Pandemic Lending: The Unintended Effects of Model-based Regulation

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Motivation

- Bank lending is inherently pro-cyclical (Rajan, 1994)
  - **Model-based capital regulation** contributes to this

- Basel II was a major change in regulation since it introduced *risk-based capital requirements*. Banks can use:
  - Standardised Approach (SA): fixed risk-weights
  - Internal Ratings-Based (IRB) approach: risk-weights calculated by banks

Motivation

- Issues with Basel II approach
  - Incentives
  - Modelling
  - Cyclicality
- To smooth cyclicality standardization of models and adjustments of through-the-cycle PDs are implemented
- But "such models are useful for measuring the risk of frequent small events but not for systematically important events" (Danielsson et al, 2001)

This paper

Does model-based regulation induce a "credit crunch" at a time of crisis?
Yes, it does.

- **Setting:** Euro Area banks 2019Q2-2020Q3
- **Shock:** Covid-19 Pandemic, exogenous shock, not a financial crisis
- **Data:**
  - Novel and extensive confidential supervisory dataset
- **Empirical Strategy**
  - Bank-level
  - Borrower-level using a global sample of non-financial corporations

Contribution / 1

- **Lending During Crises**
  - Ivashina and Scharfstein (2010); Puri et al. (2011); De Haas and Van Horen (2013); Popov and Van Horen (2015); Berrospide et al. (2021)
  - Lending during an exogenous shock, not a financial/banking crisis

- **Capital Requirements and Lending**
  - Bridges et al. (2014); Aiyar et al. (2014); De Marco and Wieladek (2015); Mésonnier and Monks (2015); Jiménez et al. (2017); Acharya et al. (2018); Gropp et al. (2019); Cortés et al. (2020); Fraisse et al. (2020); De Jonghe et al. (2020)
  - Binding capital constraints not linked to a supervisory decision

Contribution / 2

- **Model-Based Capital Regulation**
  - Induce cyclicality (Repullo and Suarez (2013))
  - IRB banks report lower credit risk, and less lending, for same borrower (Plosser and Santos (2014); Behn et al. (2016); Bruno et al. (2017))

  - Bank perspective is important: IRB includes credit, market, operational risk and correlations/ pools
  - Shock to the same borrower
  - International sample
  - Supervisors assessments

Preview of Results

- IRB banks reduced lending by more than SA banks
- Credit was reduced more to borrowers absorbing more capital
- Credit was reduced more to borrowers in sectors more affected by the pandemic
- Suggestive evidence that IRB models better evaluated by supervisors induce more credit restrictions in face of a large shock

Data

- **Bank-level Data**
  - Supervisory data from the European Central Bank
  - Ultimate Parents and Stand Alone banks with assets over 1 billion euros
  - Banks are classified as IRB or SA according to the approach used for credit and market risk ▸ Sample ▸ Summary Statistics

- **Borrower-level Data**
  - Supervisory data from the European Central Bank
  - Large Exposures data $\geq$€300 million
  - Wide dataset of global borrowers

Bank-level

Difference-in-Differences regression using **bank-level data**:

$$\begin{aligned}\Delta Log(Y)_{i,t} = \beta_1 Post_t + \beta_2 IRB_i + \beta_3 Post_t \times IRB_i + \beta_4 X_{i,t} + Bank_i \\ + Country_i \times Time_t + \epsilon_{i,t}\end{aligned} \tag{1}$$

- Outcome variable: quarterly growth rate of the exposures of bank i in quarter t
- $IRB_i = 1$ for banks using internal models
- $Post_t = 1$ for for pandemic period
- $X_{i,t}$: Log Assets, Equity Ratio(%), ROA(%), Deposit Ratio(%), RWA Density(%)
- $Bank_i$ are bank fixed effects. $Country_i \times Time_t$ are demand fixed effects.
- We verify the parallel trend assumption. ▸ Parallel Trend

Loans

	(1)	(2)	(3)	(4)
	On-Balance Sheet	Total Loans	Loans to NFC	Loans to non-NFC
$Post_t \times IRB\_CR_i$	**-0.0110*** **	**-0.0073** **	**-0.0162*** **	**0.0170*** **
	(0.0039)	**(0.0030)**	**(0.0041)**	**(0.0064)**
Observations	1,522	1,522	1,522	1,522
R-squared	0.4004	0.3826	0.4305	0.3520
Bank FE	Yes	Yes	Yes	Yes
Country*Time FE	Yes	Yes	Yes	Yes

Dependent variables expressed as quarterly growth rates. Clustered Standard Errors at bank-level. ▸ Full Table

Securities Investments

	(1)	(2)	(3)	(4)	(5)	(6)
	Total Securities	Securities of NFC	Securities of non-NFC	Total Securities	Securities of NFC	Securities of non-NFC
$Post_t \times IRB\_CR_i$	-0.0105	**-0.0583*** **	-0.0067			
	(0.0116)	**(0.0188)**	(0.0124)			
$Post_t \times IRB\_MR_i$				-0.0166	**-0.0844*** **	-0.0073
				(0.0116)	**(0.0251)**	(0.0127)
Observations	996	996	996	996	996	996
R-squared	0.4129	0.3442	0.4122	0.4077	0.3199	0.4055
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Country*Time FE	Yes	Yes	Yes	Yes	Yes	Yes

Dependent variables expressed as quarterly growth rates. Clustered Standard Errors at bank-level. ▸ Full Table

Off-Balance Sheet Credit

	(1)	(2)	(3)	(4)
	Total Off-Balance Sheet	Off-Balance Sheet to NFC	Total Loan Commitments	Loan Commitments to NFC
$Post_t \times IRB\_CR_i$	**0.0156***	**0.0235****	**0.0158***	**0.0265****
	(0.0084)	**(0.0111)**	**(0.0085)**	**(0.0131)**
Observations	1,446	1,446	1,446	1,446
R-squared	0.2687	0.2365	0.2830	0.2493
Bank FE	Yes	Yes	Yes	Yes
Country*Time FE	Yes	Yes	Yes	Yes

Total Off-Balance Sheet= Loan Commitments + Financial Guarantees + Other Commitments

Dependent variables expressed as quarterly growth rates. Clustered Standard Errors at bank-level. ▸ Full Table

Borrower-level

Difference-in-Differences regression using **borrower-level data**:

$$\begin{aligned}\Delta Log(Y)_{i,t,j} = \beta_1 Post_t + \beta_2 IRB_i + \beta_3 Post_t \times IRB_i + \beta_4 X_{i,t} \\ + Bank_i + Firm_j + Country_j \times Time_t + \epsilon_{i,t}\end{aligned} \tag{2}$$

- Outcome Variable: quarterly growth rate of the exposures of bank i, to firm j at time t.
- IRB_i=1 for banks using internal models for *corporate* credit risk
- $Post_t = 1$ for pandemic period.
- $Bank_i$ and $Firm_j$ are bank and firm fixed effects; $Country_i \times Time_t$ are demand fixed effects.
- Identification settings based on multiple-lending relationships:
  - Multi-bank Firms (at least one SA and one IRB bank)

Reduction in loans to same borrower

- Do IRB banks reduce lending more than SA banks to the same borrower?

Table: Multiple Lending Relationships (at least one SA and one IRB bank)

	(1)	(2)	(3)	(4)	(5)	(6)
	Total On Balance Sheet			**Loans and Securities**		
$Post_t \times IRB\_CR_i$	-0.0347	**-0.0434***	**-0.0609****	**-0.0485***	**-0.0643****	**-0.0805****
	(0.0210)	**(0.0246)**	**(0.0267)**	**(0.0276)**	**(0.0314)**	**(0.0373)**
$Post_t$	0.0079	-0.0043		0.0153	-0.0050	
	(0.0157)	(0.0201)		(0.0236)	(0.0289)	
IRB_CR_i	0.0034			0.0017		
	(0.0164)			(0.0209)		
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,430	1,430	1,430	1,430	1,430	1,430
R-squared	0.0273	0.0462	0.1105	0.0322	0.0585	0.1188
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	Yes	No	Yes	Yes
Country*Time FE	No	No	Yes	No	No	Yes

Dependent variables expressed as quarterly growth rates. Clustered Standard Errors at bank-level.

▸ Results for Full Sample

Borrower Selection

1. Do IRB banks reduce lending to borrowers absorbing more capital? **Yes** ▸ Credit Risk Mitigation
2. Do IRB banks reduce lending to borrowers in the most affected sector? **Yes**
3. Do IRB banks reduce lending to foreign borrowers more than to domestic borrowers? **No evidence**
4. Do IRB banks with a greater portion of corporate portfolio under IRB reduce lending more? **Yes**

For identification, we divide the IRB sample in banks with Low and High capital ▸ Parallel Trend ▸ Results

Large Exposures Lending - Borrowers Selection

	(1)	(2)	(3)	(4)	(5)	(6)
	Total On Balance Sheet			**Loans and Securities**		
Panel A. Credit Risk Mitigation						
$Post_t \times LowCap_i \times CRM_j$	**-0.1067*** **	**-0.1091*** **	**-0.1340*** **	**-0.1330*** **	**-0.1125*** **	**-0.1346*** **
	(0.0386)	**(0.0384)**	**(0.0395)**	**(0.0395)**	**(0.0363)**	**(0.0382)**
Panel B. Sectoral Exposures						
$Post_t \times LowCap_i \times Most\_Affected_j$	**-0.0371***	-0.0365	-0.0294	**-0.0520** **	**-0.0499** **	**-0.0412** **
	(0.0221)	(0.0222)	(0.0237)	**(0.0198)**	**(0.0193)**	**(0.0201)**
Panel C. Domestic Borrowers						
$Post_t \times LowCap_i \times Domestic_j$	0.0060	0.0042	-0.0174	0.0334	0.0303	0.0101
	(0.0377)	(0.0384)	(0.0397)	(0.0347)	(0.0354)	(0.0381)
Panel D. Weight of IRB Corporate Portfolio						
$Post_t \times LowCap_i \times IRB\_Weight_i$	0.0078	0.0146	0.0182	**-0.0462***	**-0.0416** **	**-0.0370***
	(0.0302)	(0.0426)	(0.0312)	**(0.0263)**	**(0.0196)**	**(0.0201)**
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,082	8,082	8,082	8,082	8,082	8,082
R-squared	0.0448	0.0542	0.0960	0.0407	0.0469	0.0904
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	Yes	No	Yes	Yes
Country*Time FE	No	No	Yes	No	No	Yes

Supervisory Assessment

- For identification we use the findings of the ECB's Targeted Review of Internal Model (TRIM): a large scale supervisory exercise to improve standardization of internal models
- Supervisors rated the internal models used by banks (reliable and comparable)
- Worse rated models through-the-cycle reduced lending the least

Supervisory Assessment

- *High_Severity*$_i$ =1 for banks receiving a *severe* finding (severity F3 or F4) from TRIM investigations for the topic "Downturn LGD"

	(1)	(2)	(3)
		Loans and Securities	
Post$_t$ × *High_Severity*$_i$	**0.0545***	**0.0842****	**0.0881****
	(0.0301)	**(0.0353)**	**(0.0369)**
Post$_t$	**-0.1461*****	**-0.2524*****	
	(0.0396)	**(0.0573)**	
High_Severity$_i$	-0.0277		
	(0.0243)		
Bank Controls	Yes	Yes	Yes
Observations	4,956	4,956	4,956
R-squared	0.0451	0.0503	0.1168
Firm FE	Yes	Yes	Yes
Bank FE	No	Yes	Yes
Country*Time FE	No	No	Yes

Dependent variables expressed as quarterly growth rates. Clustered Standard Errors at country*time-level.

Takeaways

- Empirical evidence that IRB models constrain lending during crisis periods when borrowers need it the most

- IRB banks lend less to the same borrowers during Covid-19
- Supervisory assessment might be exacerbating cyclicality under extreme events
- Provide empirical support for the implementation of a floor for the output from internal models
  - Basel 3.5 to be fully implemented by 2027 "as a back-stop to reduce excessive variability of risk-weighted assets and to make risk-weighted capital ratios more comparable"

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Background Slides

Sample Composition

Number of banks by country according to the approach used for credit and market risk

		Credit Risk		Market Risk	
Country	Total	SA	IRB	SA	IRB
Austria	20	17	3	18	2
Belgium	8	3	5	6	2
Cyprus	3	3	-	3	-
Germany	94	77	17	87	7
Estonia	3	1	2	3	-
Finland	10	6	4	10	1
France	16	9	7	11	5
Greece	6	5	1	6	3
Ireland	5	2	3	5	-
Italy	32	23	9	29	3
Latvia	4	2	2	4	-
Lithuania	3	1	2	3	-
Luxembourg	9	6	3	9	-
Malta	2	2	-	2	-
Netherlands	12	6	6	8	4
Portugal	6	5	1	5	1
Spain	22	16	6	19	3
Total	255	184	71	224	31

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Summary Statistics

	SA				IRB			
Variable	N	Mean	Median	Std. Dev.	N	Mean	Median	Std. Dev.
Panel A. Outcome Variables at Bank-level (Growth Rates)								
On-Balance Sheet	1096	0.0111	0.0092	0.0295	426	0.0053	0.0054	0.0304
Total Loans	1096	0.0098	0.0102	0.0247	426	0.0031	0.0045	0.0279
Loans to NFC	1096	0.0113	0.0102	0.0344	426	0.0057	0.0079	0.0346
Loans to non-NFC	1096	0.0235	0.0187	0.0546	426	0.0229	0.0195	0.0563
Total Securities	636	0.0166	0.0031	0.0821	360	0.0041	0.0007	0.0673
Securities of NFC	636	-0.0006	0.0015	0.1448	360	0.0067	0.0021	0.1471
Securities of non-NFC	636	0.0172	0.0037	0.0873	360	0.0039	0.0008	0.0686
Off-Balance Sheet	1032	0.0148	0.0129	0.0679	414	0.0099	0.0105	0.0624
Off-Balance Sheet to NFC	1032	0.0159	0.0127	0.0936	414	0.0074	0.0112	0.0751
Off-Balance Sheet to non-NFC	1032	0.0137	0.0071	0.1051	414	0.0059	0.0094	0.0894
Loan Commitments	1032	0.0151	0.0117	0.073	414	0.0136	0.0145	0.068
Loan Commitments to NFC	1032	0.0195	0.0112	0.1129	414	0.0139	0.0114	0.089
Loan Commitments to non-NFC	1032	0.0133	0.0071	0.0998	414	0.0068	0.0105	0.0887
Panel B. Outcome Variables at Loan-level (Growth Rates)								
On-Balance Sheet	1238	0.0093	0.0053	0.0905	11370	0.0044	-0.0002	0.2847
Loans and Securities	1238	0.0077	0.0003	0.1033	11370	0.0086	-0.0012	0.3193
Panel C. Control Variables								
Total Assets (Log)	1096	23.0254	22.8684	0.8386	426	25.2941	25.1425	1.5548
Equity Ratio (%)	1096	8.9649	8.7353	2.9841	426	7.6064	6.7503	2.9148
ROA (%)	1096	0.4317	0.4121	0.3323	426	0.4862	0.3951	0.3710
Deposit Ratio (%)	1096	85.1038	92.7199	18.1706	426	72.5229	72.3186	16.1254
RWA Density (%)	1096	38.3702	39.7388	10.6712	426	26.2193	25.1707	7.0028

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Parallel Trend

The choice of being IRB or SA is not random, but the two types of banks are comparable before the shock

		(1)	(2)	(3)	(4)	(5)
Variable	**Time**	**SA**	**IRB**	**Mean SA**	**Mean IRB**	**Difference**
Panel A. Pre-treatment Mean Comparison						
Loans to NFC	2019Q2	184	71	0.0120	0.0155	-0.0035
Loans to NFC	2019Q3	184	71	0.0115	0.0060	0.0055
Loans to NFC	2019Q4	184	71	0.0070	0.0065	0.0005
Loans to NFC	2020Q1	184	71	0.0145	0.0185	-0.0045
Panel B. Post-treatment Mean Comparison						
Loans to NFC	2020Q2	184	71	0.0130	0.0010	**0.0120****
Loans to NFC	2020Q3	184	71	0.0123	-0.0135	**0.0235*****

Note: Loans to NFC is expressed as quarterly growth rate.

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Results - **Loans (Complete Results)**

	(1)	(2)	(3)	(4)
	On-Balance Sheet	Total Loans	Loans to NFC	Loans to non-NFC
$Post_t \times IRB\_CR_i$	-0.0110***	-0.0073**	-0.0162***	0.0170***
	(0.0039)	(0.0030)	(0.0041)	(0.0064)
$Log(Assets)_{i,t}$	0.1174***	0.0781***	0.0046	0.2909***
	(0.0037)	(0.0240)	(0.0319)	(0.0471)
$Equity\_Ratio_{i,t}$	0.0032	0.0025	-0.0009	-0.0018
	(0.0029)	(0.0027)	(0.0029)	(0.0051)
$ROA_{i,t}$	-0.0068	-0.0037	-0.0105*	0.0171
	(0.0070)	(0.0055)	(0.0059)	(0.0125)
$Deposit\_Ratio_{i,t}$	-0.0012*	-0.0003	-0.0004	0.0000
	(0.0005)	(0.0004)	(0.0005)	(0.0009)
$RWA\_Density_{i,t}$	-0.0007	0.0001	0.0018**	-0.0045***
	(0.0008)	(0.0006)	(0.0009)	(0.0016)
Observations	1,522	1,522	1,522	1,522
R-squared	0.4004	0.3826	0.4305	0.3520
Bank FE	Yes	Yes	Yes	Yes
Country*Time FE	Yes	Yes	Yes	Yes

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Results - **Securities Investments (Complete Results)**

	(1)	(2)	(3)	(4)	(5)	(6)
	Total Securities	Securities of NFC	Securities of non-NFC	Total Securities	Securities of NFC	Securities of non-NFC
$Post_t \times IRB\_CR_i$	-0.0105	-0.0583***	-0.0067			
	(0.0116)	(0.0188)	(0.0124)			
$Post_t \times IRB\_MR_i$				-0.0166	-0.0844***	-0.0073
				(0.0116)	(0.0251)	(0.0127)
$Log(Assets)_{i,t}$	0.1042	-0.1462	0.1059	0.1018	-0.1938*	0.1117
	(0.0650)	(0.1128)	(0.0691)	(0.0673)	(0.1144)	(0.0698)
$Equity\_Ratio_{i,t}$	-0.0008	-0.0474***	0.0034	0.0013	-0.0458***	0.0055
	(0.0072)	(0.0156)	(0.0071)	(0.0070)	(0.0159)	(0.0067)
$ROA_{i,t}$	-0.0239	0.0345	-0.0365	-0.0279	0.0345	-0.0389
	(0.0256)	(0.0331)	(0.0277)	(0.0243)	(0.0322)	(0.0263)
$Deposit\_Ratio_{i,t}$	-0.0024*	-0.0009	-0.0025**	-0.0028**	-0.0016	-0.0029**
	(0.0012)	(0.0025)	(0.0013)	(0.0013)	(0.0026)	(0.0013)
$RWA\_Density_{i,t}$	-0.0050*	0.0093**	-0.0059**	-0.0047*	0.0074*	-0.0053**
	(0.0025)	(0.0042)	(0.0026)	(0.0024)	(0.0039)	(0.0024)
Observations	996	996	996	996	996	996
R-squared	0.4129	0.3442	0.4122	0.4077	0.3199	0.4055
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Country*Time FE	Yes	Yes	Yes	Yes	Yes	Yes

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Results - **Off-Balance Sheet (Complete Results)**

	(1) Total Off-Balance Sheet	(2) Off-Balance Sheet to NFC	(3) Off-Balance Sheet to non-NFC	(4) Total Loan Commitments	(5) Loan Commitments to NFC	(6) Loan Commitments to Non-NFC
$Post_t \times IRB\_CR_i$	0.0156*	0.0235**	0.0246**	0.0158*	0.0265**	0.0220**
	(0.0084)	(0.0111)	(0.0122)	(0.0085)	(0.0131)	(0.0107)
$Log(Assets)_{i,t}$	0.0517	0.0548	0.1448	0.0020	0.0528	0.0625
	(0.0628)	(0.0804)	(0.0988)	(0.0630)	(0.0935)	(0.0825)
$Equity\_Ratio_{i,t}$	0.0069	0.0186*	0.0127	0.0067	0.0244*	0.0115
	(0.0063)	(0.0107)	(0.0094)	(0.0059)	(0.0128)	(0.0086)
$ROA_{i,t}$	0.0083	-0.0049	-0.0125	0.0038	-0.0099	-0.0155
	(0.0157)	(0.0198)	(0.0250)	(0.0178)	(0.0246)	(0.0224)
$Deposit\_Ratio_{i,t}$	-0.0005	-0.0004	-0.0022	-0.0014	-0.0025*	-0.0021
	(0.0011)	(0.0012)	(0.0019)	(0.0013)	(0.0014)	(0.0018)
$RWA\_Density_{i,t}$	-0.0028	-0.0042*	-0.0019	-0.0024	-0.0049	-0.0004
	(0.0019)	(0.0025)	(0.0026)	(0.0019)	(0.0030)	(0.0023)
Observations	1,446	1,446	1,446	1,446	1,446	1,446
R-squared	0.2687	0.2365	0.2310	0.2830	0.2493	0.2329
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Country*Time FE	Yes	Yes	Yes	Yes	Yes	Yes

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Large Exposures Lending - **Baseline (1)**

- Do IRB banks reduce lending more than SA banks?

Table: All bank-firm relationships (Single and Multiple Lending relationships)

	(1)	(2)	(3)	(4)	(5)	(6)
	Total On Balance Sheet			**Loans and Securities**		
Full Sample						
$Post_t \times IRB\_CR_i$	-0.0248*	-0.0247**	-0.0233*	-0.0296**	-0.0201*	-0.0211
	(0.0144)	(0.0105)	(0.0127)	(0.0145)	(0.0121)	(0.0157)
$Post_t$	-0.0404***			-0.0525***		
	(0.0118)			(0.0132)		
IRB_CR_i		0.0095			0.0108	
		(0.0125)			(0.0110)	
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,608	12,608	12,608	12,608	12,608	12,608
R-squared	0.0216	0.1498	0.1571	0.0160	0.1454	0.1519
Bank FE	Yes	No	Yes	Yes	No	Yes
Sector*Country*Time FE	No	Yes	Yes	No	Yes	Yes

Dependent variables expressed as quarterly growth rates. Clustered Standard Errors at bank-level.

Large Exposures - Reduction in loans to same borrower

- Do IRB banks reduce lending more than SA banks to the same borrower?

Table: Multiple Lending Relationships

	(1)	(2)	(3)	(4)	(5)	(6)
	Total On Balance Sheet			**Loans and Securities**		
$Post_t \times IRB\_CR_i$	**-0.0599*** **	**-0.0464** **	**-0.0650*** **	**-0.0628*** **	**-0.0635** **	**-0.0724** **
	(0.0173)	**(0.0230)**	**(0.0206)**	**(0.0232)**	**(0.0298)**	**(0.0291)**
$Post_t$	0.0062	-0.0293		0.0054	-0.0444	
	(0.0160)	(0.0236)		(0.0222)	(0.0294)	
IRB_CR_i	**0.0628*** **			**0.0505*** **		
	(0.0193)			**(0.0164)**		
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,522	8,522	8,522	8,522	8,522	8,522
R-squared	0.0447	0.0542	0.0978	0.0401	0.0477	0.0931
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	Yes	No	Yes	Yes
Country*Time FE	No	No	Yes	No	No	Yes

Dependent variables expressed as quarterly growth rates. Clustered Standard Errors at bank-level.

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Parallel Trend- **Low vs High Capitalized Banks**

- $LowCap_i$=1 if IRB bank is in the first tercile of CET1 distribution

	Time	High	Low	Mean High	Mean Low	Diff
Panel A. Pre-treatment Mean Comparison						
Loans to NFC	2019Q2	31	17	0.0145	0.0165	-0.0021
Loans to NFC	2019Q3	31	17	0.0123	0.0034	0.0075
Loans to NFC	2019Q4	31	17	0.0015	0.0075	-0.0077
Loans to NFC	2020Q1	31	17	0.0186	0.0265	-0.0085
Panel B. Post-treatment Mean Comparison						
Loans to NFC	2020Q2	31	17	0.0025	0.0225	**-0.0298***
Loans to NFC	2020Q3	31	17	-0.0070	-0.0227	0.0158

Note: Loans to NFC is expressed as quarterly growth rate. Back

Large Exposures Lending - **Low vs High Capitalized Banks**

- Do low capitalized IRB banks reduce lending more than high capitalized IRB banks to the same borrower?
- $LowCap_i$=1 if IRB bank is in the first tercile of CET1 distribution

	(1)	(2)	(3)	(4)	(5)	(6)
	Total On Balance Sheet			**Loans and Securities**		
$Post_t \times LowCap_i$	-0.0217	-0.0204	-0.0268	**-0.0414*** **	**-0.0369** **	**-0.0355***
	(0.0146)	(0.0249)	(0.0187)	**(0.0117)**	**(0.0180)**	**(0.0183)**
$Post_t$	**-0.0377*** **	**-0.0649** **		**-0.0342*** **	**-0.0945*** **	
	(0.0082)	**(0.0247)**		**(0.0075)**	**(0.0189)**	
$LowCap_i$	-0.0000			**0.0196** **		
	(0.0104)			**(0.0090)**		
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,082	8,082	8,082	8,082	8,082	8,082
R-squared	0.0457	0.0539	0.0959	0.0411	0.0470	0.0905
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	Yes	No	Yes	Yes
Country*Time FE	No	No	Yes	No	No	Yes

Dependent variables expressed as quarterly growth rates. Clustered Standard Errors at bank-level.

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Large Exposures Lending - Credit Risk Mitigation

- Define an indicator of Credit Risk Mitigation:

$$CRM_j = \frac{Exposure\ after\ CRM}{Original\ Exposure}$$

  - A value close to 1 implies a lower role of CRM techniques (i.e., a riskier exposure, absorbing more capital)
  - Calculated as of 2019Q2 as a proxy for the riskiness of the exposures pre-shock

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