The COVID-19 Shock and Firm Financing: Government or Market? Or Both?

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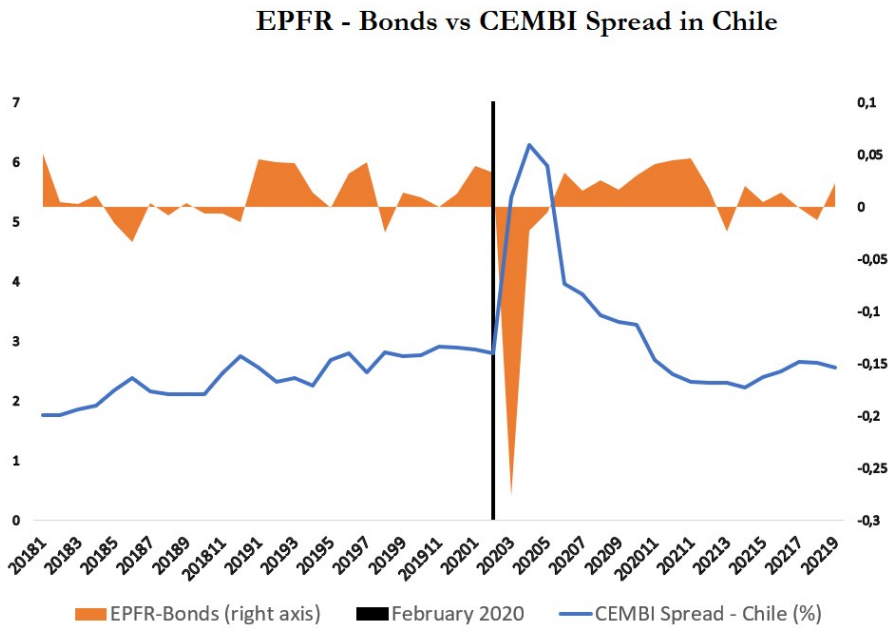
[1]Disclaimer: views do not correspond to those of the Central Bank of Chile or its board members.

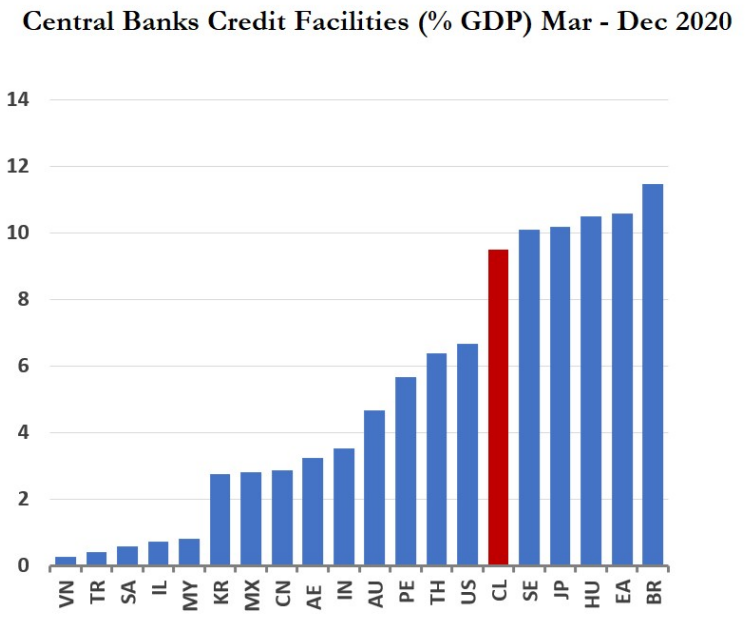
Motivation

- The **COVID-19 shock** has propagated to economies through various channels
- One strand of literature: how **firms** coped with this shock & role of **policies** (see Alfaro et al. 2020; Gourinchas et al. 2021; Albagli et.al 2021, among others)
- Another strand: large movements in cross-border **capital flows** brought about by the pandemic, (Kalemli-Özcan 2020; BIS 2020/21, IMF 2020/21, among others)
- **How did firms react to the sudden drying out of international capital markets? Were they able to adjust their finance mix between international and domestic finance? To what extent was this related to credit support policies implemented?**

Motivation

Providing answers to these questions is of **first order importance** for small open economies: Chile's case provides a good illustration





What we do

- We provide **answers** to these questions using **data** on Chilean firms and **economic theory**:
  1. Empirical analysis: Unique administrative dataset that allow us to study the **full spectrum of the finance mix for the universe of firms** in Chile & the **effect of credit support policies** via RDD analysis
  2. Theoretical analysis: Model with heterogeneous firms and financial frictions to rationalize the **key channels** behind drivers of firms' finance mix in the wake of COVID and the role played by **credit support policies**

What we find

- Empirical analysis:
  1. **Change in the finance mix**: firms moved away from foreign debt into domestic debt
  2. **Causal link from credit policies**, namely firms' eligibility to loans with sovereign guarantees
- Theoretical analysis:
  1. Model stresses the role of **financial frictions** in the mechanism of debt substitution
  2. Underscores the role of policies also: **complementarity** between liquidity provisions by the central bank & sovereign guarantees on bank loans to firms

Data

Massive effort by the CBCh in a repository with (anonymized) administrative datasets for policy & research:

1. Capital Inflows: universe of borrowing transactions (bonds & loans) between firms and foreign lenders (spreads, loan amounts, etc)
2. Credit registry: Universe of domestic stock and flows of firms' bank debt (rates, loan amounts, etc.). Includes loans under credit support programs after COVID
3. Bond Issuance: universe of firms' bond issuance in the domestic financial market.
4. Production: tax forms for the universe of firms' sales and expenditures

Monthly merged dataset, 2012-2020: 2M observations; 300.000 firms Filters Descriptive Stats

Credit Support Policies

- **Credit support** was an **essential element** of the policy package deployed to minimize the economic scarring effects of COVID in Chile
- **Two pillars** of the credit support programs were
  1. FCIC: a novel **credit line facility** from the central bank to commercial banks conditional on the growth of credit issuance, particularly to small and medium firms

     The facility provided USD40 billions to commercial banks and accounted for the unprecedented 10% GDP increase of the CB balance sheet
  2. FOGAPE-COVID: **sovereign guarantees** on commercial banks' loans to firms below a chosen pre-determined size

Credit Support Policies: FOGAPE-COVID

- FOGAPE dates back to 1980, through which government resources are used as a fraction of collateral for credits taken by small firms
- Eligibility to borrow under the program depends on yearly sales
- On **April 25, 2020, the government launched the FOGAPE-COVID** program which included a massive recapitalization of the fund guaranteeing up to 9% of GDP in credits
- Crucially, FOGAPE-COVID relaxed the cutoff required to access the typical FOGAPE credits

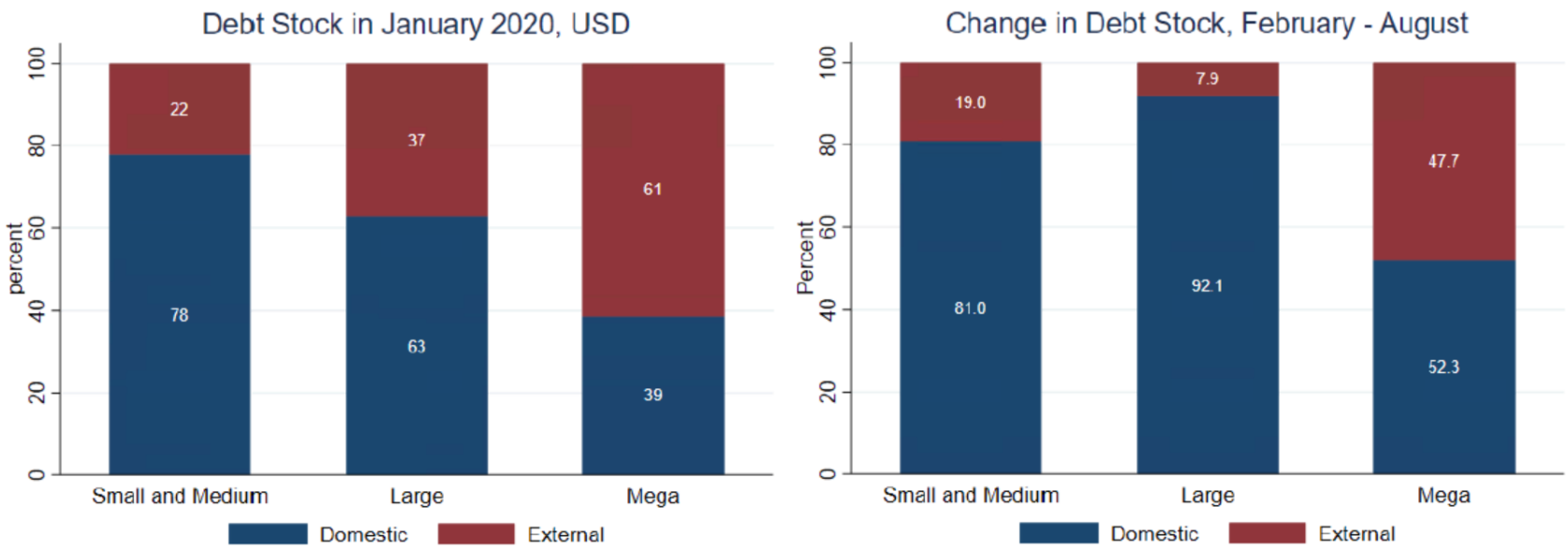
Credit Support Policies: FOGAPE-COVID

Table: **FOGAPE in January 2020 Vs FOGAPE-COVID in April 2020**

	FOGAPE - Jan 2020	FOGAPE-COVID - April 2020
Fund capitalization (USD Millions)	100	3,000
Interest rate (CHP)	Market	MPR+3%
Max. annual sales eligibility threshold (UF)	350,000	1,000,000
	Fraction guaranteed/maximum loan value	
Sales range (UF)	Jan-20	May-20
0 - 25,000	80% - 5,000 UF	85% - 6,250 UF
25,000 - 100,000	50% - 15,000 UF	80% - 25,000 UF
100,000 - 350,000	30% - 50,000 UF	70% - 150,000 UF
350,000 - 600,000	Non elegible	70% - 150,000 UF
600,000 - 1,000,000	Non elegible	60% - 250,000 UF
$>$ 1,000,000	Non elegible	Non elegible

Descriptive Stats.

Figure: **Firms' Finance Mix in Chile: Before & During COVID**



Regression Discontinuity Design (RDD) Analysis

- RDD: causal effect of becoming eligible to receive a FOGAPE-COVID credit on firms' domestic debt share mix
- Natural approach: **exogenous changes** in the sales' thresholds required for eligibility to FOGAPE-COVID credits
- Firms with annual sales up to 1,000,000UF suddenly became eligible (treated): **quasi-randomly assigned** around the new eligibility threshold
- **No self-selection**: assignment variable (2019 sales) is observable & depends on a threshold in the past

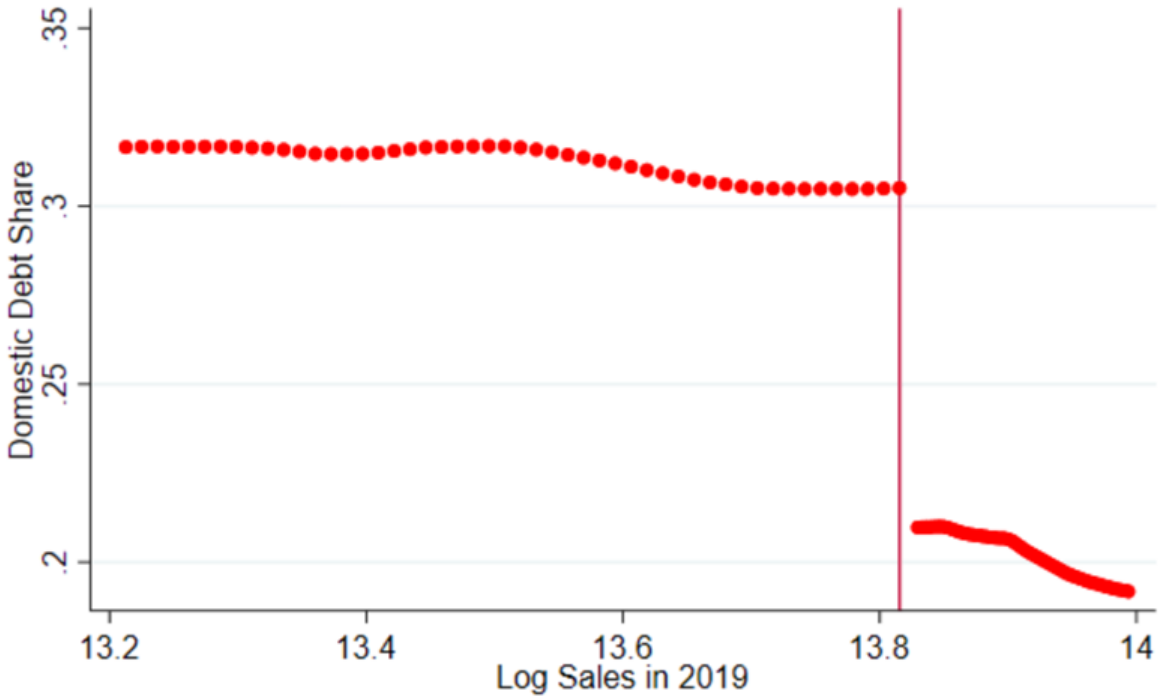
Continuity test Sorting test

- We ran the following spec. between May and July of 2020:

$$\frac{D_i^{domestic}}{D_i^{total}} = \beta_0 + \beta_1 Log(sales_i^{2019}) + \delta Eligible_i + \epsilon_i \qquad (1)$$

Regression Discontinuity Design (RDD) Analysis

- δ significant at $5-10\%$: eligibility increased domestic debt share by $9-14\%$
- **Macro implications**: sales of newly eligible firms are 18% of GDP; their increase in domestic credit was about 1% of GDP



RDD Results

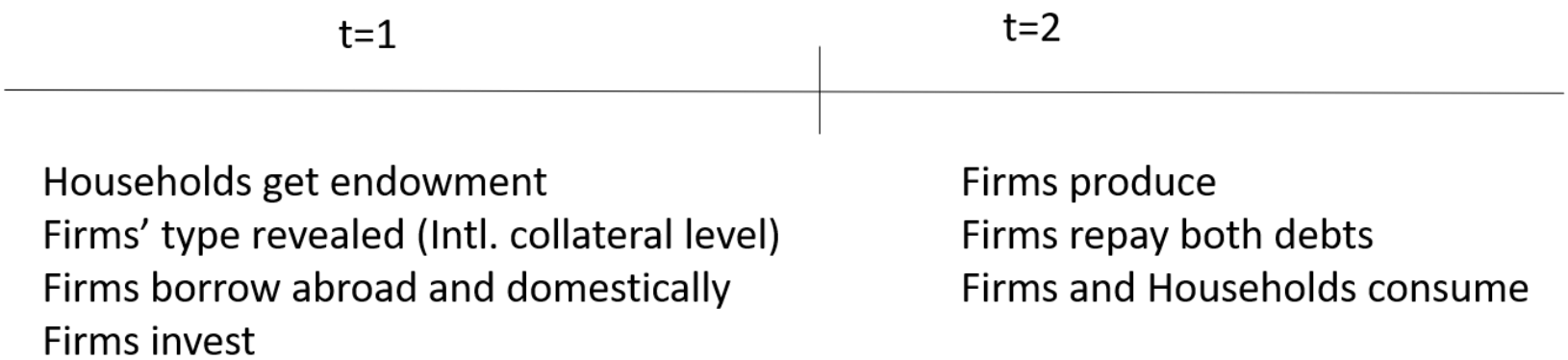
SOE Model's Key Elements

- What are the channels behind the debt substitution results?
- Key elements that we want to model/understand:

1. Endogenous domestic-foreign debt finance mix
2. Heterogeneous finance mix across firms -> financial frictions
   More evidence
3. Endogeneous interest rate differential with $R > R^{\star}$ Evidence
4. Credit supply affected by risk aversion
5. A COVID Shock & Policies akin to FCIC and FOGAPE

SOE Model - Environment

- Two periods $t = 1, 2$, small open economy, real model (no exchange rate), single good
- Agents: Identical households; heterogeneous firms; government (policies); foreign lenders; banks



Model - Collateral Constraints

- Collateral constraints (CC) a la Caballero-Krishnamurthy but with heterogeneity in Intl. collateral $\lambda^i_{2,f} \sim U[0, \bar{\lambda}]$:

$$\begin{aligned} R^\star d^i_{1,f} &\leq \lambda^i_{2,f} \\ R_2 d^i_{1,d} &\leq \theta_d * Y^i_2 + (\lambda^i_{2,f} - R^\star d^i_{1,f}) \end{aligned}$$

  Where $Y^i_2 = A_2(k^i_2)^\alpha$ and $k^i_2 = d^i_{1,d} + d^i_{1,f}$

- Without CC, first-best level of capital for all firms equals:

$$(A_2\alpha)^{\frac{1}{1-\alpha}} \equiv k^\star$$

- $k^\star$, target level of capital all firms wish to finance.

Model - Two Groups of Firms

- Because $\bar{\lambda} < k^\star$ & $R > R^\star \implies$ most firms have some domestic debt & all firms borrow up to their Intl. Collateral
- This gives rise to two kinds of firms:

1. Domestically unconstrained firms with with high $\lambda^i_{2,f}$: can finance $k^\star$; slack domestic CC
2. Domestically constrained firms with low $\lambda^i_{2,f}$: cannot finance $k^\star$; borrow domestically up to their pledgeable income ($\theta_d A_2 (k^i)^\alpha$); binding CC

Model - Equilibrium R_2

- The market clearing condition in the domestic credit market pins down R_2:

$$\underbrace{\int_0^{\hat{\lambda}} d^{\star}_{1,d}(\lambda^i_{2,f})}_{\text{Demand from constrained firms}} + \underbrace{\int_{\hat{\lambda}}^{\bar{\lambda}} \left(k^{\star} - \lambda^i_{2,f}\right)}_{\text{Demand from unconstrained firms}} = e_T$$

where e_T is total credit supply and $\hat{\lambda}$ is the endogenous cut-off that separates constrained from unconstrained firms Expression

Model - Credit Supply

- Need a minimal structure on the credit supply side to talk about risk aversion amid crisis & effects of policies
- Credit supply has two parts: Central Bank ($e_{CB} < 1$) and households (e_H):

$$e_T = e_{CB}^{\phi} + e_H \quad (2)$$

$$\phi = e^{R^* - 1} - \psi(\Delta\theta_d) \quad (3)$$

where ϕ captures risk-aversion from shocks to capital markets

- If $\phi > 1$ then excess reserves in "banks" are accumulated: $e_{CB} - e_{CB}^{\phi}$

Model - Quantitative Experiments

- We use the model to run two quantitative experiments:

1. A COVID shock that impacts world capital markets and make EMEs riskier: $R^\star$ increases
2. Two policies
   - FCIC-type as an increase central bank liquidity:

$$\Delta e_{CB} > 0$$

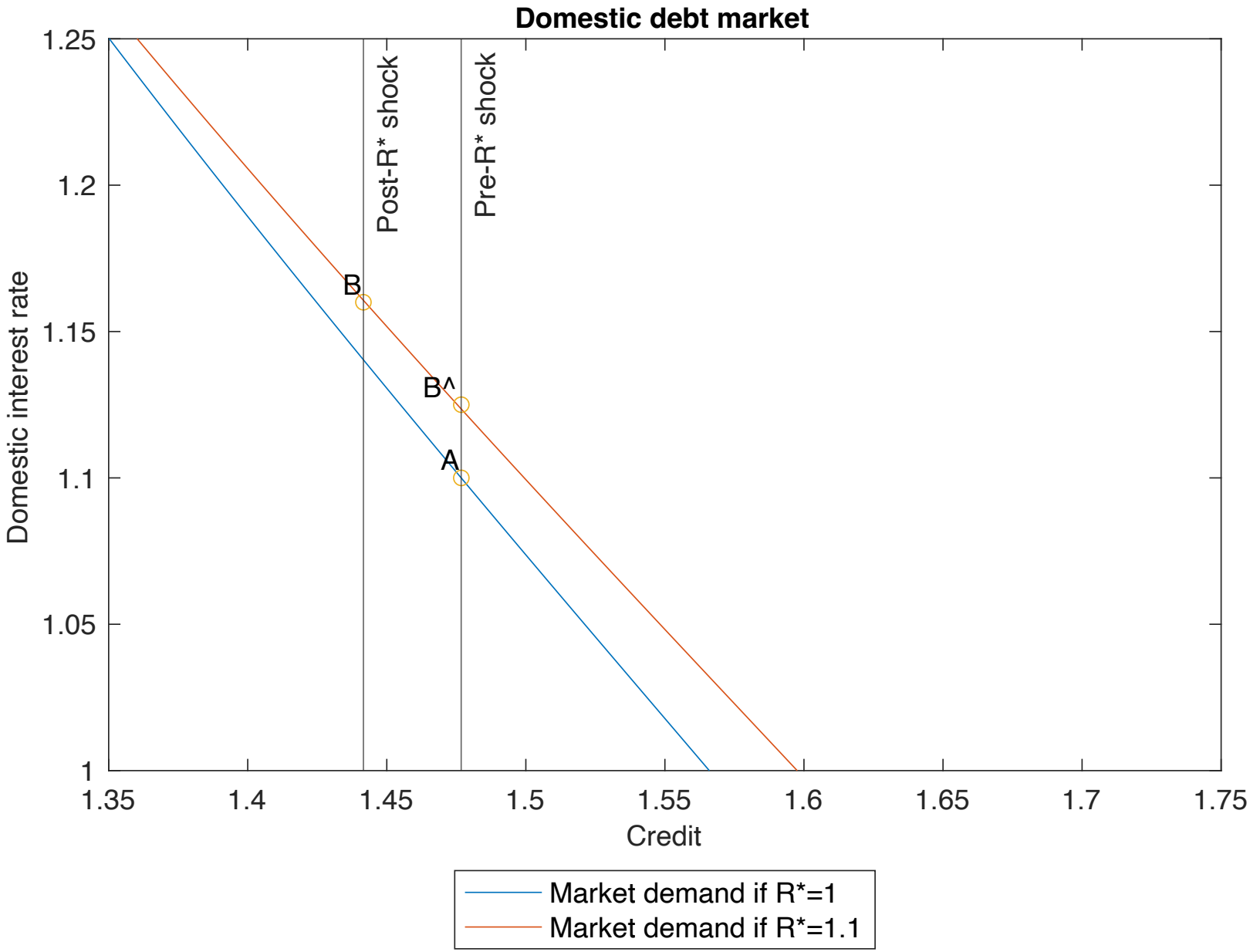
   - FOGAPE-type as a relaxation of collateral:

$$\Delta \theta_d > 0$$

Quantitative Experiment No. 1: COVID Shock

1. Demand channel:
   - Less foreign debt: collateral constraint becomes tighter for **all firms**
   - **Unconstrained firms substitute debt** by borrowing more at home: $\uparrow R_2$
   - **Constrained firms forced to borrow less** as domestic pledgeable output falls and domestic interest rates increase
2. Supply channel:
   - Banks' risk aversion increases: Market supply shifts left because $\phi \uparrow$

Quantitative Experiment No. 1: COVID Shock



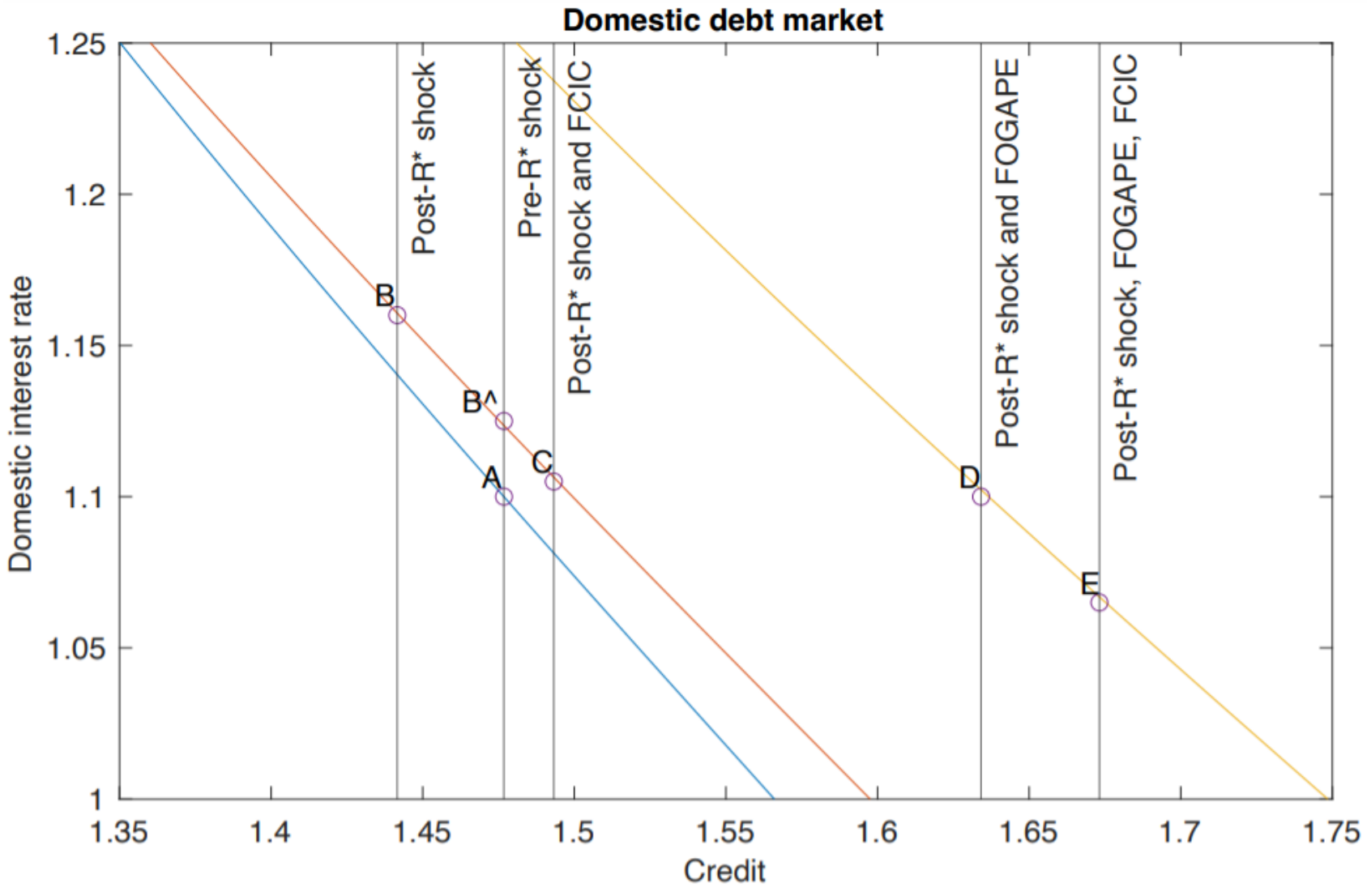
Quantitative Experiment No. 2: Policies

$$e_T = e_{CB}^{\phi} + e_H$$

$$\phi = e^{R^\star - 1} - \psi(\Delta\theta_d)$$

1. Central Bank liquidity (FCIC) alone:
   - The higher the risk aversion in banks the less effective
   - Liquidity likely to flow only to few large safe firms
2. Sovereign Guarantees (FOGAPE) alone:
   - Unlocks credit supply by reducing risk aversion
   - But the boost in credit demand may be larger, thus increasing rates
3. Joint FCIC & FOGAPE: **Complementarity**

Quantitative Experiment No. 2: Policies



Takeaways

- We show evidence of **debt substitution** by firms at the onset of COVID, away from foreign and into domestic debt
- RDD evidence shows debt substitution **fostered by credit support policies**
- A heterogeneous firms model with financial frictions allows us to rationalize these findings, stressing the **complementarity between policies**, namely sovereign guarantees and central bank liquidity

Thanks

THANK YOU!

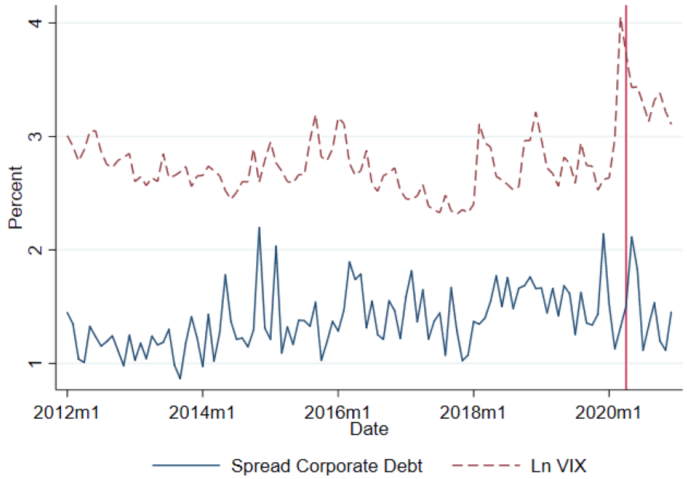
Question 2: Theoretical analysis - Domestic debt share, $\hat{\lambda}$

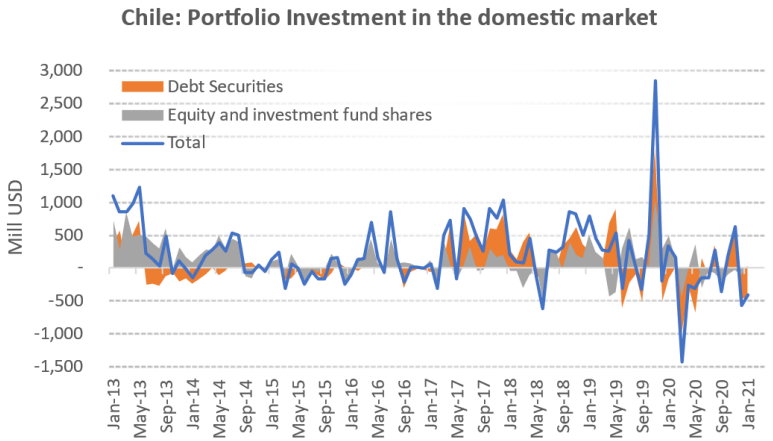
- **Debt substitution**
  - A global shock, $\downarrow d_{1,f}$ for all firms. Unconstrained can substitute.
  - Policies that $\downarrow R_2$, $\uparrow d_{1,d}$ for constrained firms.
- **Share of unconstrained firms**
  - A global shock shrinks share of unconstrained firms. Intuitively, having less $d_{1,f}$, $\downarrow$ output, tightening domestic CC.
  - Policies that $\downarrow R_2$, expand share of unconstrained firms. Intuitively, $R_2 \downarrow$ alleviates domestic CC.

Global shock FOGAPE

Covid Shock and Capital Flows

- There was a sharp decrease in credit inflows to Chile, and a sharp increase in the spreads of newly-issued foreign debt.





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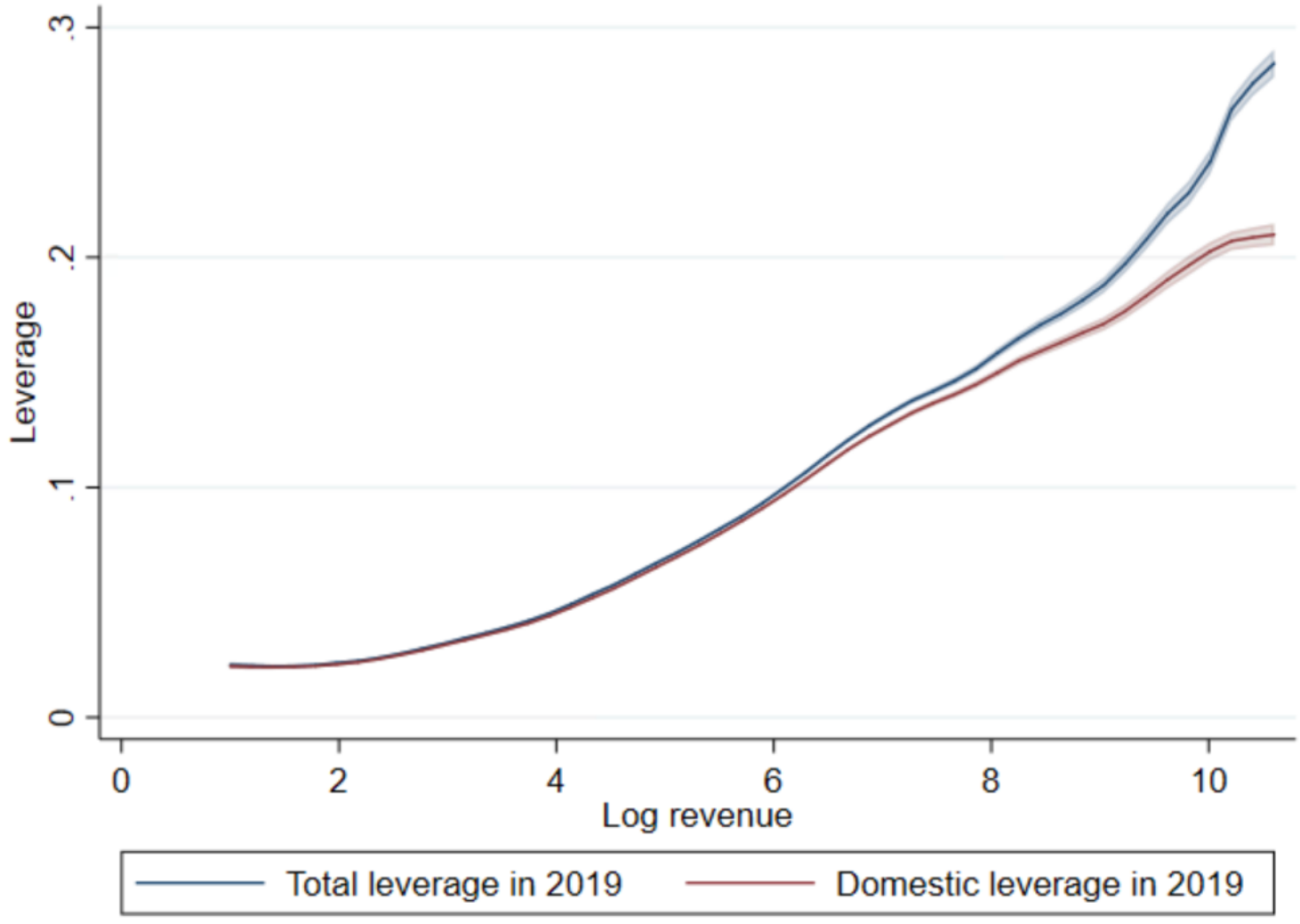
Data filters

- For firms that borrow abroad we keep only non-trade credit loans and bond issuance.
- Foreign credits in either U.S. Dollar, Euros, Japanese Yens or Chilean Pesos.
- Credits with positive spreads
- Firms that reports F29 (about 40% of total external borrowing, and its behavior is highly correlated with that ofthe full sample).
- We consider the period between April 2012 and December 2020. Back

Leverage and firm size



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Descriptive Stats

Table: Descriptive statistics - Merged Dataset

	Domestic loans	Foreign loans	Domestic interest rate (CHP -%)	Foreign interest rate (USD - %)	Foreign interest rate (CHP Ex-Post UIP - %)
Mean	150166 USD	39530 USD	13.2	3.3	10.2
Standard Deviation	1164683 USD	184548 USD	8.8	2.3	9.1
Total yearly loans (% of GDP)	34.59	32.13			
Number of loans	1972626	9872			
	Domestic loans only	Foreign loans only	Domestic and Foreign Debt	All firms	
Total yearly sales (% GDP)	122.2	2.8	32.7	157.7	
Total yearly sales (% F29 total sales)	56	1.3	14.9	72.3	
Number of firms	282922	465	703	284090	

Back - Data Back - Model

Descriptive Stats.

Table: Interest rates 2020 vs 2019

	March - July 2019	March - July 2020
Mean i (CHP - %)	15.9	5
Mean i^* (USD - %)	4.3	3.5
Mean i^* (CHP Ex-Post UIP - %)	11.5	22.6
CEMBI (USD %)	2.5	5.1
Number of firms (i)	59479	174010
Number of firms (i*)	64	75
Mean 2019 sales UF (i)	16153	14587
Mean 2019 sales UF (i*)	864459	1360514

FOGAPE details

	Jan-20	Apr-20
Características		
Financiamiento	US$100 millones	US$3.000 millones
Límite	350.000 UF (1)	1.000.000 UF
Tasa	-	tpm+3%
Límite por tramos (porcentaje - monto)		
Hasta 25.000 UF	80% - 5.000 UF	85% - 6250 UF
Entre 25.000 y 100.000	50% - 15.000 UF	80% - 25.000 UF
Entre 100.000 y 600.000	30% - 50.000 (2)	70% - 150.000 UF
Entre 600.000 y 1.000.000	-	60% - 250.000 UF

(1) Este límite es transitorio. Se cambia el límite permanentemente desde 25.000 a 100.000 UF
(2) Este porcentaje aplica hasta las ventas anuales de 350.000 UF

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RDD Estimates

Table: Estimate - Regression Discontinuity Design

	Baseline (degree 0, tri)	Alternative 1 (degree 1, tri)	Alternative 2 (degree 0, epa)	Alternative 3 (degree 0, epa)
Treatment estimate	0.09205*	0.12213*	0.09758**	0.13603*
Standard Error	0.05363	0.06678	0.05383	0.06762
Number of Observations	653	653	653	653

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RDD Sorting Test

- Cataneo et al. (2020) manipulation test.
- We find no evidence of manipulation (sorting) in our sample.

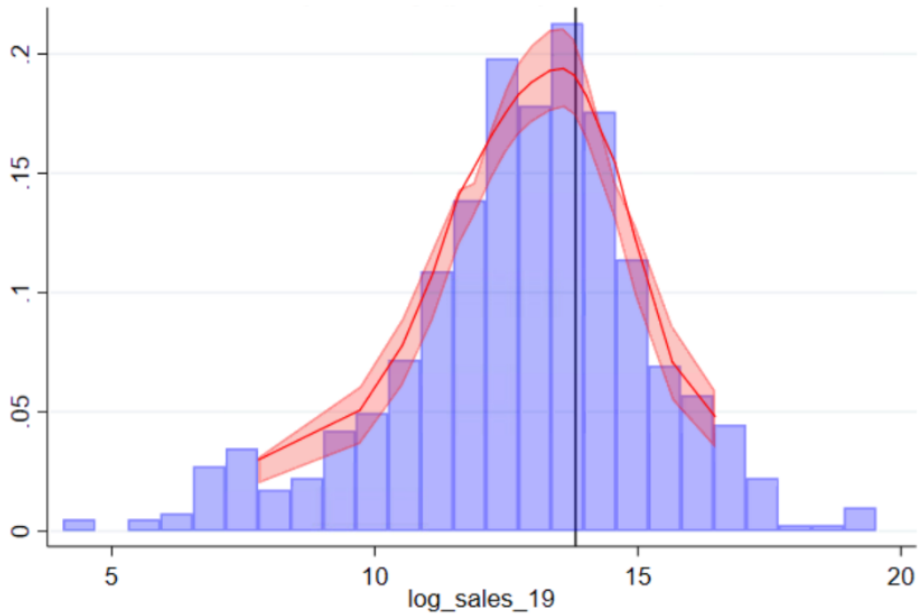

Figure: Manipulation test around the cutoff

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RDD Continuity Test

- We test for continuity in absence of the treatment.
- We use as a placebo sample May-July 2019 instead of 2020 for the domestic debt share.
- We find no evidence of discontinuity at the cutoff in absence of the treatment.

	Baseline (degree 0, tri)	Alternative 1 (degree 1, tri)	Alternative 2 (degree 0, epa)	Alternative 3 (degree 0, epa)
Treatment estimate	0.00814	0.02325	0.01852	0.02954
Standard Error	0.04981	0.08466	0.05144	0.08478
Number of Observations	632	632	632	632

Table: Domestic debt share vs Sales - Estimated polynomial May to July of 2019

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Parameters

Parameters used in the baseline quantitative exercise			
Parameter	Value	Parameter	Value
$R^\star$	1	$e_{1,H}$	1.4768-$e_{1,CB}$
A_2	3	θ_d	0.25
α	$\frac{1}{2}$	$e_{1,CB}$	0.5
$k^\star$	2.25	ψ	10
$\underline{\lambda}$	0	Δe_{CB}	0.05
$\bar{\lambda}$	$k^\star - 0.2$	$\Delta\theta_d$	0.05

- $e_{1,T}$ is chosen so that $R_2 = 1.1$ in the baseline equilibrium (consistent with empirical evidence on domestic rates).
- θ_d is chosen to ensure leverage is increasing throughout firm size: $\ell_U > \ell_C$.

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Expression for $\hat{\lambda}$

$$\hat{\lambda} = R^{\star}\left(k^{\star} - \frac{\theta_d A_2 k^{\star}}{R_2}\right)$$

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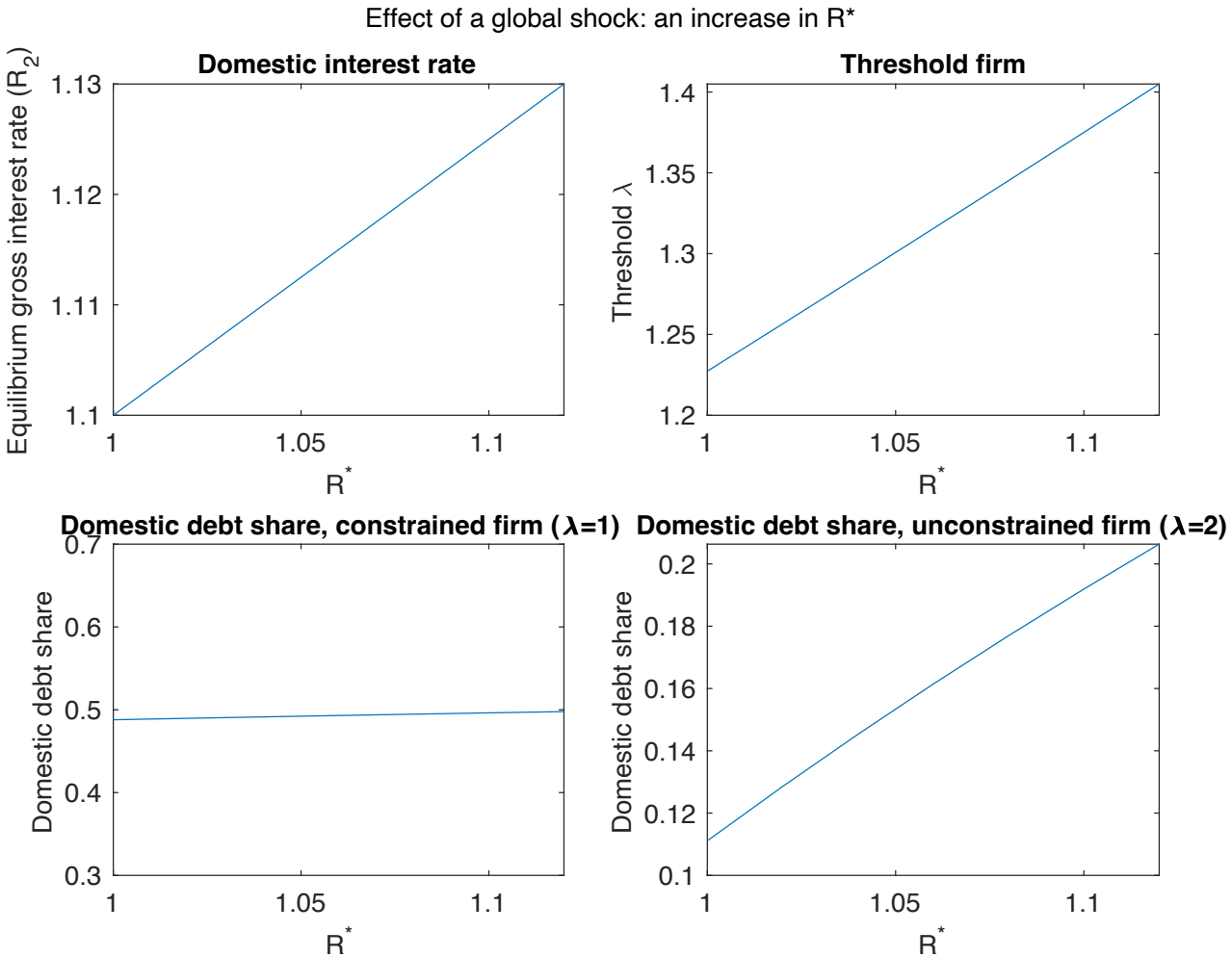
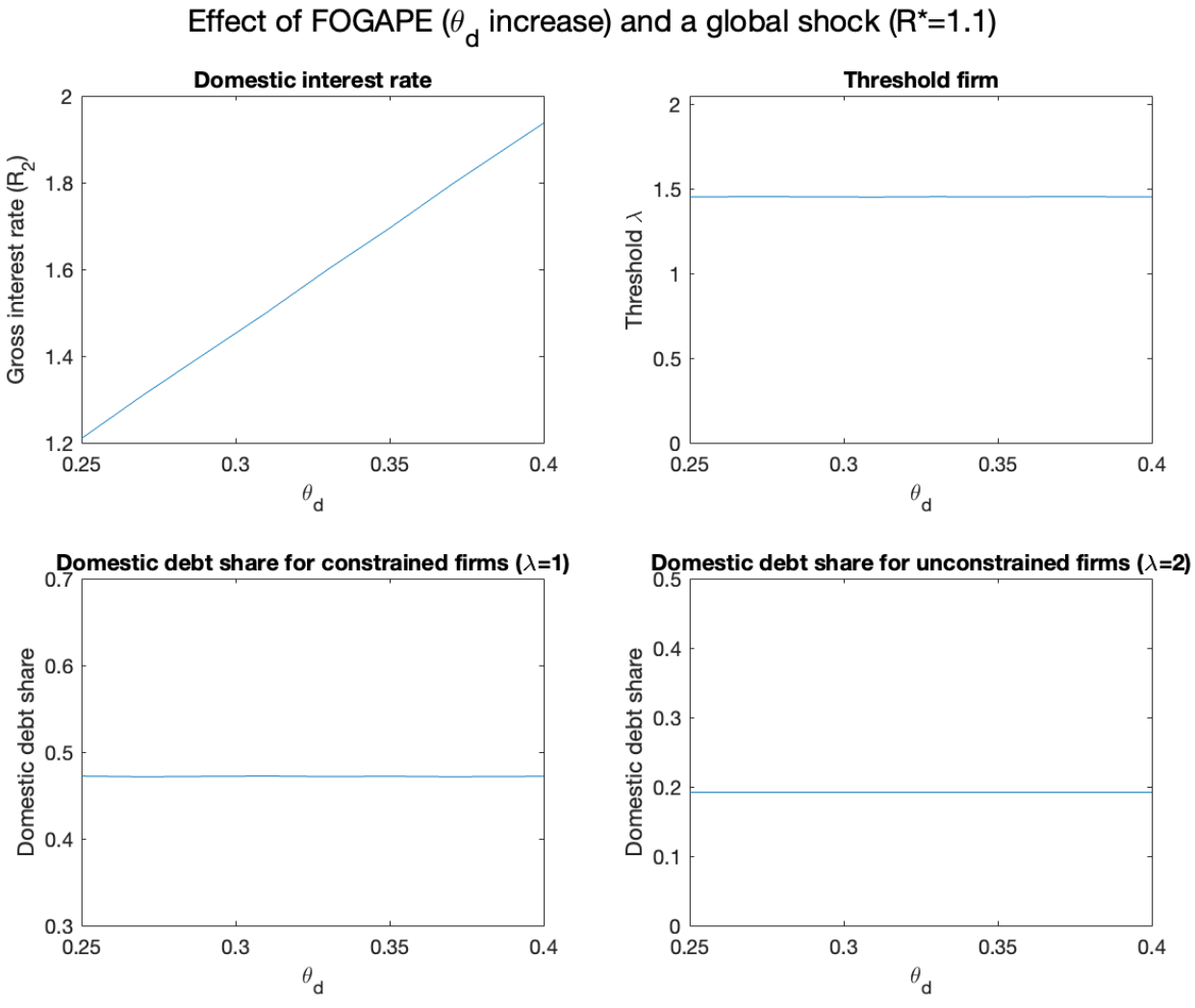
Effects of a global shock in more detail



Back to all shocks Back to domestic debt share

Effects of FOGAPE in more detail (without supply effect)



Back to all shocks Back to domestic debt share