

COVID-19, Policy Interventions and Credit: The Brazilian Experience

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Overview

- **Research question:** Do the COVID-19 pandemic and ensuing policy interventions impact the local credit in Brazil?
- **Identification:** the COVID-19 pandemic as an unexpected and exogenous shock to local credit markets and local governments in Brazil
- **Data:**
 - COVID-19 and policy intervention data: Ministry of Health of Brazil
 - Bank data: ESTBAN data from Central Bank of Brazil (BCB)
 - Political and economic data: Superior Electoral Court, CAGED, IPEA
- **Main results and contributions:**
 - Negative impact of the pandemic on local credit in Brazil
 - Heterogenous effects of interventions: positive effects of soft interventions and late reopening, and negative effects of hard interventions and early reopening
 - Clear policy implications for policy makers and financial regulators
 - First study on local credit in Brazil during the COVID-19 crisis

Literature

Literature on the economic consequences of the COVID-19 pandemic:

- Prior studies show that the pandemic strongly affects equity funds markets (Pastor and Vorsatz, 2020), stock markets (Baker et al., 2020a, Fahlenbrach et al., 2020), consumer credit (Horvath et al., 2021), household consumptions (Baker et al., 2020b), and credit markets (Acharya and Steffen, 2020; Beck and Keil, 2021)
- Berger et al. (2021) document that relationship borrowers fare worse than non-relationship borrowers, which implies the dark side of close bank-firm relationships (hold up) dominates during the COVID-19 crisis

Literature on policy interventions during the COVID-19 pandemic:

- Theoretically, Goel and Thakor (2020) develop a two-period production-consumption model that predicts that soft interventions are Pareto-optimal, while lockdowns are not, especially for developing countries
- Empirically, evidences show a negative impact of restrictive interventions on economic activity (Carletti et al., 2020; Coibion et al., 2020; Kong and Prinz, 2020; Horvath et al., 2021; Spiegel and Tookes, 2021)

Hypotheses

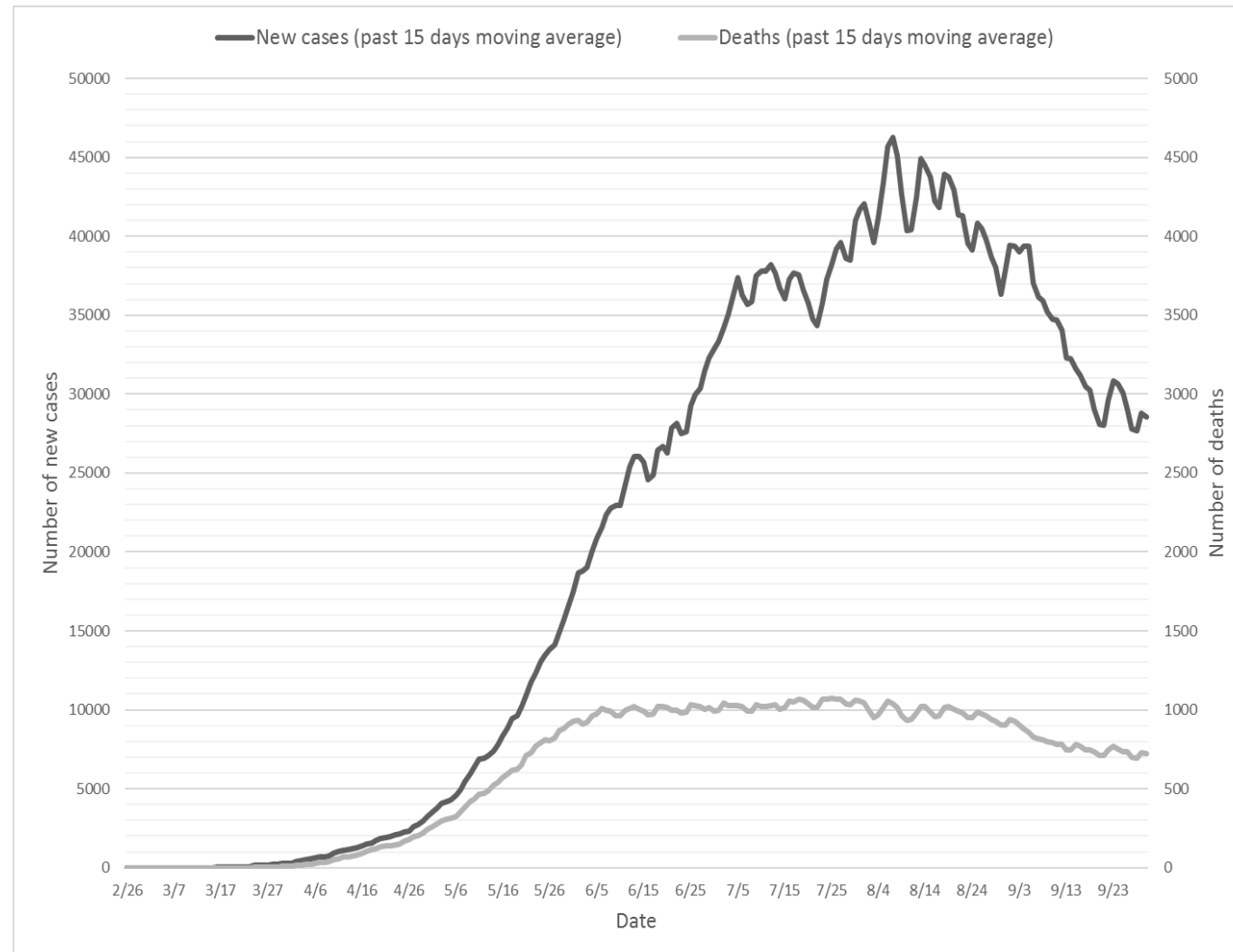
- **Hypothesis 1.** The COVID-19 pandemic has a negative impact on local credit
- **Hypothesis 2.** Policy interventions have heterogeneous effects on local credit during the COVID-19 pandemic. Soft interventions (social distancing, mass gathering restrictions and closure of schools and universities) have a positive effect (**H2a**), hard interventions (closure of public venues and/or non-essential services) have a negative effect (**H2b**), and the revoking of restrictive policy interventions (reopening) has a positive effect on local credit during the pandemic (**H2c**)
- **Hypothesis 3.** Lending by state-owned banks helps stabilize local credit during the COVID-19 crisis in Brazil

Data sources

We collect the following data **from Jan 2018 to Sep 2020**:

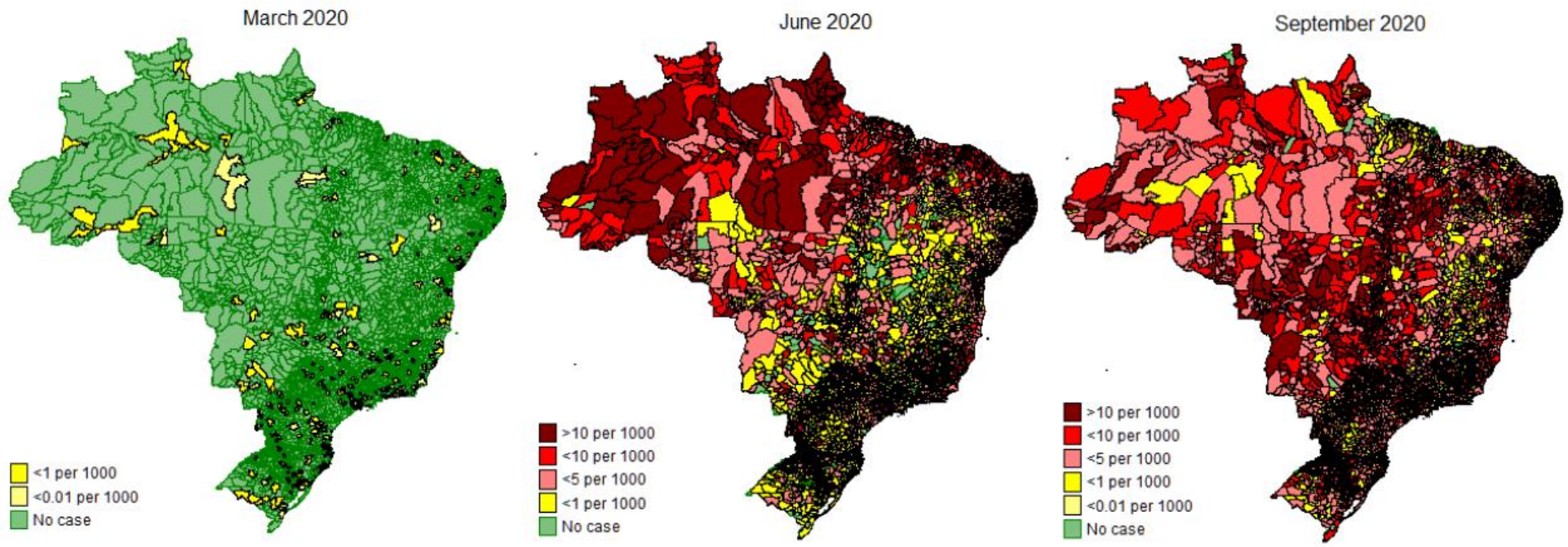
- **COVID-19 data** (municipality level): daily number of new cases and deaths from the Ministry of Health of Brazil
- **Policy intervention data**: hand-collected for 920 metropolitan municipalities from local legislative decrees, official notices (*Diário Oficial*) and health authority/media reports
- **Bank data** (bank-municipality level): ESTBAN data for all commercial banks from Central Bank of Brazil (BCB)
- **Local political and economic data**: local political preference (as instrumental variable) from the Superior Electoral Court of Brazil, IPEA data, CAGED data, and IBGE

COVID-19 new cases, deaths and government policy interventions in Brazil

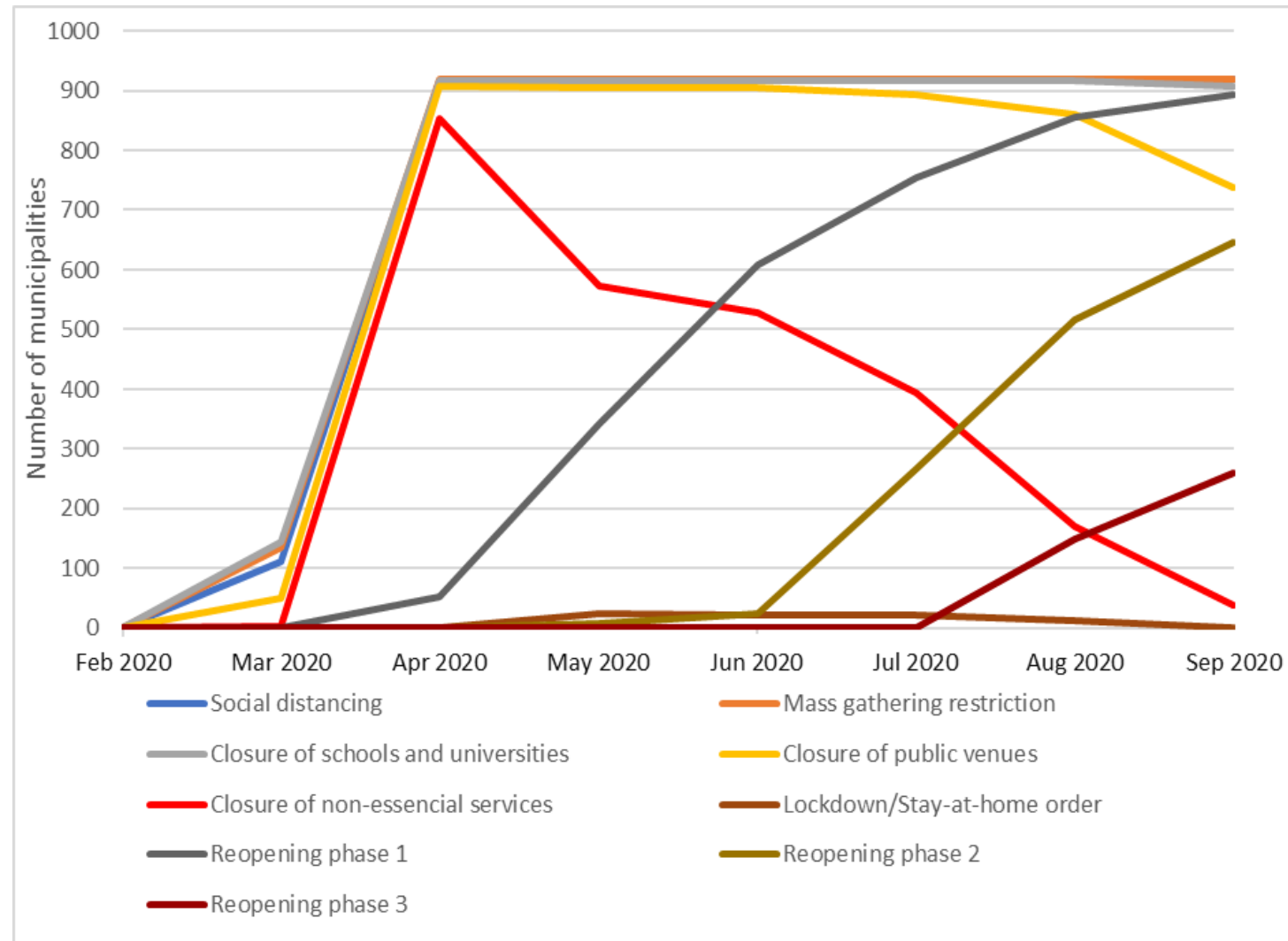


The COVID-19 pandemic in Brazil during 2020

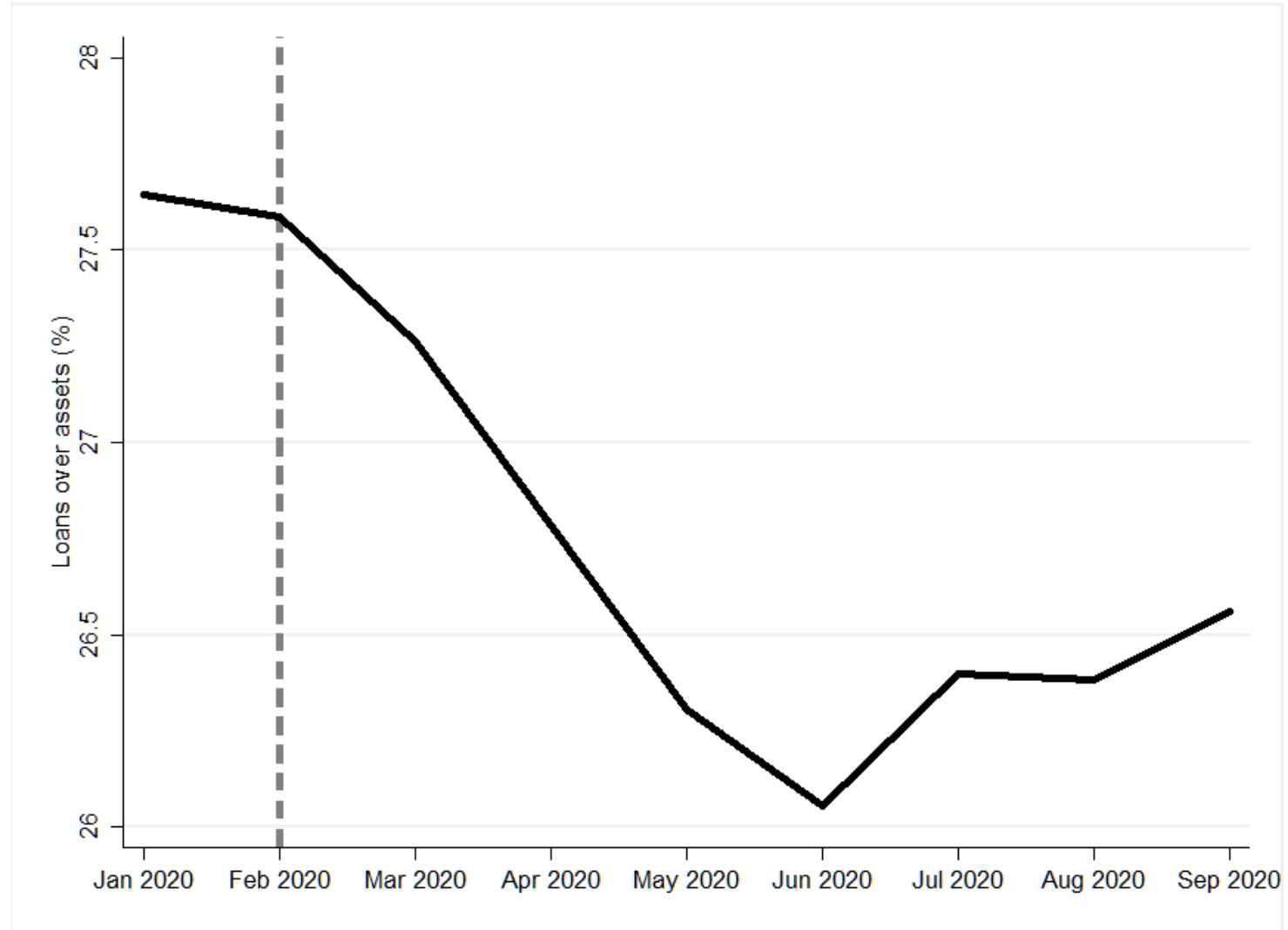
New cases per population as the case severity measure



Number of metropolitan municipalities under individual policy interventions



Local credit in Brazil during Jan 2020 to Sep 2020



Variables

Dependent variable (bank-municipality level)

- *Loans over assets*: ratio of lending amount of bank loans granted over total book assets

Crisis variables (municipality level)

- **Case severity**: *New cases, New cases per 1000 population, Deaths, Deaths per 1000 population*
- **Intervention**: *Soft intervention* (social distancing, mass gathering restrictions, closure of schools and universities), *Hard intervention* (closure of public venues or non-essential services), *Lockdown, Reopen-early phase, Reopen-late phase, Intervention intensity index*

Control variables (bank/municipality/state level)

- **Bank controls**: *Asset growth, Deposits over assets, Loan loss provision ratio, ROA, Liquidity*
- **Local controls**: *HHI deposit, Retail sales index, Average income, Unemployment rate, Labor turnover*

Instrumental variable (municipality level)

- *Political preference*: ratio of popular votes cast for Jair Bolsonaro by voters over total votes in the 2018 Brazilian general election

Summary statistics

Variable	Pre-crisis period			During-crisis period		
	Mean	Std. Dev.	Number of obs.	Mean	Std. Dev.	Number of obs.
Dependent variables						
<i>Loans over assets (%)</i>	28.132	22.477	84,593	26.669	21.658	26,374
Crisis variables						
<i>New cases</i>	0	0	84,593	1.953	8.058	26,374
<i>New cases per population</i>	0	0	84,593	2.810	4.007	26,374
<i>Deaths</i>	0	0	84,593	0.085	0.365	26,374
<i>Deaths per population</i>	0	0	84,593	0.077	0.105	26,374
<i>Soft intervention (SD/MGR/CSU)</i>	0	0	84,593	0.789	0.408	26,374
<i>Hard intervention (CPV/CNES)</i>	0	0	84,593	0.710	0.454	26,374
<i>Lockdown</i>	0	0	84,593	0.015	0.122	26,374
<i>Reopen-early phase</i>	0	0	84,593	0.478	0.500	26,374
<i>Reopen-late phase</i>	0	0	84,593	0.233	0.423	26,374
<i>Intervention intensity</i>	0	0	84,593	0.847	0.864	26,374
Control variables						
Bank controls:						
<i>Asset growth</i>	0.011	0.068	84,593	0.024	0.066	26,374
<i>Deposits over assets</i>	0.301	0.195	84,593	0.318	0.204	26,374
<i>Loan loss provision ratio</i>	0.005	0.011	84,593	0.005	0.011	26,374
<i>ROA</i>	0.014	0.016	84,593	0.011	0.013	26,374
<i>Liquidity</i>	0.018	0.056	84,593	0.016	0.052	26,374
Local controls:						
<i>HHI deposit</i>	0.393	0.195	84,593	0.392	0.193	26,374
<i>Retail sales index</i>	97.463	10.722	84,593	97.923	16.877	26,374
<i>Average income</i>	2.478	0.543	84,593	2.732	0.589	26,374
<i>Unemployment rate (%)</i>	5.606	1.513	84,593	10.922	4.501	26,374
<i>Labor turnover (%)</i>	0.028	0.101	84,593	-0.041	0.246	26,374
Instrumental variable						
<i>Political preference</i>	0.623	0.166	84,593	0.623	0.166	26,374

Methodology

- First, we examine whether and how the COVID-19 pandemic directly affects the local credit in Brazil. We estimate:

$$\text{Loans over assets}_{i,m,t} = \beta_0 + \beta_1 \text{Case severity}_{m,t} + \gamma Z_{i,m,t-1} + v_{i,t} + \theta_s + \varepsilon_{i,m,t}$$

- Second, we examine whether and how the COVID-19 crisis and different policy interventions jointly affect local credit across municipalities over time. We estimate:

$$\begin{aligned} &\text{Loans over assets}_{i,m,t} \\ &= \beta_0 + \beta_1 \text{Case severity}_{m,t} \times \text{Intervention}_{m,t} + \beta_2 \text{Case severity}_{m,t} + \beta_3 \text{Intervention}_{m,t} + \gamma Z_{i,m,t-1} \\ &+ v_{i,t} + \theta_s + \varepsilon_{i,m,t} \end{aligned}$$

- where $v_{i,t}$ are bank-time fixed effects; θ_s are state fixed effects
- Controls lagged to mitigate the potential endogeneity and simultaneity between bank loan lending and local socioeconomic characteristics

Results for local credit using new cases per population and deaths per population as case severity measures

- We find that the coefficients of *Case severity* are negative and statistically significant across case severity measures and regression models
- The economic magnitude estimated of pandemic effect is large, e.g., one death per 1000 local pop. corresponds to a 4.07 percentage points drop in the loans over assets ratio (14.4 percent of the pre-crisis mean)

Dependent variable	<i>Loans over assets (%)</i>			
	(1) <i>New cases per population</i>	(2)	(3) <i>Deaths per population</i>	(4)
<i>Case severity</i>	-0.244*** (0.035)	-0.097*** (0.028)	-19.426*** (1.321)	-4.076*** (0.960)
Bank controls:	No	Yes	No	Yes
Local controls:	No	Yes	No	Yes
Bank-time FE	No	Yes	No	Yes
State FE	No	Yes	No	Yes
Adjusted R-squared	0.001	0.705	0.003	0.705
Number of obs.	110,967	110,967	110,967	110,967

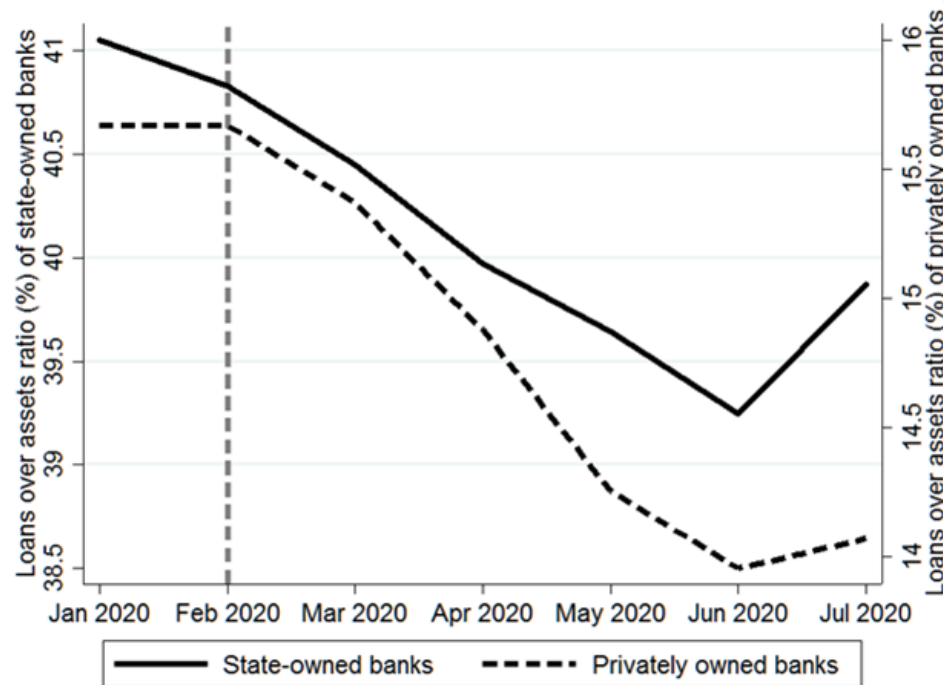
Results for the effects of the government policy interventions on local credit

- Positive effects of the soft interventions and late-stage reopening
- Negative effects of the hard interventions and early-stage reopening

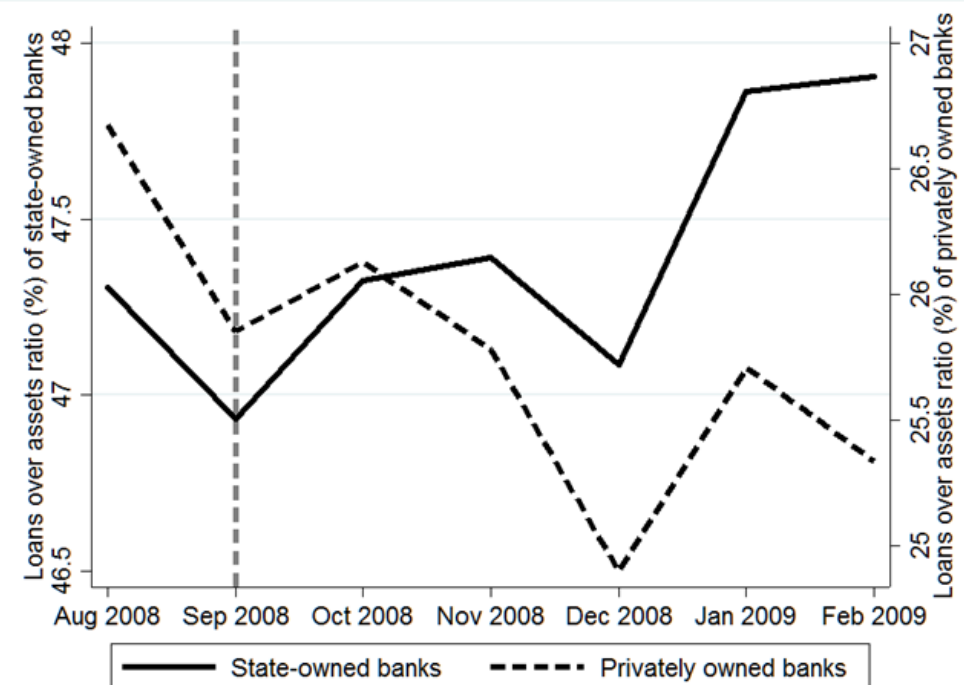
Dependent variable	<i>Loans over assets (%)</i>			
	(1) <i>New cases per population</i>	(2)	(3) <i>Deaths per population</i>	(4)
<i>Soft intervention × Case severity</i>	50.266*** (9.414)		363.266*** (69.919)	
<i>Hard intervention × Case severity</i>	-0.168** (0.085)		-6.577* (3.729)	
<i>Lockdown × Case severity</i>	0.190* (0.095)		5.175* (3.231)	
<i>Reopen-early phase × Case severity</i>	-0.174*** (0.059)		-5.020*** (1.926)	
<i>Reopen-late phase × Case severity</i>	0.108** (0.055)		3.420 (2.219)	
<i>Intervention intensity × Case severity</i>		0.056** (0.023)		2.080** (0.820)
Bank controls	Yes	Yes	Yes	Yes
Local controls	Yes	Yes	Yes	Yes
Bank-time FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Adjusted R-squared	0.705	0.705	0.705	0.705
Number of obs.	110,967	110,967	110,967	110,967

State-owned banks in the COVID-19 crisis vis-à-vis the 2008 Global Financial Crisis

Panel A: State-owned and privately owned banks during the 2020 crisis



Panel B: State-owned and privately owned banks during the 2008 crisis



State-owned banks in the COVID-19 crisis vis-à-vis the 2008 Global Financial Crisis

- We find **state-owned banks grant more local credit than privately owned banks** during both the 2008 crisis and 2020 crisis in Brazil, however, the differential response of state-owned banks is **less pronounced in the 2020 crisis**

Dependent variable	<i>Loans over assets (%)</i>			
	(1)	(2)	(3)	(4)
	<i>2020 COVID-19 Crisis</i>		<i>2008 Financial Crisis</i>	
Panel A: All state-owned and privately owned banks				
<i>State-owned × Post</i>	0.043 (0.148)	0.013 (0.141)	1.768*** (0.220)	0.722*** (0.203)
Bank controls:	No	Yes	No	Yes
Local controls:	No	Yes	No	Yes
Bank FE	No	Yes	No	Yes
Time FE	No	Yes	No	Yes
State FE	No	Yes	No	Yes
Adjusted R-squared	0.339	0.687	0.123	0.632
Number of obs.	39,801	39,801	47,044	47,044

Results for the instrumental variable (IV) analysis: First stage results using *Political preference* as the instrument

We use local pre-pandemic political preference as instrument for local policy interventions, which is pre-determined thus exogenous to the pandemic

- We find *Political preference* is significantly related to policy interventions in five of six models. The signs of coefficients are all as expected
- The IV diagnosis statistics indicate the instrument is econometrically neither irrelevant nor weak

Dependent variable	<i>Soft intervention</i>	<i>Hard intervention</i>	<i>Lockdown</i>	<i>Reopen-early phase</i>	<i>Reopen-late phase</i>	<i>Intervention intensity</i>
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Political preference</i>	0.003 (0.002)	-0.010** (0.004)	-0.004** (0.002)	0.031*** (0.006)	0.040*** (0.006)	-0.078*** (0.010)
<i>Case severity</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Bank controls</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Local controls</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Bank-time FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>State FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.960	0.919	0.140	0.823	0.650	0.804
Number of obs.	110,967	110,967	110,967	110,967	110,967	110,967
IV diagnosis statistics:						
Under-identification test						
Kleibergen-Paap rk LM statistic	1.913	6.506	3.173	30.545	41.796	53.666
Chi-square test P-value	0.167	0.011	0.075	<0.01	<0.01	<0.01
Weak identification test						
Cragg-Donald Wald F statistic	0.930	7.861	3.732	47.375	74.050	87.276

Results for the instrumental variable (IV) analysis: Final stage results with the policy intervention variables

- We confirm our main results are consistent and robust in the IV analysis

Dependent variable	<i>Loans over assets (%)</i>							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<i>New cases</i>		<i>New cases per population</i>		<i>Deaths</i>		<i>Deaths per population</i>	
<i>IV-Soft intervention × Case severity</i>	33.656*** (11.465)		14.509* (8.242)		809.388*** (289.095)		37.586 (338.753)	
<i>IV-Hard intervention × Case severity</i>	-18.093*** (6.079)		-23.798** (10.358)		-528.927** (269.300)		-555.260 (419.833)	
<i>IV-Lockdown × Case severity</i>	-35.614** (15.394)		-8.828 (5.580)		-673.645* (363.900)		39.480 (241.506)	
<i>IV-Reopen-early phase × Case severity</i>	-37.548** (15.464)		-10.375* (5.700)		-719.775** (364.053)		-8.689 (246.884)	
<i>IV-Reopen-late phase × Case severity</i>	5.579* (2.874)		-1.934 (1.352)		86.281 (78.051)		-100.306 (61.153)	
<i>IV-Intervention intensity × Case severity</i>		0.283 (0.356)		0.364*** (0.117)		6.042 (10.181)		2.657 (7.042)
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Local controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.707	0.705	0.707	0.705	0.707	0.705	0.707	0.705
Number of obs.	110,967	110,967	110,967	110,967	110,967	110,967	110,967	110,967

Results for orthogonalization test

We use orthogonalized intervention variables to address the concern on possible collinearity between case severity and intervention implementation

- Our results are also upheld in the orthogonalization test

Dependent variable	<i>Loans over assets (%)</i>							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<i>New cases</i>		<i>New cases per population</i>		<i>Deaths</i>		<i>Deaths per population</i>	
<i>Ortho-Soft intervention × Case severity</i>	-0.021 (0.303)		0.210** (0.096)		-3.448 (15.221)		5.071 (3.952)	
<i>Ortho-Hard intervention × Case severity</i>	-0.180** (0.086)		-0.204** (0.084)		-7.229** (3.705)		-7.753** (3.719)	
<i>Ortho-Lockdown × Case severity</i>	0.155* (0.097)		0.142 (0.096)		3.683 (3.725)		-1.487 (3.556)	
<i>Ortho-Reopen-early phase × Case severity</i>	-0.182*** (0.059)		-0.203*** (0.059)		-5.325*** (1.898)		-4.972** (1.936)	
<i>Ortho-Reopen-late phase × Case severity</i>	0.101* (0.054)		0.118** (0.053)		3.271 (2.233)		2.922 (2.119)	
<i>Ortho-Intervention intensity × Case severity</i>		0.041* (0.025)		-0.019 (0.018)		2.165** (0.878)		-0.732 (0.798)
<i>Case severity</i>	0.156 (0.225)	-0.097** (0.040)	-0.256*** (0.083)	-0.104*** (0.029)	7.283 (12.122)	-4.864*** (1.728)	-9.757*** (3.084)	-3.884*** (1.019)
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Local controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.705	0.705	0.705	0.705	0.705	0.705	0.705	0.705
Number of obs.	110,967	110,967	110,967	110,967	110,967	110,967	110,967	110,967

Further checks and robustness tests

- **Sectoral dependence of local credit:** We find the crisis and policy interventions have a larger negative impact on local credit to the agriculture sector → further suggests a potential credit reallocation channel between rural agriculture sector and urban corporate and housing sectors under different policy interventions
- **Duration and reaction speed:** The effects are stronger with longer intervention duration and higher intervention speed
- **Placebo tests:** We show our results are not driven by unobserved contemporaneous shocks or random local and temporal confounders in the data, using placebo explanatory variables which are similarly distributed but with randomly assigned values

Conclusions

We investigate whether and how the COVID-19 pandemic and ensuing policy interventions impact the local credit in Brazil. We find:

- Consistent evidence that the COVID-19 pandemic has a significantly negative impact on local credit
- The policy interventions in response to the COVID-19 pandemic have heterogeneous effects on local credit
- Positive effects of soft interventions (less restrictive interventions on individuals such as SD and MGR) and late-stage reopening
- Negative effects of hard interventions (more restrictive interventions focused on local economic activities such as CPV and CNES), and early-stage reopening
- State-owned banks grant more local credit than privately owned banks during the COVID-19 crisis but this difference is less pronounced than it was in the 2008 Financial Crisis
- The evidence suggests clear policy implications