Climate supervisory shocks and bank credit lending
Empirical evidence from microdata

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Disclaimer

The views expressed in this presentation are those of the author and do not necessarily reflect the official positions of Banca d'Italia.

Roadmap

Introduction

Data and empirical strategy

Results

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Introduction

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  - Data gaps on SMEs and non-listed firms: limited non-financial disclosure

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    - IT: 47% of loans to firms, 67% of Value Added, 79% of employment
  - Under/Overestimation?

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   - **NO**. Predominance of credit reallocation effect

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  - YES. Worse pricing and less credit for *green-meets-green attitude* (Degryse et al., 2023, Kacperczyk and Peydró, 2021)
  - NO. Less likely to establish new relationships and overemphasis of climate targets (greenwashing), Ehlers and De Greiff (2021), Giannetti et al. (2023), Sastry et al. (2024))

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Contribution

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- Shock 1: September 2020 - February 2021
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Short-term effects

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$\simeq$ 45K firms, 38 banking groups (11 SIs and 27 LSIs), 6 months time-window (3 before, 3 after)

Bank and firm targets/commitments

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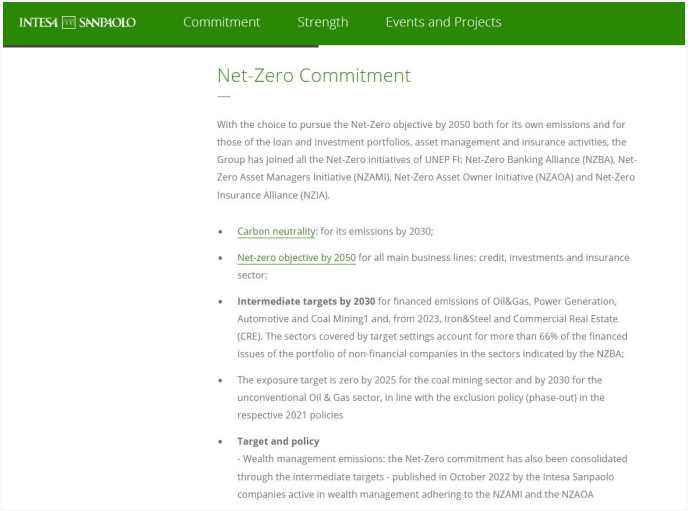
- Non-Financial Reports, Sustainability Reports, Corporate Social Responsibility, Environmental Reports, and Annual Reports

Climate commitments before the shocks: 3 banks (SIs), 24 large and listed firms

Example bank commitment: Intesa San Paolo



Example firm commitment: Sumitomo Pharma Co Ltd

Long-term Environmental Goals (Fiscal 2021-2030) (Established in December 2019)

Priority issues		Long-term Environmental Goals (Fiscal 2021-2030)
Creating low-carbon society		● Reduce emissions of greenhouse gases (GHG) to curtail rises in average global temperatures. <Target> Reduce GHG emissions (Scope 1+2) by 35% from fiscal 2017 level by fiscal 2030.
Efficient use of resources	Water	● Preserve water resources by reducing water withdrawal. <Target> Reduce water withdrawal by 12% from fiscal 2018 level by fiscal 2030.
	Waste	● Carry out proper waste management and treatment, and promote 3Rs (reduce, reuse, recycle) to efficiently utilize limited resources. <Targets> (i) Maintain recycling rate at 80% or higher and aim for at least 85% by fiscal 2030. (ii) Maintain final disposal rate at less than 1% and aim for less than 0.5% by fiscal 2030.

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⏩ ECB observed practices 2022

Brownness classification

- To infer firm-level emissions *within-sector variability depends only on the number of workers*
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Firm-level CO2 emissions

Eurostat, INPS, ISTAT Cerved

- Obtained from sectoral energy consumption for different energy sources downscaled wrt the no. of employees ⏩ details

⏩ Descriptive statistics:whole sample ⏩ Descriptive statistics:only listed firms

Methodology DDD

$$Y_{b,f,t,l} = \alpha_1(Brown_f \times Post_t \times Tre_b) + \alpha_2(Brown_f \times Tre_b) + \alpha_3 Covid_{b,f,t} + \delta_{b,t} + \omega_{f,t} + \eta_{l,t} + \epsilon_{b,f,t,l}$$

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Bank b, Firm f, Month t, Loan-type l

- $Y_{b,f,t,l}$ log of total credit granted/average credit spread
- $Brown_f \in [0,1]$, if firm-level CO2 emissions are $\geq$ median of pre-shock distribution
- $Post_t \in [0,1]$, 1 after the introduction of the ECB Guide / Climate Stress Test
- $Tre_b \in [0,1]$, 1 treated bank

⏩ Loans to NFCs with Covid-19 guarantess

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- $Brown_f \in [0,1]$, if firm-level CO2 emissions are $\geq$ median of pre-shock distribution across sectors
- $Post_t \in [0,1]$, 1 after the introduction of the ECB Guide / Climate Stress Test
- $Tre_b \in [0,1]$, 1 treated bank (SI)

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Identification with multi-bank credit relationships

$\hat{\alpha_1} \rightarrow$ Difference between two DD estimates:

$$[(\overline{Y}_{SI,Brown,Post} - \overline{Y}_{SI,Brown,Pre}) - (\overline{Y}_{LSI,Brown,Post} - \overline{Y}_{LSI,Brown,Pre})] -$$
$$[(\overline{Y}_{SI,NotBr,Post} - \overline{Y}_{SI,NotBr,Pre}) - (\overline{Y}_{LSI,NotBr,Post} - \overline{Y}_{LSI,NotBr,Pre})]$$

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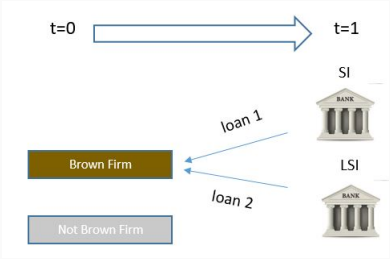
$$[(\overline{Y}_{SI,NotBr,Post} - \overline{Y}_{SI,NotBr,Pre}) - (\overline{Y}_{LSI,NotBr,Post} - \overline{Y}_{LSI,NotBr,Pre})]$$

2 banks (b): SI (treated), LSI (control)
2 firms (f): Brown, not Brown
2 time periods (t): t=0 (before), t=1 (after)

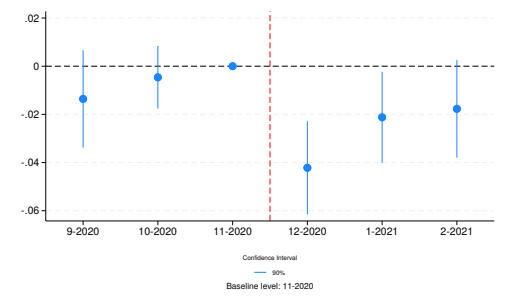


Results

Did SIs reallocate credit to less brown firms after the shock(s)?

YES: SIs reallocated credit (-2.1%) compared to LSIs after the 2020 expectations

	$\log(\text{credit}_{b,f,t,l})$
$Brown_f \times Post_t \times Tre_b$	-0.0209**
	(0.00996)
$Brown_f \times Tre_b$	0.0607***
	(0.0175)
$Covid_{b,f,t}$	0.0180***
	(0.00101)
Observations	652,744
Fixed Effects	Yes
Bank and Firm controls	Yes



Results for price-channel: 2020 Supervisory Shock
Results for quantity-channel: 2022 CST
Results for price-channel: 2022 CST
Parallel trend CST
Falsification Tests

Robust results with alternative measures of transition risk

	log(credit$_{b,f,t,l}$)		
	$Brown_f$	$Brown\ High_f$	$CO2_int_f$
	$\geq$ median	$\geq$ Q3	$\frac{CO2emi_f}{Revenue_f}$
$Transition\ Risk_f \times Post_t \times Tre_b$	-0.0209**	-0.0234**	-0.0000606***
	(0.00996)	(0.0109)	(0.0000235)
$Transition\ Risk_f \times Tre_b$	0.0607***	0.0679***	0.0000703***
	(0.0175)	(0.0192)	(0.0000236)
$Covid_{b,f,t}$	0.0180***	0.0180***	0.0170***
	(0.00101)	(0.00101)	(0.000877)
Observations	652,744	652,744	652,744
Fixed Effects	Yes	Yes	Yes
Bank and Firm controls	Yes	Yes	Yes

Robust results for differences in existing bank-firm relationships

	log(credit$_{b,f,t,l}$)	
$Brown_f \times Post_t \times Tre_b \times Bank\ Comm_b$		-0.0229***
		(0.00771)
$Brown_f \times Post_t \times Tre_b$	-0.0135*	-0.00265
	(0.00720)	(0.00798)
$Covid_{b,f,t}$	0.0127***	0.0127***
	(0.000838)	(0.000838)
Observations	650,297	650,297
Bank-Time Fixed Effects	Yes	Yes
Firm-Time Fixed Effects	Yes	Yes
Loan Type-Time Fixed Effects	Yes	Yes
Bank-Firm Fixed Effects	Yes	Yes
Bank and Firm controls	Yes	Yes

The role of banks' commitment

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- *Rational*: green banks might be strongly impacted by the shocks, due to decarbonization policies of credit portfolios and the scrutiny of their investors

$$Y_{b,f,t,l} = \alpha_1(Brown_f \times Post_t \times Tre_b \times Bank\ Comm_b) + \alpha_2(Brown_f \times Post_t \times Tre_b) + \\ + \alpha_3(Brown_f \times Tre_b \times Bank\ Comm_b) + \alpha_4(Brown_f \times Tre_b) + \alpha_5 Covid_{b,f,t} + \\ + \delta_{b,t} + \omega_{f,t} + \eta_{l,t} + \epsilon_{b,f,t,l}$$

Which treated banks reallocated?

⇒ **GREEN** banks

	log(credit$_{b,f,t,l}$)	
$Brown_f \times Post_t \times Tre_b \times Bank\,Comm_b$		-0.0261***
		(0.0101)
$Brown_f \times Post_t \times Tre_b$	-0.0209**	-0.00901
	(0.00996)	(0.0110)
$Brown_f \times Tre_b \times Bank\,Comm_b$		-0.0134
		(0.0178)
$Brown_f \times Tre_b$	0.0607***	0.0671***
	(0.0175)	(0.0194)
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Fixed Effects	Yes	Yes
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- Supervision impacted banks with decarbonization policies of credit portfolios

The role of firms' commitment

Focus on large and listed firms

$$Y_{b,f,t,l} = \alpha_1(Brown_f \times Post_t \times Tre_b \times Firm\,Comm_f) + \alpha_2(Brown_f \times Post_t \times Tre_b) +$$
$$+\alpha_3(Brown_f \times Tre_b \times Firm\,Comm_f) + \alpha_4(Brown_f \times Tre_b) + \alpha_5 Covid_{b,f,t} +$$
$$+\delta_{b,t} + \omega_{f,t} + \eta_{l,t} + \epsilon_{b,f,t,l}$$

Results with firms' commitment: CST

	CST			
	$\log(\text{credit}_{b,f,t})$		$\text{spread}_{b,f,t}$	
$Brown_f \times Post_t \times Tre_b \times Firm\ Comm_f$		-2.118**		85.37**
		(0.906)		(37.10)
$Brown_f \times Post_t \times Tre_b$	-0.128	-0.126	92.52***	92.33***
	(0.226)	(0.226)	(30.65)	(30.62)
$Brown_f \times Tre_b \times Firm\ Comm_f$		3.785		-16.36
		(2.469)		(116.5)
$Brown_f \times Tre_b$	1.020*	1.014*	-83.74**	-83.71**
	(0.600)	(0.595)	(40.73)	(40.74)
$Covid_{b,f,t}$	0.0230**	0.0231**	-2.970*	-2.968*
	(0.0103)	(0.0103)	(1.600)	(1.601)
Observations	3,333	3,333	3,333	3,333
Fixed Effects	Yes	Yes	Yes	Yes
Bank and Firm controls	Yes	Yes	Yes	Yes

▸▸ Results for Supervisory Shock

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- Firms with targets are typically the most emitting ones in credit portfolios, based on historical CO2 emissions
- Related emissions fed in the data collected by the SSM during the exercise

$\Longrightarrow$ Supervisory initiatives can differently affect lending policies and credit supply

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- Limited role of firms' emission targets in the credit process (data reliability and gaps)

Policy implications

- Banking supervision should both provide the right incentives for banks to **properly manage climate-related risks** (Hansen, 2022)

Conclusions

- Novel evidence on the effect of climate banking supervision on credit supply with a complete assessment of banks' portfolio
- After the ECB expectations, **green SIs reallocated credit** away from polluting firms
  - **Increased efficacy of banks' commitments in the presence of supervisory shock**
- Limited role of firms' emission targets in the credit process (data reliability and gaps)

Policy implications

- Banking supervision should both provide the right incentives for banks to **properly manage climate-related risks** (Hansen, 2022)
- Avoid unintended consequences banks cut credit to brown firms needing more resources to support the transition, i.e. those committed/with targets

Thank you!

Appendix

References

Bruno, B. and S. Lombini *Climate transition risk and bank lending* (2023). Journal of Financial Research.

Degryse, H. and Goncharenko, R. and Theunisz, C. and Vadasz, T. *When Green Meets Green* (2023). Journal of Corporate Finance, Volume 78.

European Central Bank. *Good practices for climate-related and environmental risk management. Observations from the 2022 thematic review.* (2022).

Faiella, I. and Lavecchia L. and Michelangeli V. and Mistretta A. (2022). *A climate stress test on the financial vulnerability of Italian households and firms*. Journal of Policy Modeling Volume 44, Issue 2, 396-417.

Fuchs, L. and Nguyen, H. and Nguyen, T. and Schaeck, K. (2024), *Climate Stress Tests, Bank Lending, and the Transition to the Carbon-Neutral Economy*. Available at SSRN: https://ssrn.com/abstract=4427729.

Giannetti, M., M. Jasova, M. Loumioti, and C. Mendicino (2023). *Glossy green banks: The disconnect between environmental disclosures and lending activities*. Swedish House of Finance Research Paper No. 23-07, European Corporate Governance Institute – Finance Working Paper No. 919/2023.

Hansen, L. P., *Central banking challenges posed by uncertain climate change and natural disasters* (2022). Journal of Monetary Economics 125, 1–15.

Kacperczyk, M. T. and Peydro, J-L, *Carbon Emissions and the Bank-Lending Channel* (2021). CEPR Discussion Paper No. DP16778.

Reghezza, A., Y. Altunbas, D. Marques Ibanez, C. d'Acri, and M. Spaggiari (2022) *Do banks fuel climate change?*. Journal of Financial Stability 62, 101049.

Sastry, P., E. Verner, and D. Marques Ibanez (2024, March). *Business as usual: bank climate commitments, lending, and engagement*. Working Paper Series 2921, European Central Bank.

Supervisory shocks

ECB Guide on Climate risk - Nov 2020

- (Non-binding) Guide where ECB expects institutions to consider climate-related risks in risk management, business strategy and governance frameworks
- Supervised banks to perform self-assessment on ECB expectations in early 2021

Climate Stress Test - Nov 2021

- *Dear CEO letter* to announce the official participation of banks
- The first supervisory stress test in 2022

2020 ECB Guide

Expectation 8

In their credit risk management, institutions are expected to consider climate-related and environmental risks at all relevant stages of the credit-granting process and to monitor the risks in their portfolios.

Box 2

Example of observed practice: Climate-related and environmental key performance indicators

The ECB observed an institution which had integrated the following climate-related and environmental key performance indicators (KPIs) into its strategic framework with a view to making its strategy of reducing exposure to transition risks measurable: i) the carbon emission footprint of its assets; ii) the average energy label of its mortgage portfolios; and iii) the number of homes that saw an energy label improvement thanks to its financing. In addition to these KPIs, the institution stresses

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Bank observed practices

Identification of exposures

Institutions are exposed to C&E risks through their exposures to, inter alia, corporates, small and medium-sized enterprises (SME), households and sovereigns. Depending on the type of exposure, different qualitative and quantitative approaches are used to assess the materiality of the risks. Institutions typically rely on proxy-based quantification methods to identify pockets of risk based on both client data and externally sourced data. Leading institutions supplement such initial analyses with a variety of more advanced assessment methods to estimate the level of risk more accurately, including portfolio alignment approaches, sensitivity analysis and financed emissions. The observed practices described in this section include some

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CST: identification of transition risk

2.1 Methodology and scenarios

The 2022 CST was a constrained bottom-up exercise, meaning that participating banks provided their own data submissions and stress test projections subject to a common methodology and common scenarios.

The methodology underlying the 2022 CST was published in October 2021, while the scenarios were published in January 2022.[5]

Three distinct modules formed the basis of the methodology (see Chart 1).

Module 1 consisted of a qualitative questionnaire aiming at providing a uniform and standardised assessment of banks' climate risk stress-testing capabilities. This module assessed banks' internal climate risk stress-testing frameworks in line with Expectation 11 (on scenario analysis and stress testing) set out in the ECB Guide on climate-related and environmental risks. Apart from including general questions regarding the existence and use of climate risk stress testing within the institution, the Module 1 questionnaire covered areas such as governance and risk appetite, integration into the institutions' business strategy, methodology and scenario design, data availability and sources, ICAAP and future plans. The aim of this was to understand interlinkages between the banks' stress-testing frameworks and other internal business processes.

Module 2 consisted of two climate risk metrics providing insights into the sensitivity of banks' income to transition risk and their exposure to carbon emission-intensive industries as of the reference date (31 December 2021). Banks were asked to split

Imputation procedure for firms' CO2 emissions

1. Estimate **energy consumption** (Faiella et al. (2022), Emambakhsh et al. (2023)):

$$e_{f,t} = \sum_{z=1}^{Z} w_{z,f,t}$$

where $z = 1, \ldots, Z$ represents the energy sources and $w_{z,f,t}$ is defined as:

$$w_{z,f,t} = \frac{l_{f,t}}{L_t} \times E_{z,t}$$

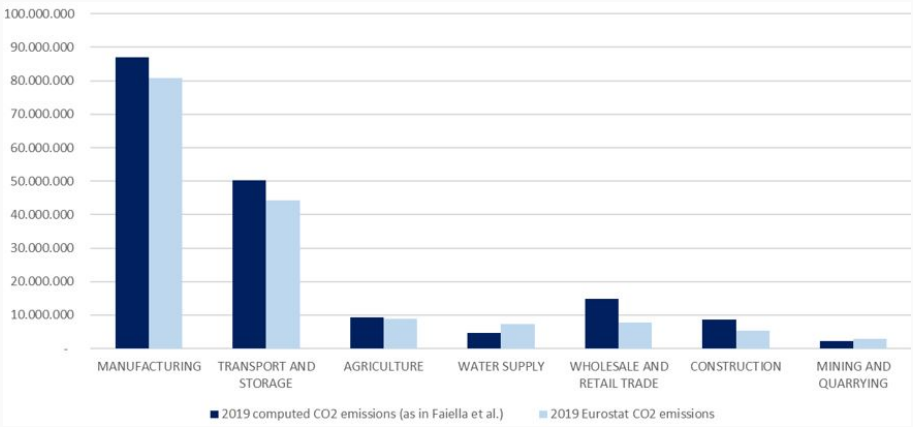
where:

- $l_{f,t}$ denotes the number of number of employees for firm f at time t
- L_t denotes the total number of employees enrolled in the same sector as the one of the firm f at time t
- $E_{z,t}$ is the energy consumption (at the sector level of firm f) for energy source z at time t

2. Estimate **S1-S2 emissions** (ton of oil equivalent, toe) through carbon emission factors for each fuel from ISPRA and Ministero dell'Ambiente

Robustness check: Top emitting sectors

Figure 1: CO2 emissions across industries (tonnes)



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Descriptive statistics: whole sample

	Mean	Std. Dev.	Q1	Median	Q3
Loan-level data					
Loan amount (log)	11.58	1.67	10.34	11.51	12.61
Loan amount Covid (log)	1.47	3.83	0.00	0.00	0.00
Loan spread (basis points)	442.43	343.86	196.44	343.70	589.45
Bank-level data					
Treated (bank)	0.79	0.41	1.00	1.00	1.00
Bank Committed (bank)	0.36	0.48	0.00	0.00	1.00
Firm-level data					
Post (month)	0.52	0.50	0.00	1.00	1.00
Brown (firm)	0.49	0.50	0.00	0.00	1.00
CO2 emissions (firm)	1.94e+06	8.50e+07	32,235.51	83,812.32	244,989.87
log(CO2 emissions) (firm)	11.50	1.66	10.38	11.34	12.41
Observations	909,816				

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Descriptive statistics: subsample of large and listed firms

	Mean	SD	Q1	Median	Q3
Loan-level data					
Loan amount (log)	13.98	2.43	12.43	13.99	15.42
Loan amount Covid (log)	0.77	3.14	0.00	0.00	0.00
Loan spread (basis points)	313.98	290.31	138.10	238.50	399.80
Bank-level data					
Treated (bank)	0.81	0.39	1.00	1.00	1.00
Firm-level data					
Post (month)	0.50	0.50	0.00	1.00	1.00
Brown_Comm (firm)	0.08	0.27	0.00	0.00	0.00
CO2 emission (firm)	2.49e+08	1.17e+09	509,321.04	1.70e+06	5.04e+06
log(CO2 emissions) (firm)	14.57	2.41	13.14	14.35	15.43
Observations	4,546				

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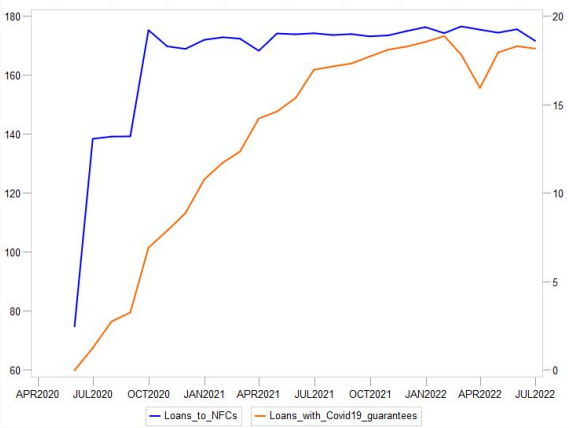
Evolution of credit in Covid-19 times



Notes: The chart plots the amount of loans to NFCs and loans to NFCs (rhs) with Covid 19 guarantees expressed in billion of euros, at monthly frequency, taking the end-month values. Source: supervisory data drawn from AnaCredit.

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Results for price-channel: 2020 Supervisory Shock

	(1)	(2)	(3)	(4)
$Brown_f \times Post_t \times Tre_b$	-1.610	0.740	1.440	0.441
	(2.606)	(2.852)	(2.762)	(2.556)
$Brown_f \times Tre_b$	-24.08***	-17.25***	-18.37***	-17.15***
	(4.470)	(4.687)	(4.456)	(4.171)
$Covid_{b,f,t}$	-5.653***	-9.283***	-8.987***	-3.502***
	(0.199)	(0.223)	(0.226)	(0.208)
Controls	Yes	Yes	Yes	Yes
Bank-Time Fixed Effects	Yes		Yes	Yes
Firm-Time Fixed Effects		Yes	Yes	Yes
Loan Type-Time Fixed Effects				Yes
Observations	652,744	652,744	652,744	652,744
R^2	0.083	0.289	0.318	0.528
R^2	0.073	0.306	0.324	0.541
Number of Banks	38	38	38	38
Number of Firms	26,808	26,808	26,808	26,808

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Results for quantity-channel: 2022 CST

	(1)	(2)	(3)	(4)
$Brown_f \times Post_t \times Tre_b$	0.0127	0.0134	0.0108	0.00792
	(0.00896)	(0.00845)	(0.00843)	(0.00828)
$Brown_f \times Tre_b$	0.0547**	0.0355**	0.0462***	0.0386**
	(0.0224)	(0.0171)	(0.0168)	(0.0165)
$Covid_{b,f,t}$	0.0114***	0.0274***	0.0337***	0.0165***
	(0.00116)	(0.000899)	(0.000947)	(0.000932)
Controls	Yes	Yes	Yes	Yes
Bank-Time Fixed Effects	Yes		Yes	Yes
Firm-Time Fixed Effects		Yes	Yes	Yes
Loan Type-Time Fixed Effects				Yes
Observations	703,796	703,796	703,796	703,796
R^2	0.083	0.471	0.477	0.578
Number of Banks	38	38	38	38
Number of Firms	27,404	27,404	27,404	27,404

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Results for price-channel: 2022 CST

	(1)	(2)	(3)	(4)
$Brown_f \times Post_t \times Tre_b$	0.361	-1.355	-0.648	0.0162
	(1.765)	(1.926)	(1.898)	(1.748)
$Brown_f \times Tre_b$	-24.13***	-19.01***	-16.08***	-12.17***
	(3.483)	(3.575)	(3.493)	(3.161)
$Covid_{b,f,t}$	-4.417***	-6.770***	-7.114***	-2.154***
	(0.158)	(0.168)	(0.177)	(0.161)
Controls	Yes	Yes	Yes	Yes
Bank-Time Fixed Effects	Yes		Yes	Yes
Firm-Time Fixed Effects		Yes	Yes	Yes
Loan Type-Time Fixed Effects				Yes
Observations	703,796	703,796	703,796	703,796
R^2	0.083	0.471	0.477	0.556
Number of Banks	38	38	38	38
Number of Firms	27,404	27,404	27,404	27,404

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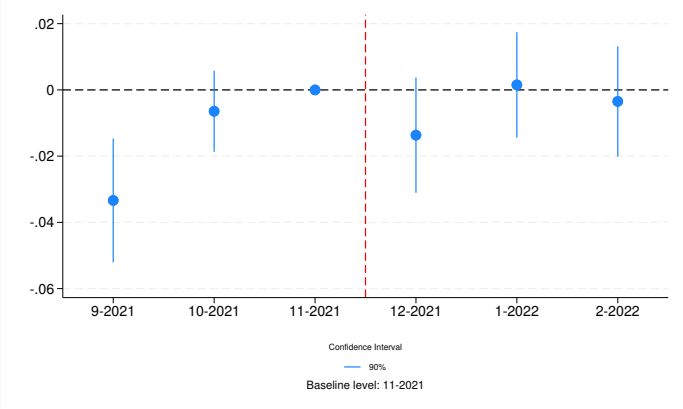
Parallel Trend: the launch of the 2022 CST



⇒Not significant impact, neither before, nor after the official launch of the 2022 Climate Stress Test one year later, in November 2021

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Results with firms' commitment: Sup expectations

	Sup expectations			
	$\log(\text{credit}_{b,f,t})$		$\text{spread}_{b,f,t}$	
$Brown_f \times Post_t \times Tre_b \times Firm\,Comm_f$		1.288		-148.8*
		(1.169)		(79.41)
$Brown_f \times Post_t \times Tre_b$	1.124	1.125*	-136.4**	-136.8**
	(0.685)	(0.667)	(65.28)	(64.98)
$Brown_f \times Tre_b \times Firm\,Comm_f$		2.792		19.33
		(2.155)		(102.3)
$Brown_f \times Tre_b$	0.178	0.188	90.07	90.10
	(0.321)	(0.320)	(68.98)	(68.98)
$Covid_{b,f,t}$	0.0273**	0.0235***	-5.776**	-5.677***
	(0.0117)	(0.0112)	(1.911)	(1.908)
Observations	3,337	3,337	3,337	3,337
Fixed Effects	Yes	Yes	Yes	Yes
Bank and Firm controls	Yes	Yes	Yes	Yes

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Falsification Tests

	$Log(credit_{b,f,t})$	$Spread_{b,f,t}$	$Log(credit_{b,f,t})$	$Spread_{b,f,t}$
$Brown_f \times Post_t \times Fake\,Tre_b$	0.0037	0.4032		
	(0.0097)	(2.465)		
$Brown_f \times Fake\,Tre_b$	-0.048***	-1.32		
	(0.018)	(4.085)		
$Covid_{b,f,t}$	0.018***	-3.530***		
	(0.001)	(0.208)		
$Brown_f \times Fake\,Post_t \times Tre_b$			0.004	-0.014
			(0.007)	(0.017)
$Brown_f \times Tre_b$			0.0596***	-0.223***
			(0.0132)	(0.032)
$Covid_{b,f,t}$			0.0175***	-0.035***
			(0.00083)	(0.00176)
Observations	652,744	652,744	792,781	792,781
R^2	0.585	0.541	0.576	0.535

- Randomly assigning treated banks renders key coefficient not significant
- Assigning the month of the release of the Guide to a fake period also renders the key coefficient not significant

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