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

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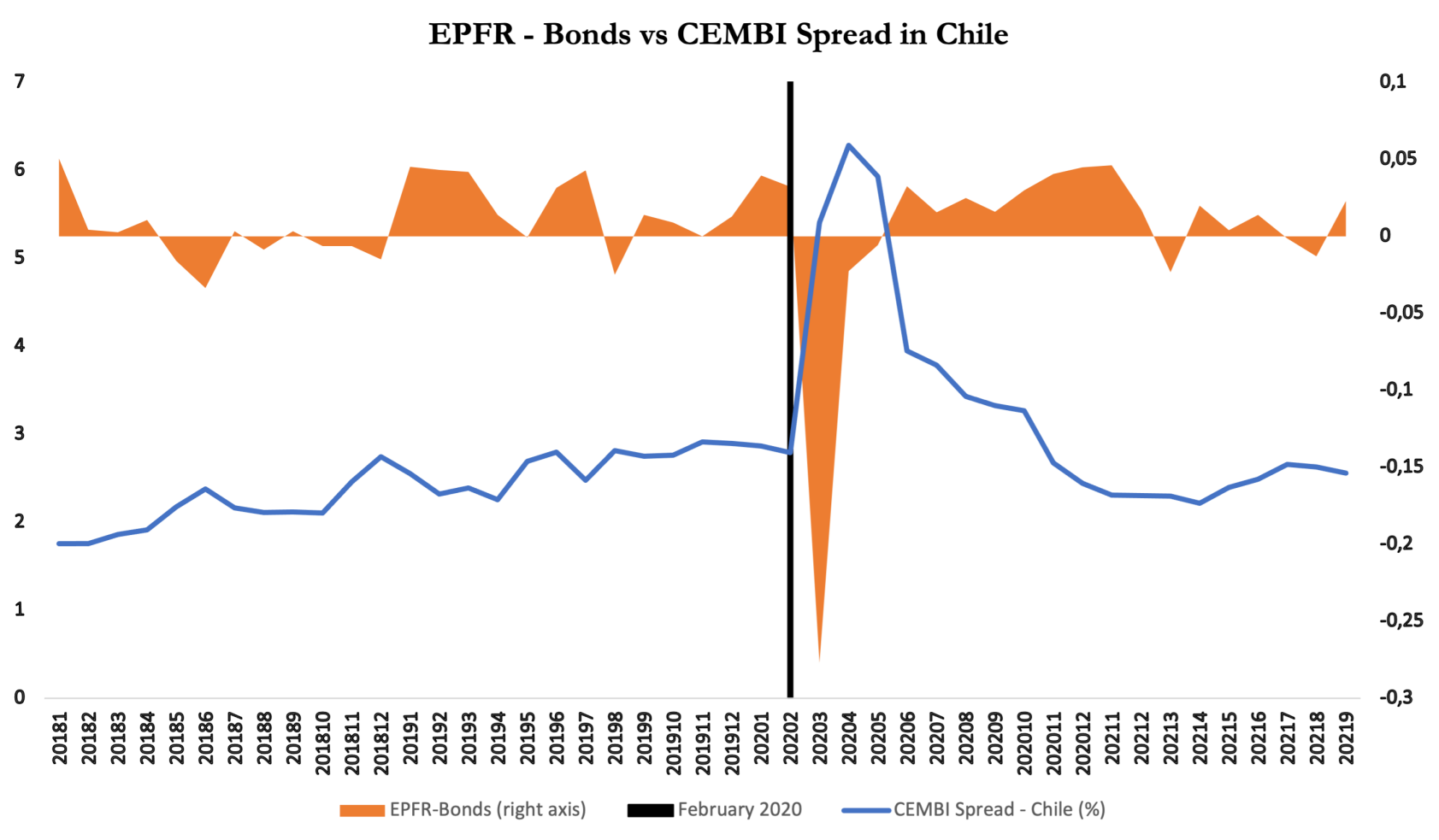
Two Motivating Facts

FACT 1: The **COVID shock brought a Sudden Stop** to Chile (and other EMEs), with sharp capital outflows and many firms loosing access to foreign funding



Two Motivating Facts

FACT 2: **firms substituted foreign for domestic borrowing**, particularly medium and large ones, though not mega firms.

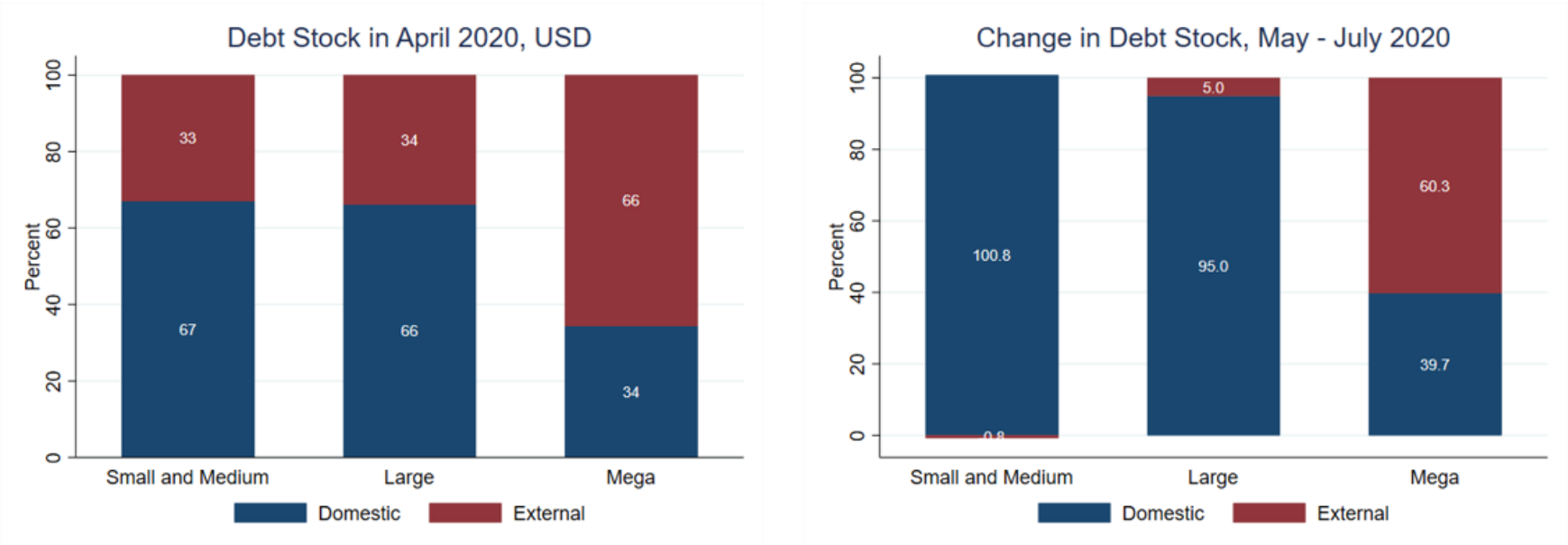


Figure: Firms' Finance Mix in Chile: Before & During Policies

Three Questions

1. **Did unconventional policies deployed during COVID caused this change in the finance mix of firms?**
2. **What were the main channels at play?**
3. **What lessons can we draw from this episode for the type of stabilization tools policymakers have in the wake of large shocks?**

What we do: Data Analysis & Theory

- Using a unique micro dataset of firms in Chile, we study **if/how unconventional policies at the onset of COVID impacted firms' debt composition** (domestic vs external debt)
- **Unconventional credit support policies**:
  1. **Sovereign guarantees** on commercial banks' loans to firms
  2. **Central Bank's credit line** facility for banks, provided they lent to firms
- **Heterogeneous firms SOE model** with endogenous debt composition and the two unconventional policies

KEY TAKEAWAYS

- **Empirical Analysis**:
  1. Unconventional Policies *caused* firms' debt composition to alter
  2. *Cost channel*: UIP premium reversed for firms eligible for credit support
- **Heterogeneous Firms SOE Model**:
  1. *Complementarity* of the two types of unconventional policies
- Valuable lessons on the **efficacy of unconventional credit policies in the wake of a sudden stop**

Literature

DATA: Merge of four firm-level administrative datasets

Anonymized repository at the Central Bank of Chile:

1. Capital Inflows: universe of foreign debt issuance (bonds & loans) by firms (spreads, volume, currency, maturity, etc.)
2. Credit registry: universe of domestic stock and flows of firms' bank debt (rates, loan amounts, etc.).
3. Bond Issuance: universe of firms' bond issuance in the domestic financial market.
4. Production: tax forms for the universe of firms, includes sales, expenditures, value-added

$\Longrightarrow$ Full **360°panoramic of the financing of approx. 300.000 firms** between 2012m4-2020m10 (2M observations)
$\Longrightarrow$ **High frequency identification** of rapid deployment of policies in a fast moving object (SS) Filters Descriptive Stats

Unconventional Credit Support Policies in Chile

1. FCIC: new **credit line facility** in March 2020, from the central bank to commercial banks, conditional on the growth of credit to firms
   - Increase in CB's balance sheet of ∼10% GDP
2. FOGAPE-COVID: **sovereign guarantees** of up to 85% of commercial banks' loans to firms below a chosen pre-determined size (2019 sales).
   - FOGAPE dates back to 1980. Recapitalized and relaunched on April 25, 2020, guaranteeing credits up to 9% of GDP

Sovereign Guarantees: 2 key elements

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

UF: unit of account, 1UF≈USD35 in March 2020

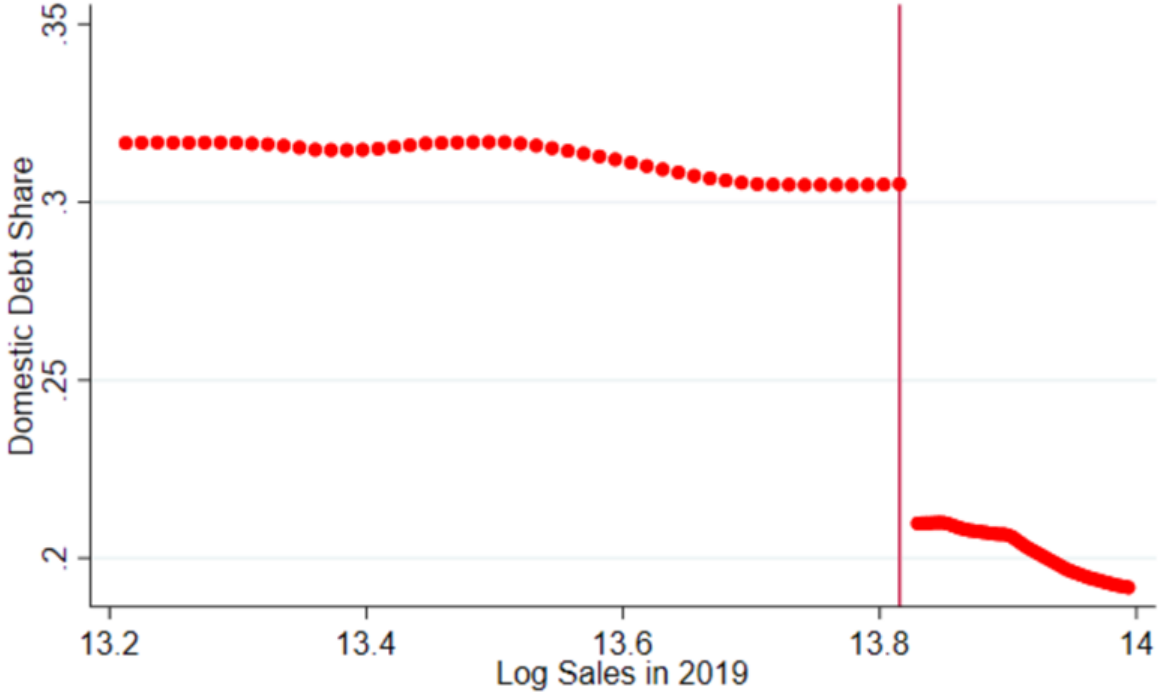
Regression Discontinuity Design (RDD) Analysis

- **Causal effect of becoming eligible to receive credit with sovereign guarantees on (treated) firms' domestic debt share mix**
  - Firms are **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 (Placebo) Sorting test
- **RDD specification** ran between May-July 2020:

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

RDD results

- δ **significant at** $5-10\%$: eligibility increased domestic debt share by $9-14$ pp depending on specification. RDD Results



- **Large macro implications**: Sales of eligible firms $\approx 18\%$ of GDP, increase in domestic credit to these firms $\approx 1\%$ of GDP

Pinning down the Mechanism: The Role of Interest Rates

- A **UIP premium** exists for dollar loans in emerging markets (Kalemli-Ozcan and Varela, 2021)
- **Were policies channeled through changes in the UIP premium?**
  - A first look at the UIP premia would indicate so (evidence)
- **Two specifications:**

$$i_{f,b,d,m} = \delta FX_{f,b,d,m} + \Theta X_{f,b,M,m} + \epsilon_{f,b,d,m} \quad (2)$$

$$i_{f,b,d,m} = \delta FX_{f,b,d,m} + \psi E_{f,m} FX_{f,b,d,m} + \Theta X_{f,b,M,m} + \epsilon_{f,b,d,m} \quad (3)$$

UIP regressions: Results

Table: Interest Rate Regression, UIP Premium, and policy effect

Variables	(1) **Until Sept 2019**	(2) **March to July 2020**	(3) **March to July 2020**
Fx (δ)	-0.0395***		
	(0.00345)		
Fx·elegible			
Macro Controls	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes
Observations	5,929,453	348,550	348,550
R-squared	0.869	0.646	0.646

Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

UIP regressions: Results

Table: Interest Rate Regression, UIP Premium, and policy effect

Variables	(1) Until Sept 2019	(2) March to July 2020	(3) March to July 2020
Fx (δ)	-0.0395***	0.00115	
	(0.00345)	(0.00131)	
Fx·elegible			
Macro Controls	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes
Observations	5,929,453	348,550	348,550
R-squared	0.869	0.646	0.646

Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

FE regressions results

Table: Interest Rate Regression, UIP Premium, and policy effect

Variables	(1) Until Sept 2019	(2) March to July 2020	(3) March to July 2020
Fx (δ)	-0.0395***	0.00115	-0.00377*
	(0.00345)	(0.00131)	(0.00215)
Fx·elegible (ψ)			0.0117***
			(0.00239)
Macro Controls	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes
Observations	5,929,453	348,550	348,550
R-squared	0.869	0.646	0.646

Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Two-period, heterogeneous firms' SOE model

- **Three key ingredients** of our story:
  1. Endogenous finance mix: Firms borrow domestically and abroad subject to different collateral constraints (Caballero and Krishnamurthy, 2001)
  2. Heterogeneity in Intl. Collateral: larger firms issuing more debt abroad
  3. Endogenous interest rate wedge ($R > R^*$): incentives to borrow abroad in equilibrium
- **Experiments**:
  1. Risk-off Shock ($\uparrow R^*$)
  2. Unconventional credit support policies in response

Credit Demand & Collateral Constraints (CC)

- Technology: $Y_2^i = A_2(k_2^i)^\alpha$; $\quad k_2^i = d_{1,f}^i + d_{1,d}^i$
- CC à la Caballero-Krishnamurthy + **heterogeneous international collateral** $\lambda_{2,f}^i \sim U[0, \bar{\lambda}]$:

$$\begin{aligned} R^\star d_{1,f}^i &\leq \lambda_{2,f}^i \\ R_2 d_{1,d}^i &\leq \theta_d * Y_2^i + (\lambda_{2,f}^i - R^\star d_{1,f}^i) \end{aligned}$$

- Identical frictionless capital for all firms: $(A_2\alpha)^{\frac{1}{1-\alpha}} \equiv k^\star > \bar{\lambda}$
- In equilibrium, $R_2 > R^\star \implies$ firms borrow up to their international collateral

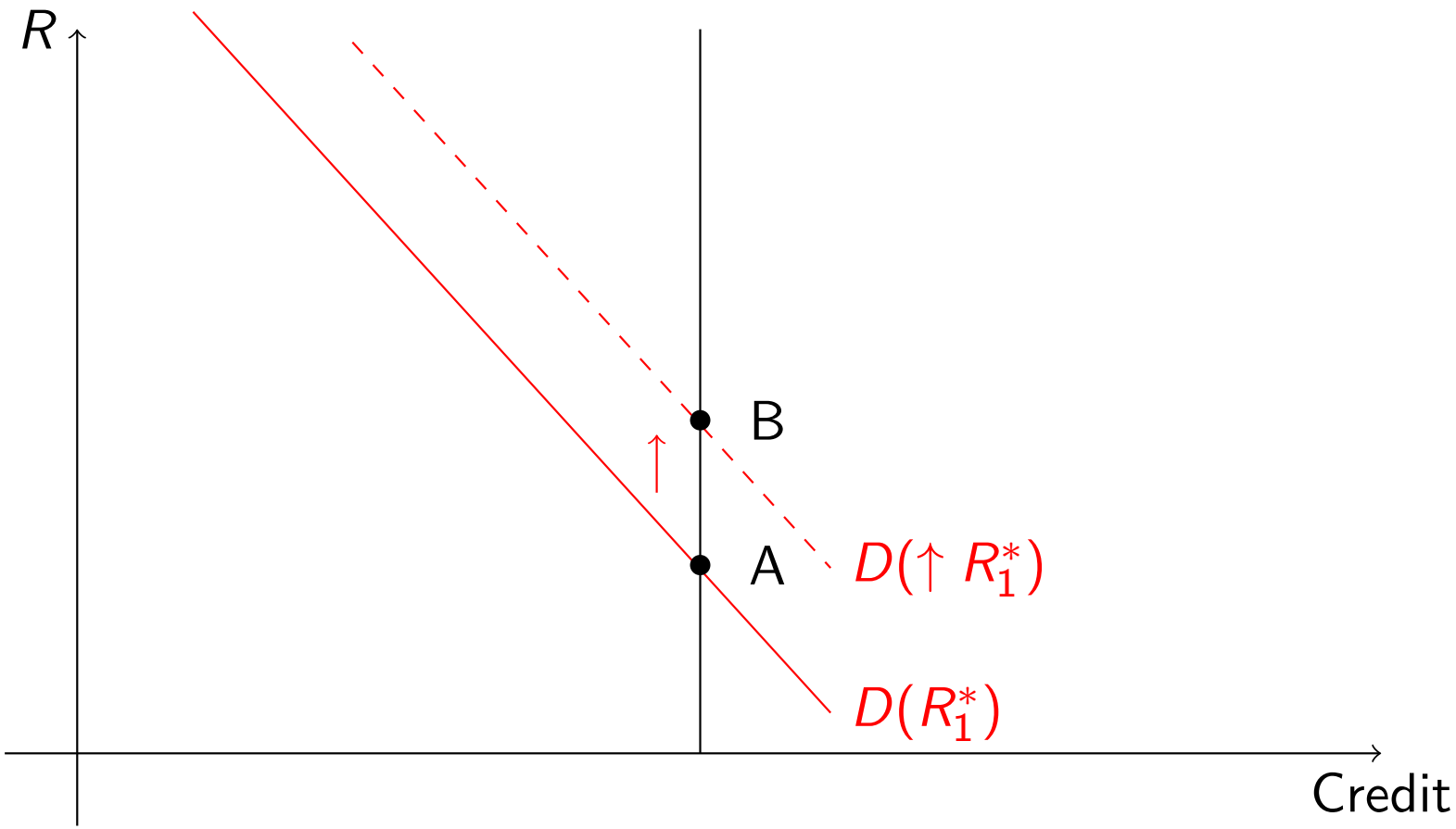
Credit Demand & Collateral Constraints (CC)

- **Two types of firms**:
  1. Unconstrained / high $\lambda^i_{2,f}$: achieve $k^\star$ by borrowing domestically $k^\star - \lambda^i_{2,f}/R^\star$
  2. Constrained / low $\lambda^i_{2,f}$: borrow domestically $\theta_d Y^i_2/R_2$, but can't achieve $k^\star$
- For a given a supply of credit (e_1), **equilibrium** is the domestic credit:

$$\underbrace{\int_0^{\hat{\lambda}} d^\star_{1,d}(\lambda^i_{2,f})d\lambda^i_{2,f}}_{\text{Demand from constrained firms}} + \underbrace{\int_{\hat{\lambda}}^{\bar{\lambda}} \left(k^\star - \frac{\lambda^i_{2,f}}{R^\star}\right) d\lambda^i_{2,f}}_{\text{Demand from unconstrained firms}} = e_1 \tag{4}$$

$\Longrightarrow$ Shocks to R^* will increase equilibrium R

Credit Demand Curve & Equilibrium



A Minimal Structure for Credit Supply

- **Two key forces at play**:
  1. Bank's heightened risk aversion to lend amid crisis
  2. Unconventional credit support policies

- Assume total credit supply e_T has 2 parts: **Central Bank credit (e_{CB})**, and households (e_H):

$$e_T = e(e_{CB}(\underset{-}{\phi}); e_H);$$

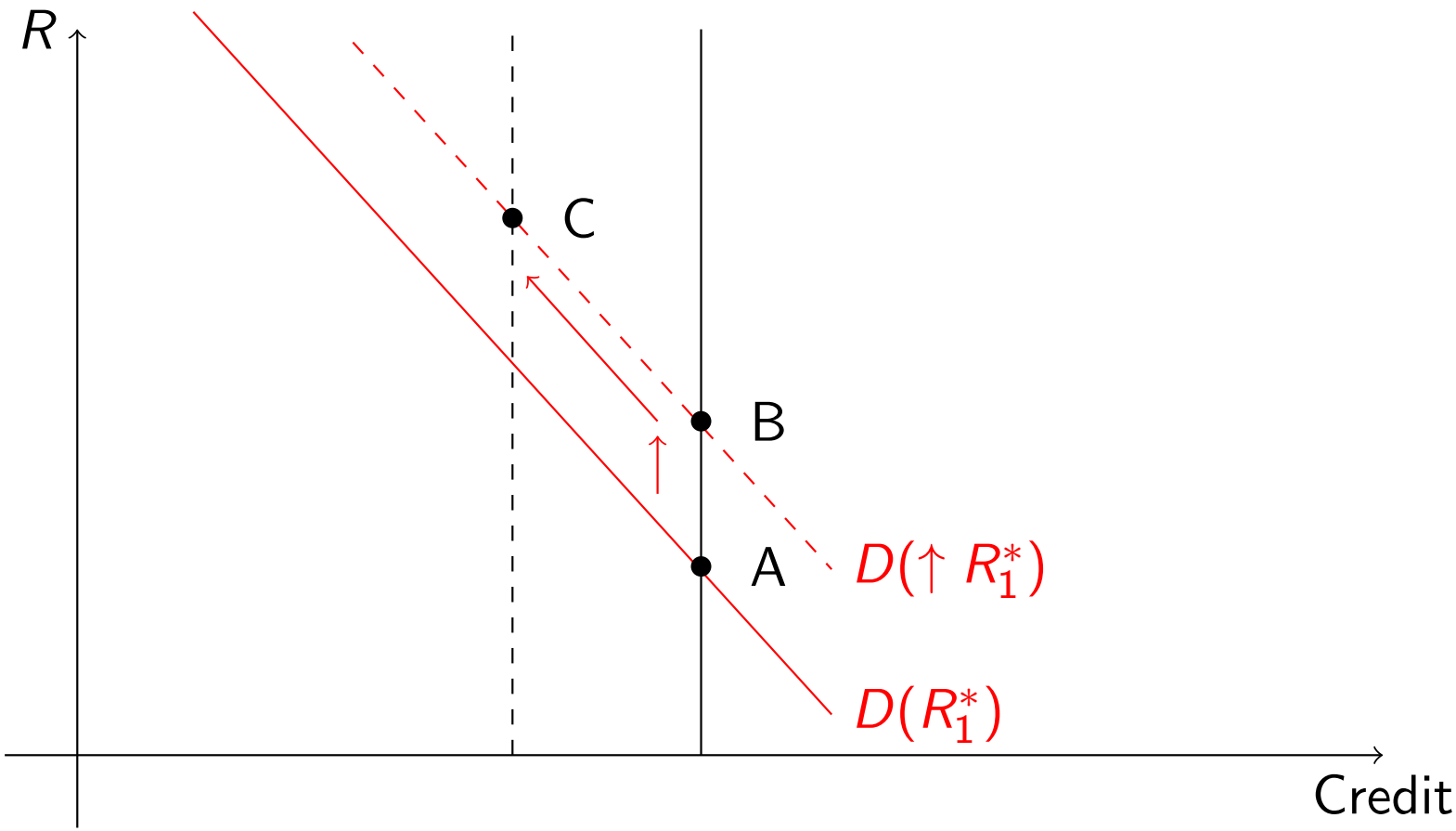
where ϕ captures risk-aversion from shocks to capital markets but also policies:

$$\phi(\underset{+}{R^\star}, \underset{-}{Policy})$$

(Appendix: microfoundation extending Curdia-Woodford, 2011)

Market clearing

Credit Market Eq'm: $\uparrow R*$

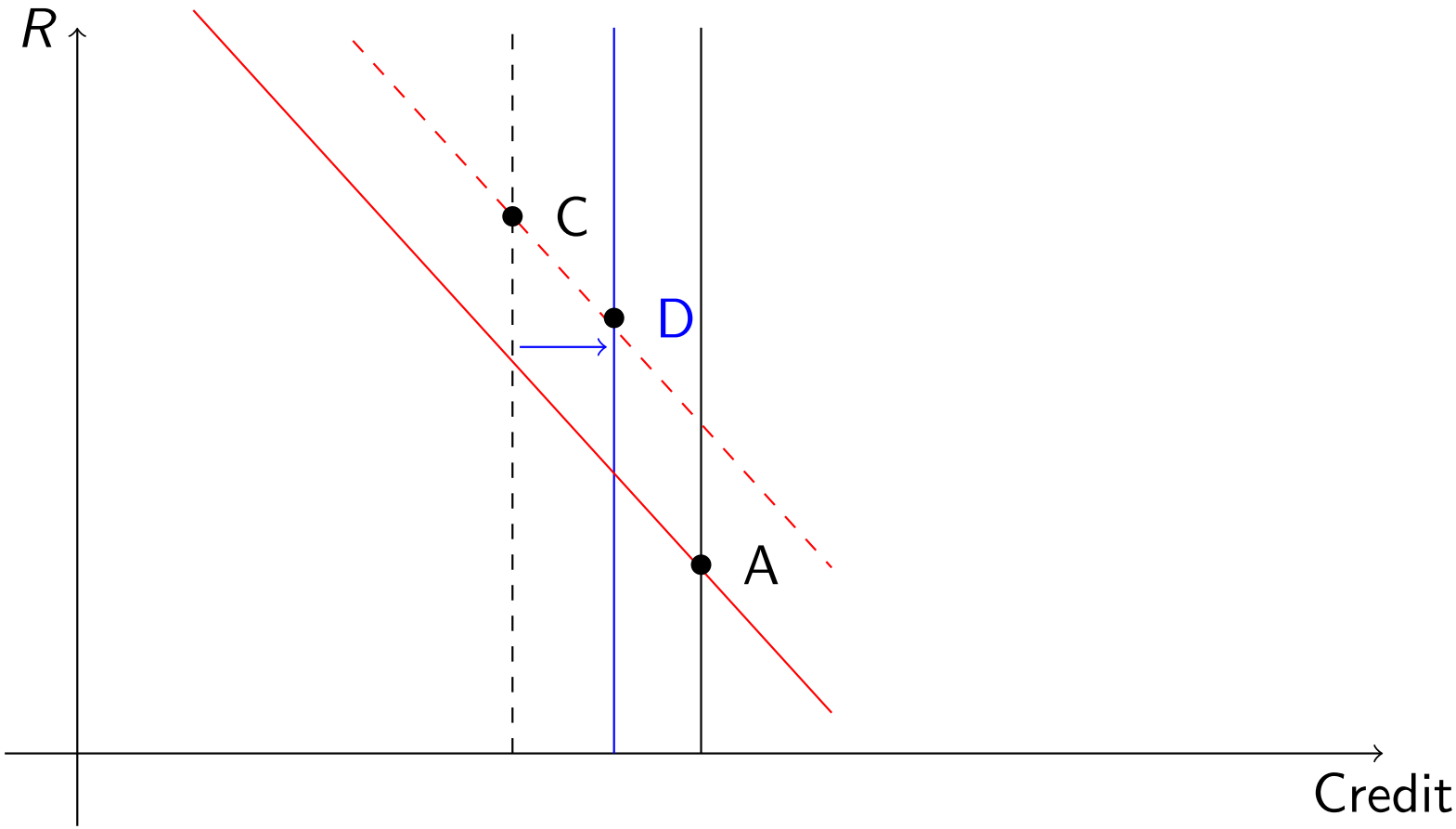


Unconventional Credit Support Policies in Model

Three Policy Experiments

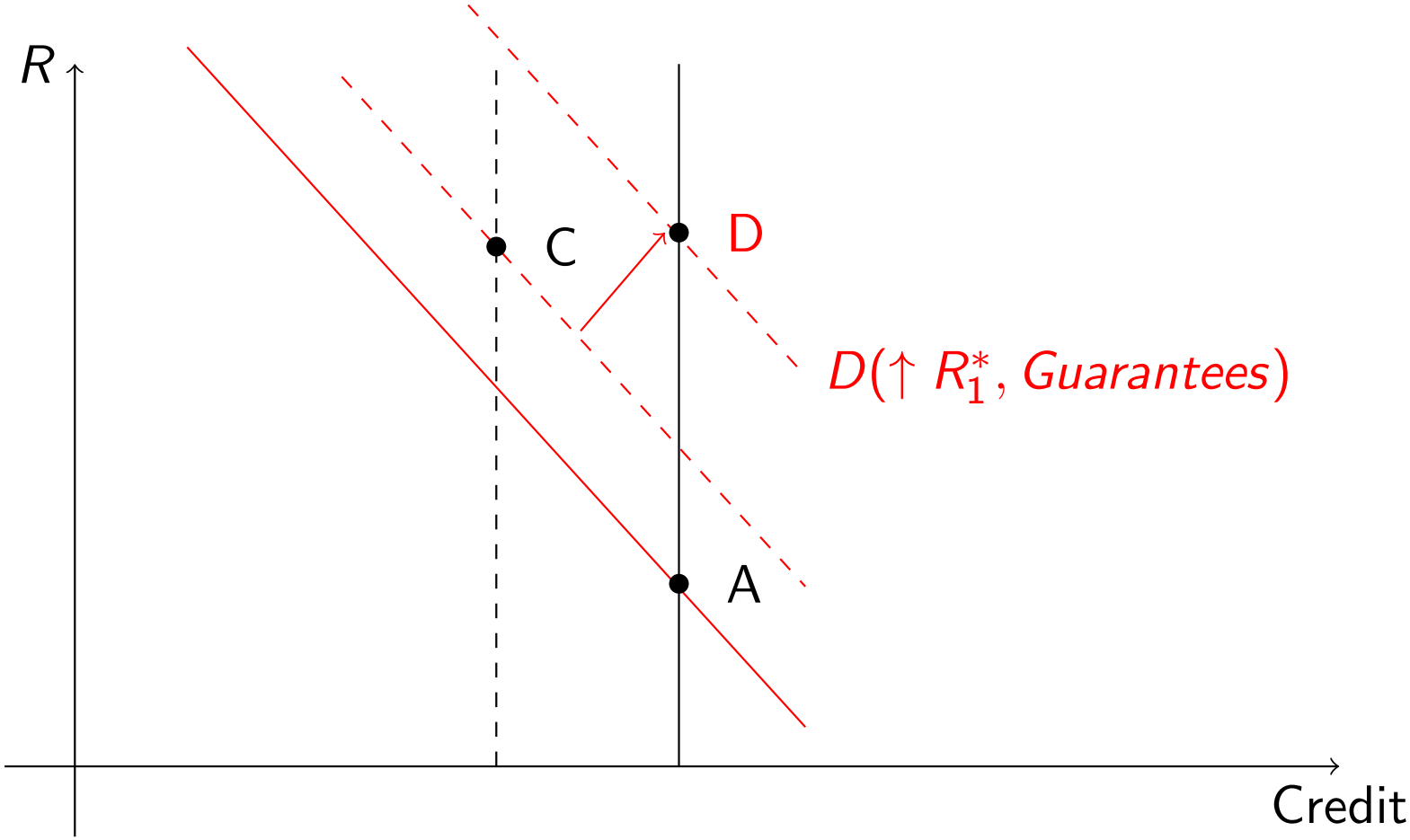
1. CB's Credit Line Facility (FCIC): $\uparrow e_{CB}$
   - Pro: Pushes up credit supply
   - Con: Less effective as risk aversion in banks increase
2. Sovereign Guarantees (FOGAPE): $\uparrow \theta_d$
   - Pro: Increases credit demand, relaxes domestic CC
   - Con: May drive interest rates up
3. Both policies jointly: **Complementarity**

Central Bank Credit Line (FCIC) in Model



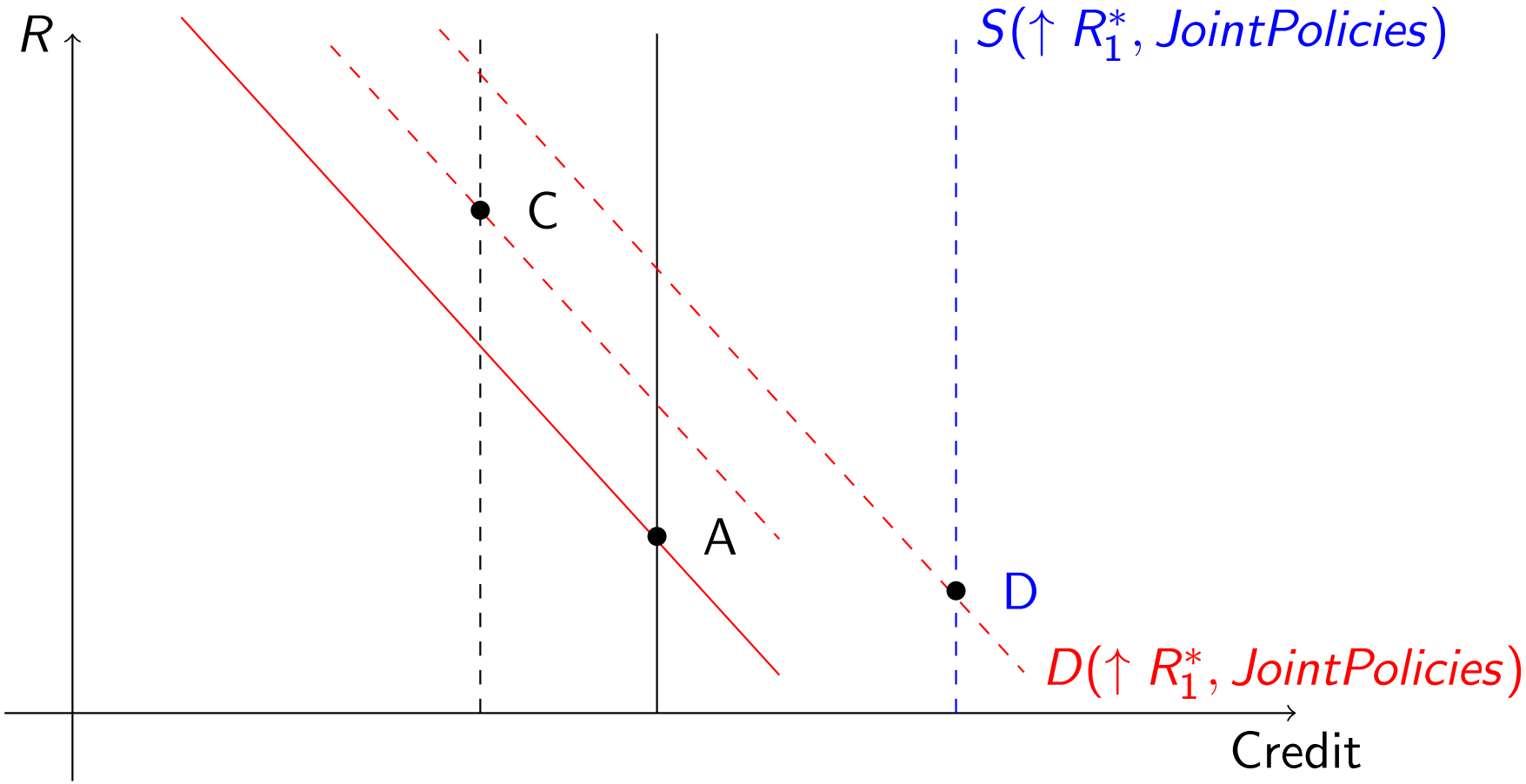
$\Longrightarrow$ A CB credit line without sovereign guarantees **may not increase credit to all firms** in the end

Sovereign Guarantees (FOGAPE) in Model



$\Longrightarrow$ Sovereign guarantees without a CB credit line **may put upward pressure on rates** (counterfactually)

Both Policies Simultaneously: Complementarity



$\Longrightarrow$ The **complementarity of both policies** achieves much more credit at lower rates

Conclusions

- COVID brought sharp capital outflows from EMEs
- Chile's microdata offers a unique window to gauge if/how unconventional policies worked to stabilize this shock
- Credit support policies sustained firms' financing and prevented a UIP spike, tilting the debt composition towards domestic (peso) debt
- Complementarity of two policies: sovereign guarantees and a CB credit line
- **There are more macro stabilizing tools for EME policymakers when confronting these large external shocks**

Conclusions

THANK YOU!

Literature

- 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)

Motivation

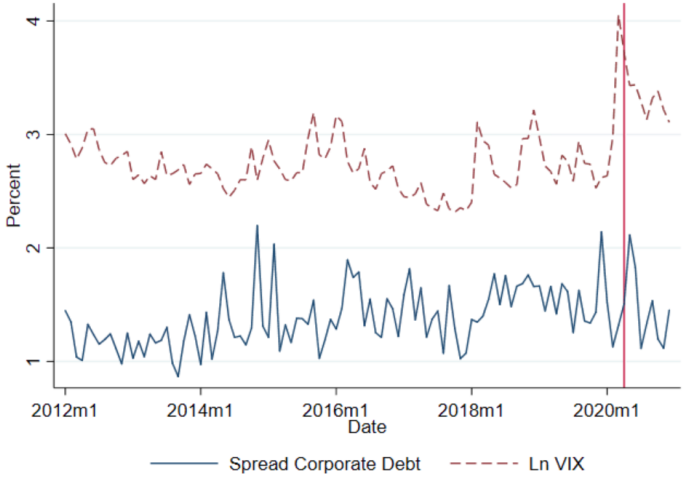
Question 2: Theoretical analysis - Domestic debt share, $\hat{\lambda}$

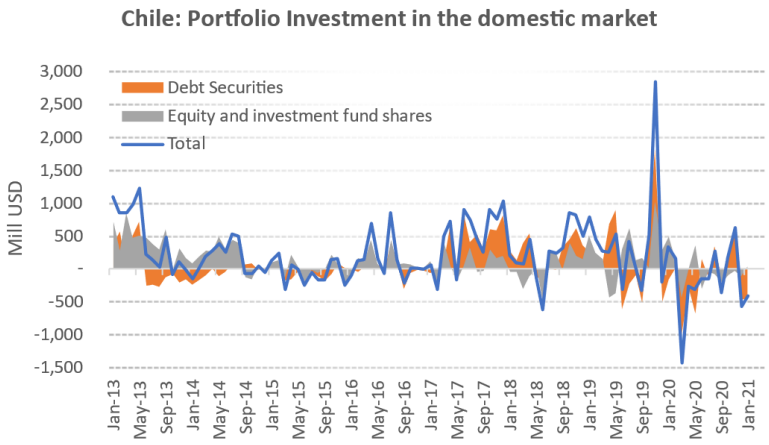
- **Debt substitution**
  - A global shock, $\downarrow d_{1,f}$ for all firms. Unconstrained can substitute.
  - Policies that $\downarrow R_2$, $\uparrow d_{1,d}$ for constrained firms
- **Share of unconstrained firms**
  - A global shock shrinks share of unconstrained firms. Intuitively, having less $d_{1,f}$, $\downarrow$ 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 October 2020.

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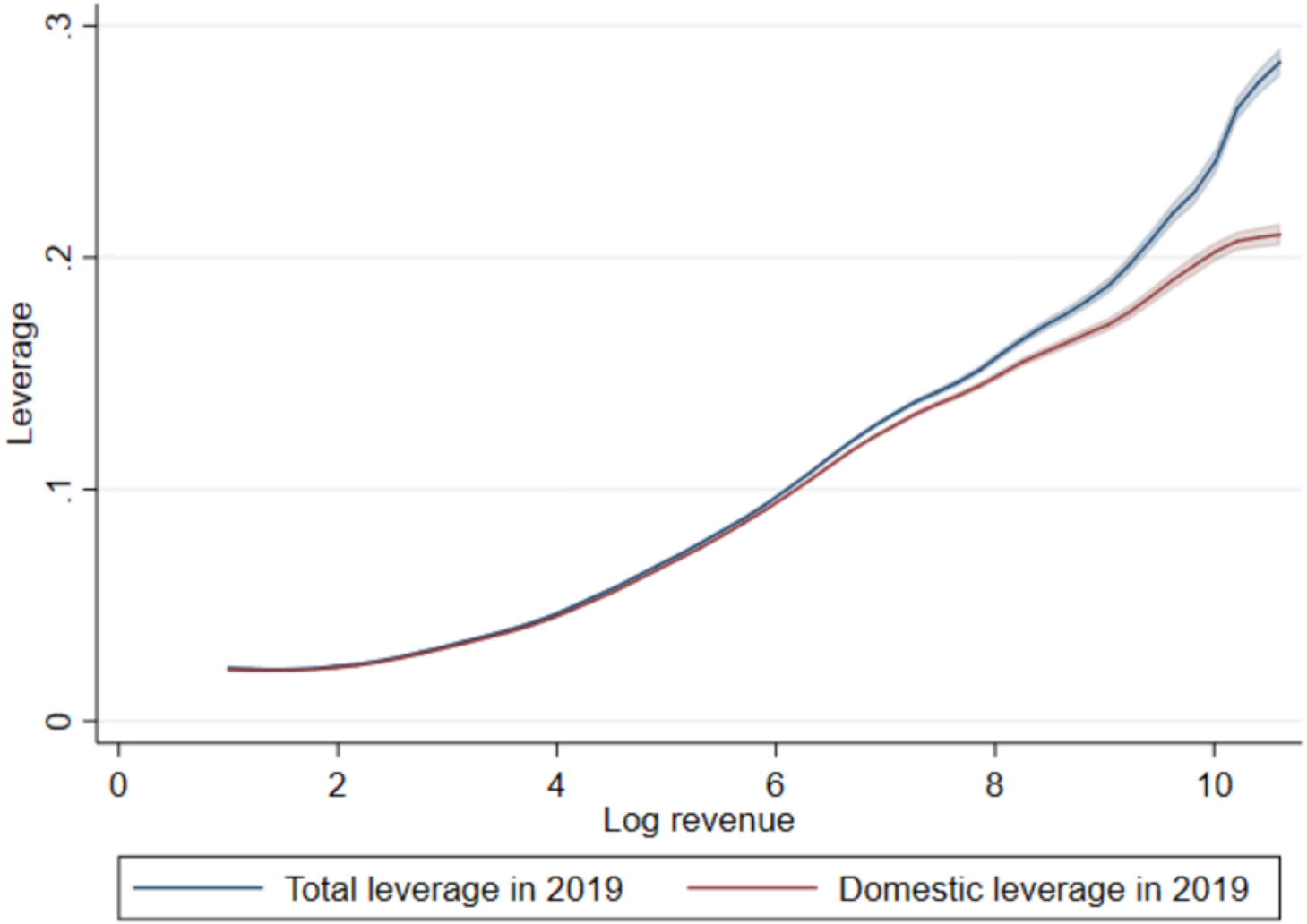
Leverage and firm size



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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	3953000 USD	13.2	3.3	10.2
Standard Deviation	1164683 USD	18454800 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 $i^\star$ (USD - %)	4.3	3.5
Mean $i^\star$ (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	-0.09422**	-0.12271*	-0.09773**	-0.13589*
Standard Error	0.05115	0.06666	0.0505	0.06699
Number of Observations	665	665	665	665

Back to graph

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	-0.00131	0.00144	0.0003	-0.0023
Standard Error	0.05025	0.04697	0.0856	0.08585
Number of Observations	652	652	652	652

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

Back

RDD Sorting Test

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

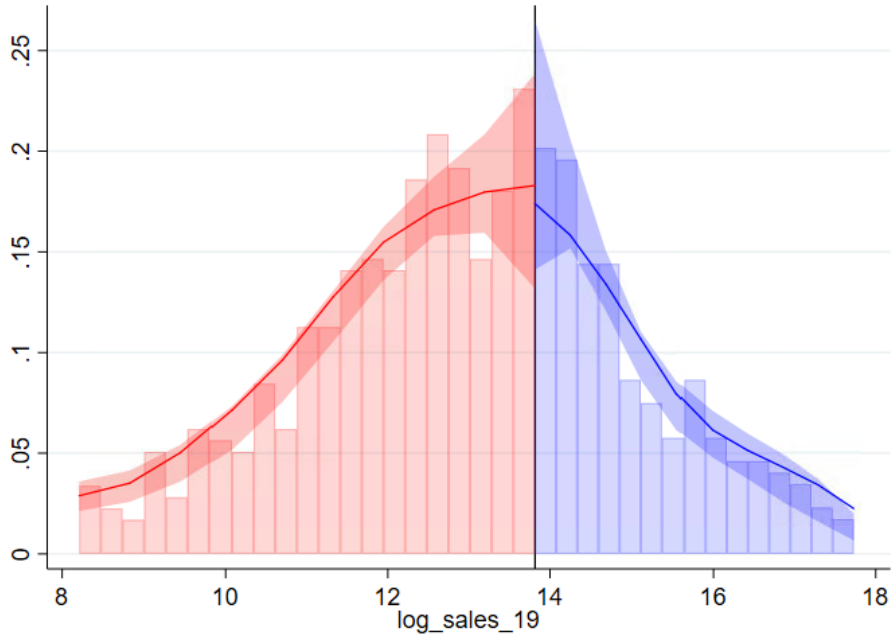

Figure: Manipulation test around the cutoff

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Results are robust to...

- A battery of different FE.
- Including the foreign debt with all external borrower as the same agent for the FE (no $Z_{b,m}$).

Back

Model - Market clearing

Market clearing in the domestic credit market pins down R_2:

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

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

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: $\ell_U > \ell_C$

Back

Quantitative Experiments - No. 1: COVID Shock

A COVID-19 Shock that impacts capital markets and makes EMEs riskier: $\uparrow R^\star$

1. Demand channel:
   - $\downarrow$ foreign debt: international CC become tighter for **all firms**
   - **Unconstrained firms substitute debt** by borrowing more at home $\implies \uparrow R_2$.
   - **Constrained firms forced to borrow less** as domestic pledgeable output falls and $\uparrow R_2$.
2. Supply channel:
   - Banks' risk aversion increases: market supply shifts left because $\phi \uparrow$

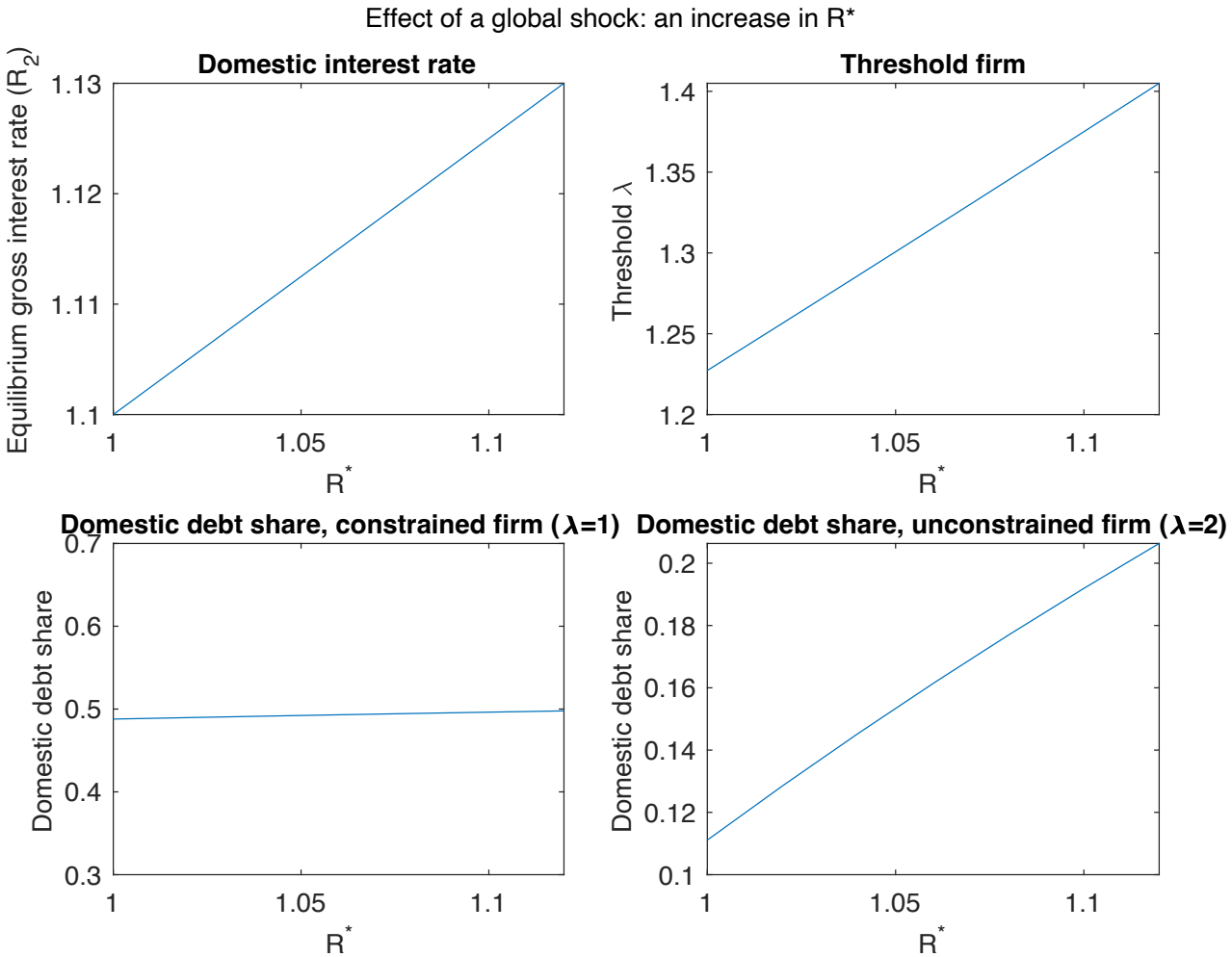
Back

Expression for $\hat{\lambda}$

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

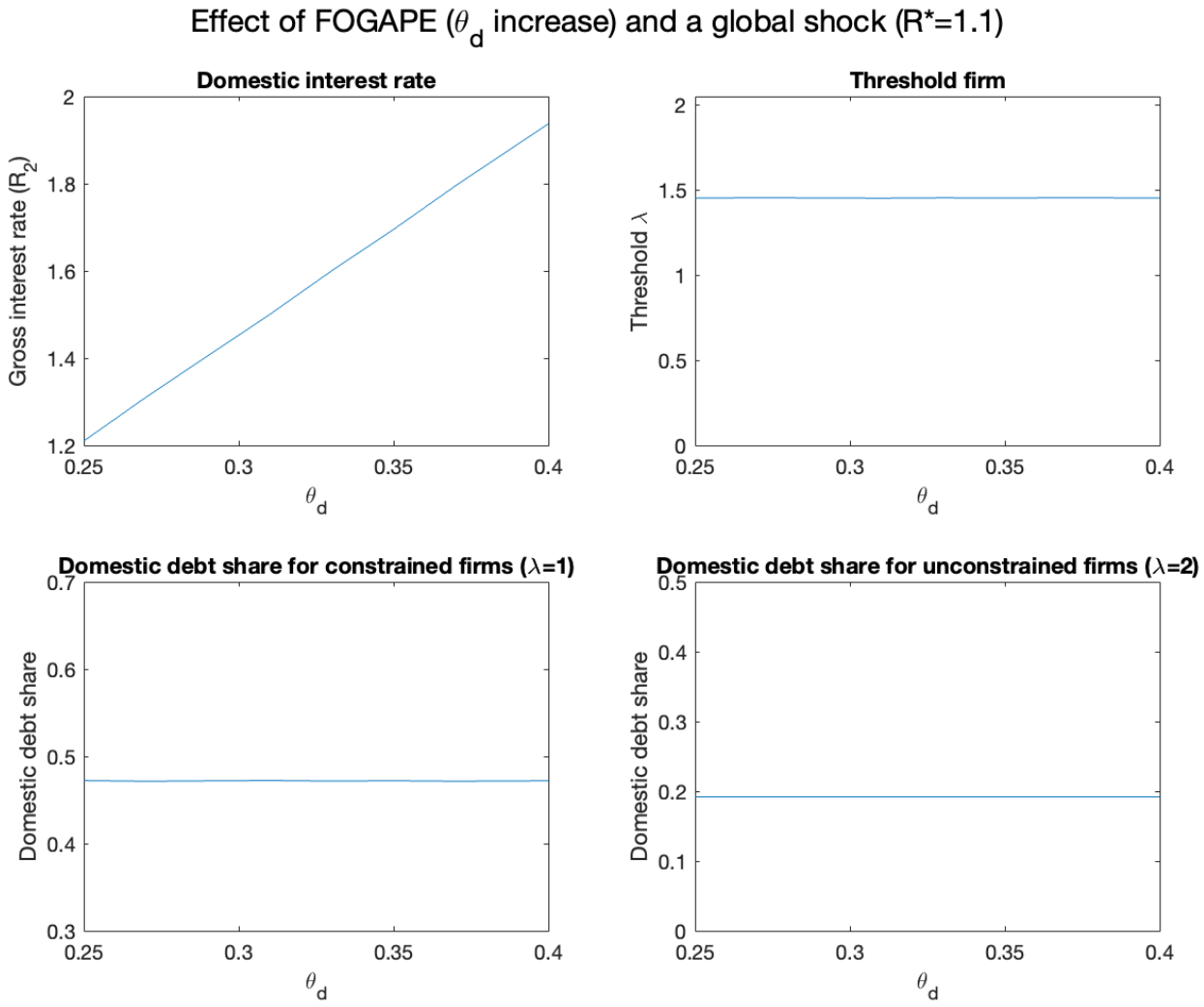
Back

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

UIP Deviations

Return

Demand side of the model - Collateral Constraints (CC)

- CC à la Caballero-Krishnamurthy but with heterogeneity in international collateral $\lambda^i_{2,f} \sim U[0, \bar{\lambda}]$:

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

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

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

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

- FOGAPE-COVID captured by $\uparrow \theta_d$.

Model - Credit demand

- Because, in equilibrium, $R_2 > R^\star \implies$ all firms borrow up to their international CC.

Domestically, two types of firms:

1. Unconstrained can finance $k^\star$ (high $\lambda^i_{2,f}$), borrow $k^\star - \lambda^i_{2,f}/R^\star$
2. Constrained cannot (low $\lambda^i_{2,f}$), borrow $\theta_d Y^i_2/R_2$

Model - Credit Supply

- Models risk aversion amid crisis and effects of policies in reduced-form way.
- Credit supply has 2 parts: Central Bank ($e_{CB} < 1$) and households (e_H):

$$e_T = e_{CB}^{\phi} + e_H \quad (5)$$

$$\phi = e^{R^\star - 1} - \psi(\Delta\theta_d) \quad (6)$$

where ϕ captures risk-aversion from shocks to capital markets.

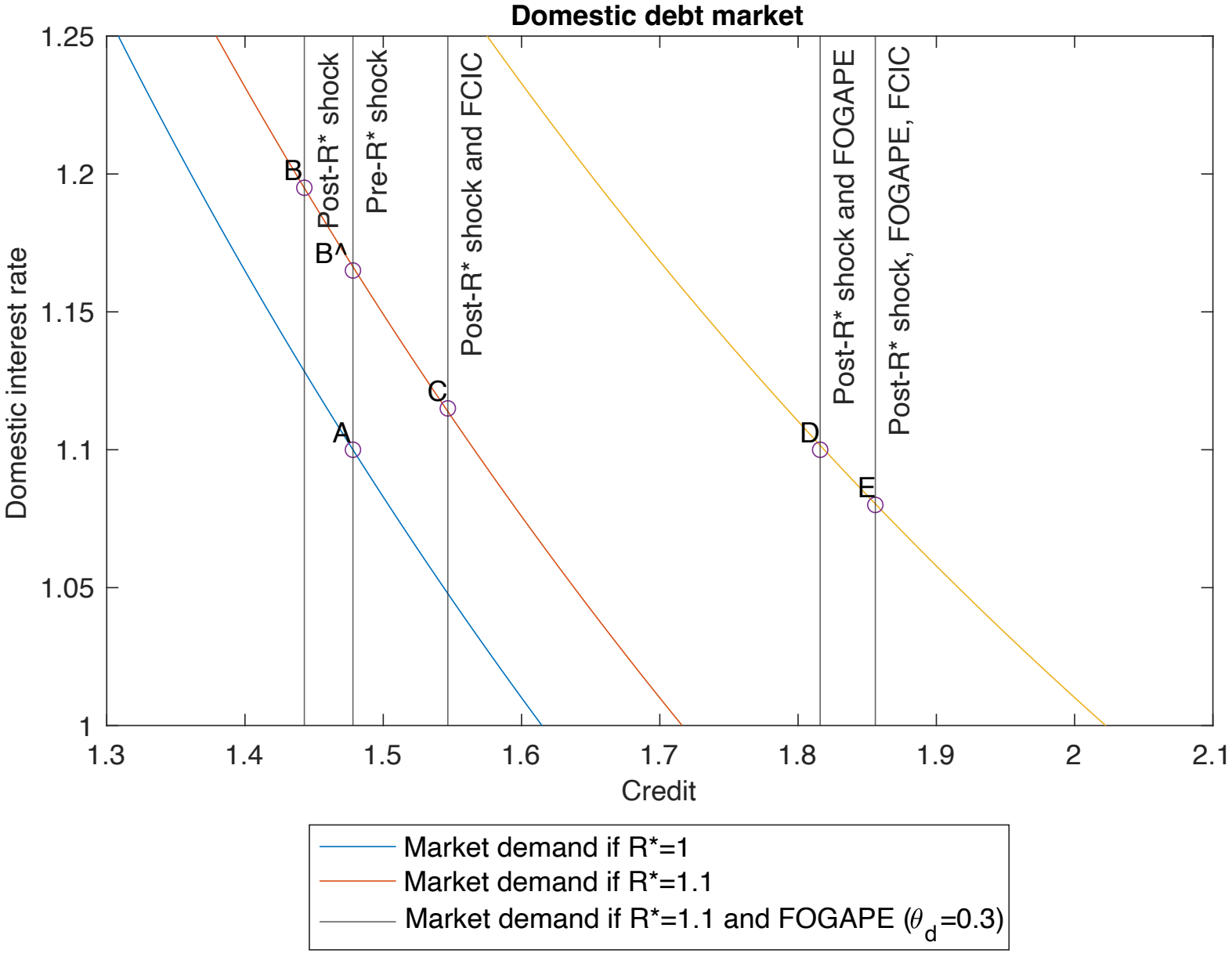
- FCIC captured by $\uparrow e_{CB}$. FOGAPE decreases ϕ.
- Can microfound using Curdia and Woodford (2011).

Market clearing

Quantitative Experiment: Policies

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

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

1. FCIC: $\uparrow e_{CB}$. The higher the risk aversion in banks, the less effective.
2. FOGAPE: $\uparrow \theta_d$
   - Unlocks credit supply by $\downarrow$ risk aversion (ϕ).
   - Increases credit demand, relaxes domestic CC.
3. Joint FCIC & FOGAPE: **Complementarity**

Quantitative Experiment: Policies COVID-19 shock