
- Analyze partial and general equilibrium effects of loan guarantees.
- Explore alternative designs of the sovereign loan guarantee scheme.

Results

- Sovereign guarantees on firm loans reduce banks' default rate, increase credit and speed up economic recovery.
  - The scheme reduces banks' yearly default rate by 0.3% and increases yearly credit and output by 6.3% and 0.3%, respectively.
  - The effect of the scheme on banks' default rate is larger the lower the elasticity of banks' capital to capital requirements.
- The expected fiscal costs of the policy are small and critically depend on the loan guarantee fee.
  - The direct fiscal cost is 0.7% of the 2019Q4 output.
- The size, duration, and timing of the scheme impact its effectiveness.
  - For example, the guarantee scheme would have had little benefits if its implementation had it been delayed by a year.

Outline

1. The sovereign loan guarantee scheme
2. Modeling of sovereign loan guarantees
3. Parameterization
    3.1 The sanitary crisis
    3.2 The share of guaranteed loans
    3.3 The loan guarantee fee
    3.4 The elasticity of banks' capital to required capital
4. General equilibrium analysis
5. Sensitivity analysis
6. Alternative designs of the loan guarantee scheme
7. Conclusion

02 The sovereign loan guarantee scheme

The sovereign loan guarantee scheme: core features

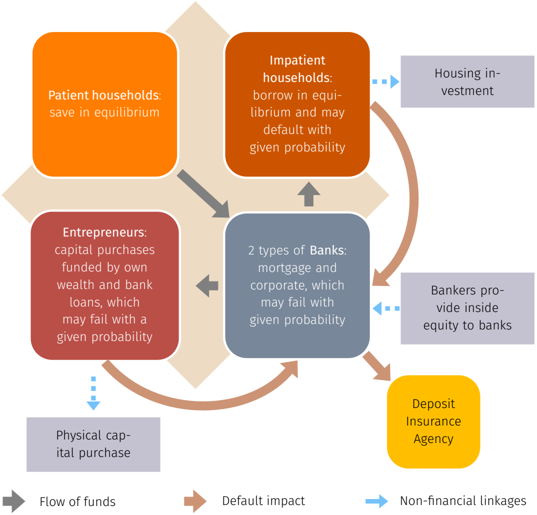
1. Sovereign loan guarantees insure banks against corporate default.
2. This insurance is costly: borrowers pay a loan guarantee fee.
3. The guaranteed portion of the loan has a regulatory risk-weight of zero.

The sovereign loan guarantee scheme in Portugal

- The scheme consists at most of 13 billion euros of guaranteed loans, notably for firms in the sectors most affected by the pandemic – for example, restaurants, tourism, travel agencies.
- The guarantee's coverage varies between 80 and 90% depending on firm size but cannot exceed 90%.
- The maximum maturity of the guarantee is 6 years, and borrowers pay a guarantee fee that depends on the maturity of the loan and on the firms' size.
- In October 2021, the amount of new guaranteed loans reached 8.87 billion euros, 85% of which issued in 2020.
- Most guarantees were granted with the maximum maturity, and in October 2021 the average residual maturity was about 4.5 years.

03 Modeling of sovereign loan guarantees

The 3D model (Clerc *et al.* 2015)



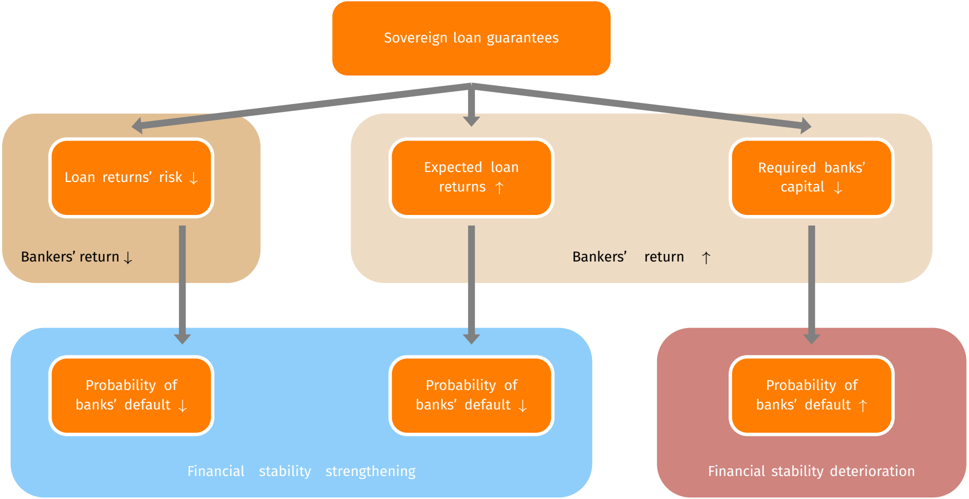
- Patient households deposit their savings in corporate and mortgage banks.
- Banks use their net worth and deposits to lend to impatient households and entrepreneurs. Banks are subject to capital requirements.
- Impatient households use their net worth and mortgage loans to buy houses.
- Entrepreneurs use their net worth and corporate loans to buy capital.
- Impatient households and entrepreneurs may default on their loans. Banks may default on deposits.
- When banks default, the government covers depositors' losses with lump-sum taxes on patient households.
- Main frictions: 1. costly loan verification, 2. deposit insurance transaction costs.

Adding loan guarantees to the 3D model

- We assume that a fraction g_t of every firm loan is guaranteed by the sovereign.
- We assume banks, rather than borrowers, pay the guarantee fee f_t to the sovereign.
- The scheme transfers to banks the difference between the contractual and the realized gross interest rates of loans net of the fee. Transfers are funded with lump-sum taxes on patient households.
- Loans with a sovereign loan guarantee have a 0% risk-weight.
- We generalize the capital requirements' constraint to accommodate elasticities of banks' capital to required regulatory capital different from 1.
  - Banks' capital ratio does not change 1-to-1 with the required capital ratio.

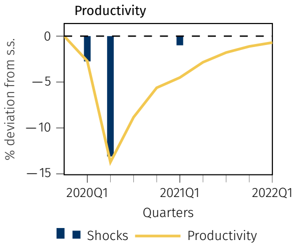
Equations

The effects of sovereign loan guarantees and their impact on financial stability

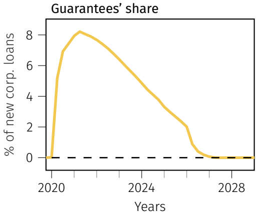


04 Parameterization

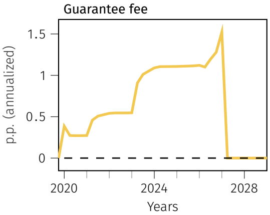
The sanitary crisis, the share of loan guarantees and the guarantee fee



- COVID-19 shock modelled as a series of productivity shocks that simulate the lockdown periods and the recovery.
- Shocks are set to approximate the fall in GDP predicted in 2020 (BdP Economic Bulletin).



- Granular data from Banco de Portugal's Credit Register to estimate g_t.
- Guaranteed credit depends on which loans are guaranteed, the coverage of each loan's guarantee, on loans' maturity and amortization.



- Portuguese credit lines guidelines to estimate f_t.
- The fee varies with number of repayment years, size of the firm and credit line at stake. f_t is computed merging the credit lines' information with data on maturity.

The elasticity of banks' capital to required capital

- We calibrate the required capital ratio $\bar{\phi}^F$ and the sensitivity of banks' capital to capital requirements so that banks' total capital prior to the COVID-19 shock equals the asset-weighted average of the observed capital ratio of the largest Portuguese banks in the period between 2017 and 2019 – 13.87%.
- We set the required capital ratio $\bar{\phi}^F$ equal to 11.25% (required total capital ratio + the asset-weighted average of the OSII capital buffer + capital conservation buffer).
- The parameter controlling the sensitivity of banks' capital to capital requirements is then 2.62%.
- The elasticity of banks' capital to required capital is $\epsilon^F = 0.81$.

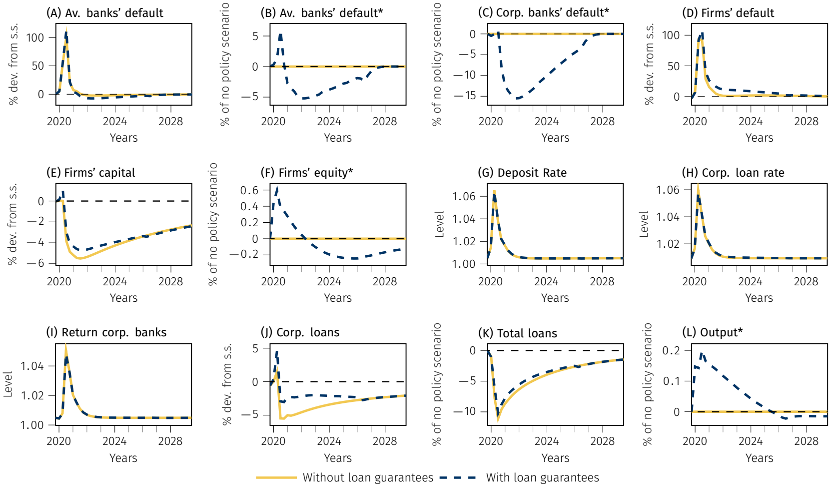
The remaining parameters and shocks characteristics

- **The remaining parameters.** The rest of the parameters results from the calibration of the 3D model for the Portuguese economy using quarterly data from 2017Q1 to 2019Q4.

- **Knowledge about shocks and policies at the time of decision making.** Productivity shocks are surprises. The sovereign guarantee program is also a surprise but only when introduced. Agents become fully aware of the path of the share of guaranteed loans once the program is introduced.

05 General equilibrium analysis

Sovereign loan guarantees reduce banks' default rate, increase credit and speeds up the recovery



Note: * In panel (B), (C), (F) and (L), the lines correspond to $(IRFs_t^1 - IRFs_t^0)/IRFs_t^0 \cdot 100$, where $IRFs_t^1$ are the IRFs after the introduction of the loan guarantee scheme, and $IRFs_t^0$ are the IRFs in a setting without loan guarantees.

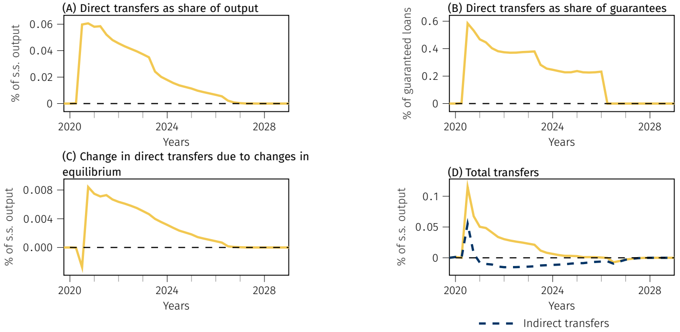
Sovereign loan guarantees reduce banks' default rate, increase credit and speeds up the recovery

Effect of sovereign loan guarantees on:					
Corp. loans		Av. banks' default		Output	
(cum. impact)	(avg impact of 1% g_t)	(avg impact)	(avg impact of 1% g_t)	(cum. impact)	(avg impact of 1% g_t)
44%	0.32%	-2.3%	-0.48%	1.9%	0.01%

Note: "cum." stands for cumulative, "avg" for average. The average impact of 1% g_t is computed over one year.

Table 1: The impact of the loan guarantee scheme after the COVID-19 shock

THE COSTS OF THE LOAN GUARANTEES SCHEME



- The direct fiscal cost of the scheme is 0.7% of the 2019Q4 output with the sovereign losing an average of 7.7 cents for each 1€ of guaranteed credit.
- The fiscal cost is small because the firms' default probability is small and because the equilibrium effects of the scheme are small.
- From mid-2026 onward, the indirect costs are so low that the total fiscal cost of the loan guarantees scheme become negative.

- At an expected yearly fiscal cost of 0.1% of 2019Q4 output, the loan guarantees scheme increased yearly output by 0.3%, decreased banks' yearly default rate by 0.3%, and increased yearly credit by 6.3%.

The costs of the loan guarantees scheme (2)

Our estimates of costs may be biased because:

- the default rate of firms that received loan guarantees may differ from that of the average firm;
- firms that received loan guarantees experienced a different drop in output and had a higher share of their loans guaranteed compared to the average firm.

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		Cumulative Direct transfers (% of 2019Q4 output)
A.	Baseline	0.7
B.	2017-2019 Calibration + matched default rate of firms	0.1
C.	2017-2019 Calibration + matched default rate of firms + sector-adjusted COVID-19 and g_t shocks	0.3

Table 1: Direct fiscal costs of the loan guarantee scheme: cumulative effects of alternative calibrations

- Direct costs are still relatively small, ranging between 0.1% and 0.3% of 2019Q4 output.

06 Sensitivity analysis

Sensitivity analysis

- The value of the sovereign loan guarantee fee may affect the costs of the scheme.
  - We explore alternative calibrations: $f_t = 0$ and $f_t = f_t^{T0}$, a fee ensuring that in every period the expected direct transfers are equal to 0.

- The elasticity of banks' capital to required capital may affect the financial stability effects of the scheme.
  - We explore two alternative calibrations: $\epsilon^F = 0.3$ (estimation) and $\epsilon^F = 1$ (banks' capital proportionally reacts to changes in capital requirements).

- The impact of the scheme may differ when modelling the increased uncertainty in firms' earnings triggered by COVID-19.
  - We model the COVID-19 shock as a combination of negative productivity shocks and positive shocks to the volatility of firms' earnings, calibrated using the VSTOXX index.

Sensitivity analysis

		Cumulative effect on: Corp. loans (%)	Av. banks' default (%)	Output (%)	Direct transfers (% of 2019Q4 output)	Total transfers (% of 2019Q4 output)
A.	Baseline	44	-2.3	1.9	0.7	0.5
Alternative calibrations of the sovereign loan guarantee fee						
B.	$f_t = 0$	47 (9)	-2.3 (1)	2.3 (17)	1.1 (47)	0.9 (65)
C.	$f_t = f_t^{T0}$	34 (-23)	-2.2 (-4)	0.9 (-52)	0.0 (-100)	-0.2 (-137)
Alternative calibrations of the sensitivity of banks' capital to capital requirements						
D.	$\epsilon^F = 0.3$	47 (8)	-8.3 (263)	1.9 (-4)	0.7 (0)	-0.2 (-134)
E.	$\epsilon^F = 1$	43 (-2)	0.4 (-116)	2 (4)	0.7 (0)	0.9 (59)
Alternative specification of the COVID-19 shock						
F.	Baseline + vol. shock	51 (18)	-2.2 (-2)	2.1 (9)	0.7 (0)	0.5 (-1)

Note: Percentage deviation from the baseline are in parenthesis. f_t^{T0} is equal to a value ensuring that in every period the expected direct transfers are equal to 0. ϵ^F is the elasticity of the banks' capital to required capital. "Vol. shock" corresponds to a 2.5 times increase in the volatility of the firms' idiosyncratic shocks.

Table 3: Sensitivity analysis: cumulative effects of alternative calibrations

- Different calibrations of the fee impact the costs of the scheme.

Sensitivity analysis

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		Corp. loans (%)	Av. banks' default (%)	Output (%)	Direct transfers (% of 2019Q4 output)	Total transfers (% of 2019Q4 output)
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Table 3: Sensitivity analysis: cumulative effects of alternative calibrations

- Different calibrations of the fee impact the costs of the scheme.
- Lower (higher) elasticity of banks' capital to required capital enhances (reduces) the financial stability effects of the scheme.

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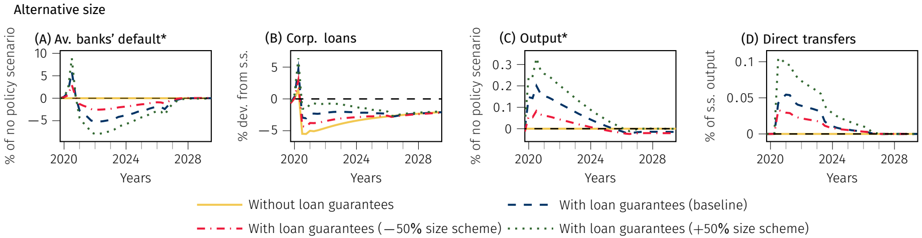
Table 3: Sensitivity analysis: cumulative effects of alternative calibrations

- Different calibrations of the fee impact the costs of the scheme.
- Lower (higher) elasticity of banks' capital to required capital enhances (reduces) the financial stability effects of the scheme.
- The scheme has a larger impact on credit and output when modeling COVID-19 as a volatility and productivity shock.

07 Alternative designs of the loan guarantee scheme

Alternative designs of the loan guarantee scheme

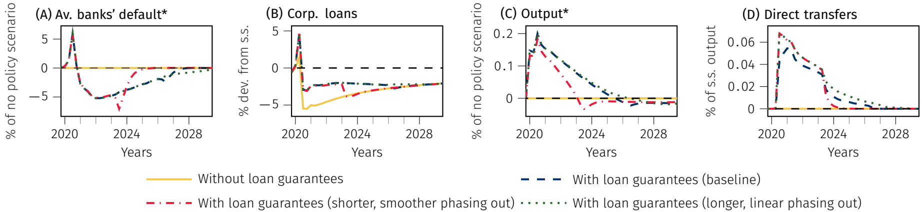
- The size of the scheme matters.
  - The impact of increasing the size of the scheme is higher the larger the scheme. Non-linear effect of the size of the scheme



Alternative designs of the loan guarantee scheme

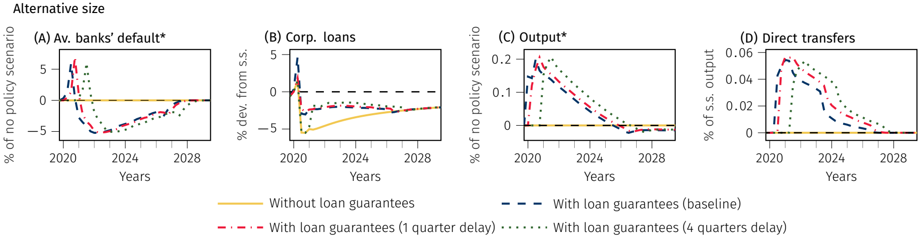
- The length of the scheme affect its phase-out and fiscal costs.
  - Shorter schemes have milder effects, smaller costs and earlier phasing out effects.
  - Longer schemes have stronger effects, postpone the phasing out effect and only slightly increase costs.

Alternative shape and length



Alternative designs of the loan guarantee scheme

- The timing of the scheme was crucial.
  - A 1-year delay in the implementation fails to counteract the 2020-2022 increase in banks' default rate and is unable to promptly stimulate credit.



08 Conclusion

Summary

- Loan guarantees reduce banks’ default rate, increase credit and speed up the recovery.
- The lower the elasticity of banks’ capital to capital requirements, the larger the effects of the sovereign guarantees.
- The expected fiscal cost of the policy are small - 0.7% of pre-pandemic output.
- The fee has an important impact on the costs of the scheme.
- The size, duration and timing of the scheme impact its effectiveness.

Conclusion

Contributions:

- We have analyzed the effect of the COVID-19 sovereign guarantees on firm loans in a general equilibrium setup that allows firms and banks to default.
- We have compared different schemes to have a more comprehensive evaluation of the scheme put in place.

What could come next:

- Modeling heterogeneous firms to capture the fact that the scheme is mainly designed for small and medium enterprises operating in specific sectors.

09 Appendix

Adding loan guarantees in the 3D model (2)

- The scheme compensates corporate banks by transferring the difference between the contractual and the realized gross interest rates of loans net of the guarantee fee.

$$T^G_{t+1} = \left(R^F_t - \tilde{R}^F_{t+1} - f_t\right) g_t b^e_t \tag{1}$$

It raises the necessary revenue to compensate corporate banks by charging lump-sum taxes, T^G_{t+1}, on patient households.

- Corporate banks' capital e^F_t satisfies the following constraint:

$$e^F_t \geq \left(\bar{\kappa}^F + \bar{\phi}^F (1 - g_t)\right) b^e_t \tag{2}$$

Parameter $\bar{\kappa}^F$ controls the sensitivity of banks' capital to capital requirements.

- Corporate banks' profits are described by:

$$\max\left[\left(R^F_t - f_t\right) b^e_t g_t + \omega^F_{t+1} \tilde{R}^F_{t+1} b^e_t (1 - g_t) - R^D_t d^F_t, 0\right] \tag{3}$$

back

Historical relation between banks' observed and required capital

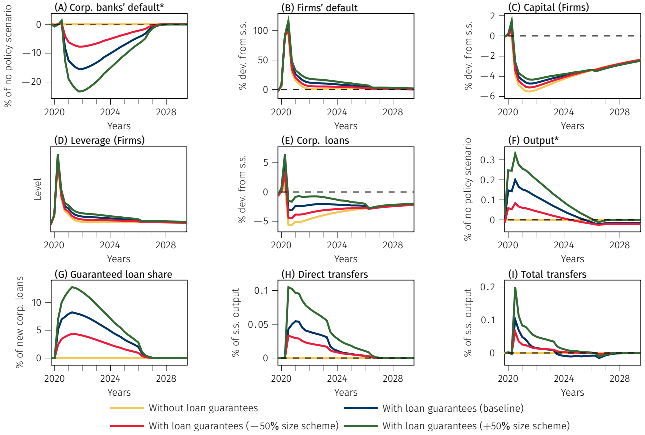
- Aggregate quarterly data from 2008Q4 to 2019Q4. The data includes Portuguese banks' capital, risk-weighted assets, loans, and securities.
- The time series of capital requirements is the sum of micro and macroprudential capital requirements.
- To obtain elasticities, we multiply the coefficients with the ratio of the averages of the relevant variables. We obtain an elasticity of capital to capital requirements of 0.313, and an elasticity of the capital ratio to the ratio of required capital ratio of 0.369. Back

	Dependent variable:	
	Capital	$\frac{\text{Capital}}{\text{Credit}}$
Required Capital	0.454***	
	(0.126)	
Required $\frac{\text{Capital}}{\text{Credit}}$		0.538
		(0.458)
Constant	21,879.160***	0.057*
	(2,804.893)	(0.028)
Observations	45	45
R^2	0.230	0.031
Adjusted R^2	0.212	0.009
Residual Std. Error (df = 43)	2,273.829	0.009
F Statistic (df = 1; 43)	12.870***	1.383

*p<0.1; **p<0.05; ***p<0.01

Table 4: Elasticity of banks' capital to required capital

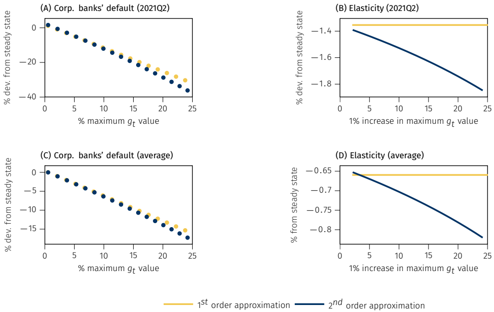
The size of the scheme matters



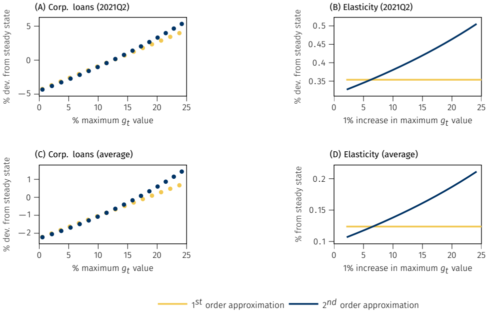
A 50% increase in the size of the scheme:

- decreases banks' default probabilities by 54%,
- increases firms' credit by 163%,
- increases output by 89%,
- increases by 58% expected direct fiscal costs.
- The impact of increasing the size of the scheme is higher the larger the scheme.

How the size of the scheme affects corporate banks' default rate and corporate credit



Note: The elasticities in panel B and D are computed as $\frac{\Delta\% PD^F_{2021Q2}}{\Delta g_{2021Q2}}$ and $\frac{\Delta\%\overline{PD^F}}{\Delta g_{2021Q2}}$ respectively, where PD^F_t is corporate bank's default rate and $\overline{PD^F}$ is its mean over the sample period.



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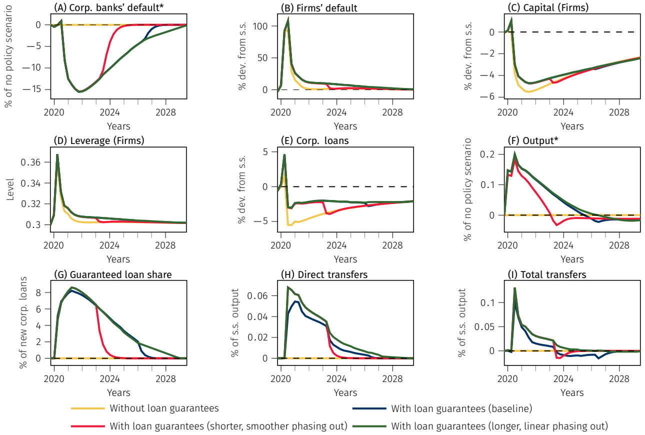
Back

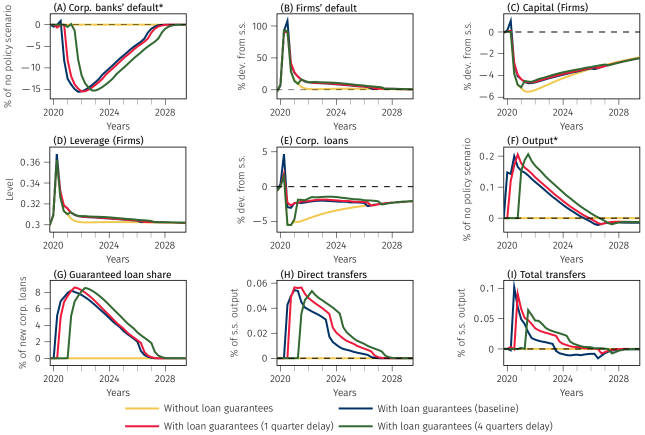
The shape and length of the scheme affect its phase-out and fiscal costs



In comparison to the baseline case (blue line):

- A shorter and smoother scheme has milder effects on banks' default rate, credit and output.
- A shorter length entails smaller expected direct costs but larger and earlier phasing-out effects for output growth.
- A longer scheme extends the increase in credit over time, implies a greater reduction in bank default rate, and postpones the phasing-out effect.
- A longer scheme increase only slightly expected direct costs.

THE TIMING OF THE SCHEME WAS CRUCIAL



In comparison with the baseline case (blue line):

- A 1-quarter delay has minor consequences on the bank default rate but entails less credit to firms.
- A 1-year delay fails to counteract the increase in banks' default rate observed between 2020 and 2022 in the absence of the scheme.
- A 1-year delay is unable to promptly stimulate credit.
- Delayed implementations have a small impact on average and cumulative output growth.

Optimality of sovereign loan guarantees

To obtain the condition determining the use of loan guarantees, differentiate the entrepreneurs' problem w.r.t. to the share of guaranteed loans, use the envelope theorem, and note that the multiplier $\xi_{e,t}$ is positive:

$$- E_t\left[\left(1-\Gamma^F\left(\bar{\omega}^F_{t+1}\right)\right)\left(\Gamma^e\left(\bar{\omega}^e_{t+1}\right)-\mu^e G^e\left(\bar{\omega}^e_{t+1}\right)\right)R^K_{t+1}\right]q^K_t k_t+\rho_t\bar{\phi}_F\left(q^K_t k_t-n^e_t\right)+$$
$$+\ E_t\left[-\Gamma'^F\left(\bar{\omega}^F_{t+1}\right)\frac{R^D_t\left(1-\bar{\kappa}^F\right)-\left(R^F_t-f_t\right)}{(1-g_t)^2}\left(q^K_t k_t-n^e_t\right)(1-g_t)\right]\Bigg)>0$$

which simplifies to:

$$f_t<R^F_t-R^D_t-\bar{\kappa}^F\left(\frac{\rho_t}{E_t\left[\Gamma'^F\left(\bar{\omega}^F_{t+1}\right)\right]}-R^D_t\right)$$

by noting that the following equality holds:

$$E_t\left[\left(1-\Gamma^F\left(\bar{\omega}^F_{t+1}\right)\right)\left(\Gamma^e\left(\bar{\omega}^e_{t+1}\right)-\mu^e G^e\left(\bar{\omega}^e_{t+1}\right)\right)R^K_{t+1}\right]q^K_t k_t=\rho_t\left(\frac{\bar{\kappa}^F}{(1-g_t)}+\bar{\phi}_F\right)\left(q^K_t k_t-n^e_t\right)$$

because bankers' participation constraint is binding.

Optimality of sovereign loan guarantees