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

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\textsuperscript{1}Disclaimer: views do not correspond to those of the Central Bank of Chile or its board members, nor those of the IMF, its executive board, or IMF management.
Motivation

- How does **COVID-19 shock** propagate to small open economies?
- So far literature focused on domestic policies (limited fiscal space) and/or capital outflows.[Literature](#)
- We focus on the effect of domestic government policies making it easier for firms to switch from international to domestic finance, or not?
What we do

- We provide both evidence and theory:
  1. **Empirical analysis**: Unique administrative dataset that allows 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.
Figure: Firms’ Finance Mix in Chile: Before & During Policies

- **Debt Stock in April 2020, USD**
  - Small and Medium: 75% Domestic, 25% External
  - Large: 66% Domestic, 34% External
  - Mega: 40% Domestic, 60% External

- **Change in Debt Stock, May - July**
  - Small and Medium: 99% Domestic, 1% External
  - Large: 95% Domestic, 5% External
  - Mega: 39% Domestic, 61% External
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
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.
**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

<table>
<thead>
<tr>
<th></th>
<th>FOGAPE - Jan 2020</th>
<th>FOGAPE-COVID - April 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fund capitalization (USD Millions)</strong></td>
<td>100</td>
<td>3,000</td>
</tr>
<tr>
<td><strong>Interest rate (CHP)</strong></td>
<td>Market</td>
<td>MPR+3%</td>
</tr>
<tr>
<td><strong>Max. annual sales eligibility threshold (UF)</strong></td>
<td>350,000</td>
<td>1,000,000</td>
</tr>
<tr>
<td><strong>Sales range (UF)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 - 25,000</td>
<td>80% - 5,000 UF</td>
<td>85% - 6,250 UF</td>
</tr>
<tr>
<td>25,000 - 100,000</td>
<td>50% - 15,000 UF</td>
<td>80% - 25,000 UF</td>
</tr>
<tr>
<td>100,000 - 350,000</td>
<td>30% - 50,000 UF</td>
<td>70% - 150,000 UF</td>
</tr>
<tr>
<td>350,000 - 600,000</td>
<td>Non elegible</td>
<td>70% - 150,000 UF</td>
</tr>
<tr>
<td>600,000 - 1,000,000</td>
<td>Non elegible</td>
<td>60% - 250,000 UF</td>
</tr>
<tr>
<td>&gt; 1,000,000</td>
<td>Non elegible</td>
<td>Non elegible</td>
</tr>
</tbody>
</table>
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

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

\[
\frac{D_{i}^{domestic}}{D_{i}^{total}} = \beta_0 + \beta_1 \log(sales_{i}^{2019}) + \delta Eligible_i + \epsilon_i
\]  (1)
Regression Discontinuity Design (RDD) Analysis

- $\delta$ 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
The previous analysis is focused on volumes, yet it is silent about prices.

We study the role of interest rates in the mechanism driving debt substitution, as suggested by the following observed fall in the mean firm-level UIP premium.
Mechanism: The Role of Interest Rates

- UIP premium is local currency premium, it is always cheaper to borrow in dollars than local currency in EM (UIP never holds) and even cheaper during bad times (UIP ↑, VIX ↑).

We:

1. Document a **UIP premium in normal times**
2. Document the **UIP premium during the crisis**
3. Study the **role of policy over the UIP premium**

For 1) and 2), we estimate:

\[ i_{f,b,d,m} = \alpha_{f,b} + \lambda Trend_m + \delta FX_{f,b,d,m} + \Theta_1 X_{f,m} + \Theta_2 Z_{b,m} + \Theta_3 \text{Macro}_{m-1} + \epsilon_{f,b,d,m} \]

For 3), we estimate:

\[ i_{f,b,d,m} = \alpha_{f,b} + \lambda Trend_m + \delta FX_{f,b,d,m} + \psi E_{f,m} FX_{f,b,d,m} + \Theta_1 X_{f,m} + \Theta_2 Z_{b,m} + \Theta_3 \text{Macro}_{m-1} + \epsilon_{f,b,d,m} \]
**Mechanism: The Role of Interest Rates**

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

<table>
<thead>
<tr>
<th>Variables</th>
<th>(1) Until Sept 2019</th>
<th>(2) March to July 2020</th>
<th>(3) March to July 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fx</td>
<td>-0.0395***</td>
<td>0.00115</td>
<td>-0.00377*</td>
</tr>
<tr>
<td></td>
<td>(0.00345)</td>
<td>(0.00131)</td>
<td>(0.00215)</td>
</tr>
<tr>
<td>Fx·eligible</td>
<td></td>
<td></td>
<td>0.0117***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.00239)</td>
</tr>
<tr>
<td>Macro Controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Firm Controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Bank Controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>5,929,453</td>
<td>348,550</td>
<td>348,550</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.869</td>
<td>0.646</td>
<td>0.646</td>
</tr>
</tbody>
</table>

Clustered standard errors in parentheses

**p<0.01, ** p<0.05, * p<0.1**
Mechanism: The Role of Interest Rates

- During normal times, there is a **UIP premium of 4 pp**
- The **UIP premium fades away during the crisis**
- **The disappearance of the UIP premium is explained by those firms eligible to FOGAPE-COVID credits**
- **Changes in domestic interest rates—enacted by eligibility to COVID-FOGAPE credits—were crucial in the mechanism behind debt substitution**
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**
  3. **Endogeneous interest rate differential with** $R > R^*$
  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

<table>
<thead>
<tr>
<th>t=1</th>
<th>t=2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Households get endowment</td>
<td>Firms produce</td>
</tr>
<tr>
<td>Firms’ type revealed (Intl. collateral level)</td>
<td>Firms repay both debts</td>
</tr>
<tr>
<td>Firms borrow abroad and domestically</td>
<td>Firms and Households consume</td>
</tr>
<tr>
<td>Firms invest</td>
<td></td>
</tr>
</tbody>
</table>
Model - Collateral Constraints

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

  \[
  R^* d_{1,f}^i \leq \lambda_{2,f}^i \\
  R_2 d_{1,d}^i \leq \theta_d * Y_2^i + (\lambda_{2,f}^i - R^* d_{1,f}^i)
  \]

  Where $Y_2^i = A_2(k_2^i)^\alpha$ and $k_2^i = d_{1,d}^i + d_{1,f}^i$

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

  \[
  (A_2\alpha)^{\frac{1}{1-\alpha}} \equiv k^*
  \]

- $k^*$, target level of capital all firms wish to finance
Model - Two Groups of Firms

Because $\bar{\lambda} < k^* & R > R^*$: most firms have some domestic debt & all firms borrow up to their Intl. Collateral. This yields two types of firms:

1. Domestically unconstrained firms with high $\lambda_{2,f}^i$
2. Domestically constrained firms with low $\lambda_{2,f}^i$

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

$$\int_0^{\bar{\lambda}} d_{1,d}(\lambda_{2,f}^i) + \int_{\hat{\lambda}}^{\bar{\lambda}} (k^* - \lambda_{2,f}^i) = e_T$$

Demand from constrained firms + Demand from unconstrained firms

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

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

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

where $\phi$ captures risk-aversion from shocks to capital markets

If $\phi > 1$ then excess reserves in “banks” are accumulated:

$$e_{CB} - e_{CB}^\phi$$
Quantitative Experiments - No. 1: COVID Shock

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

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 Experiments - No. 1: COVID Shock
Motivation

What we do/find

Empirical Analysis

Theoretical analysis

Conclusion

Appendix

Quantitative Experiment - No. 2: Policies

\[ e_T = e_{CB}^\phi + e_H \]

\[ \phi = e^{R^* - 1} - \psi(\Delta \theta_d) \]

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 Experiments - No. 2: Policies
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** through a lower UIP premium driven by lower domestic interest rates.

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.
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)
**Question 2: Theoretical analysis - Domestic debt share, \( \lambda \)**

- **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
There was a sharp decrease in credit inflows to Chile, and a sharp increase in the spreads of newly-issued foreign debt.
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 of the full sample)
- We consider the period between April 2012 and December 2020
Leverage and firm size

- Total leverage in 2019
- Domestic leverage in 2019
# Descriptive Stats

**Table: Descriptive statistics - Merged Dataset**

<table>
<thead>
<tr>
<th></th>
<th>Domestic loans</th>
<th>Foreign loans</th>
<th>Domestic interest rate (CHP -%)</th>
<th>Foreign interest rate (USD - %)</th>
<th>Foreign interest rate (CHP Ex-Post UIP - %)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean</strong></td>
<td>150166 USD</td>
<td>3953000 USD</td>
<td>13.2</td>
<td>3.3</td>
<td>10.2</td>
</tr>
<tr>
<td><strong>Standard Deviation</strong></td>
<td>1164683 USD</td>
<td>18454800 USD</td>
<td>8.8</td>
<td>2.3</td>
<td>9.1</td>
</tr>
<tr>
<td><strong>Total yearly loans (% of GDP)</strong></td>
<td>34.59</td>
<td>32.13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Number of loans</strong></td>
<td>1972626</td>
<td>9872</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Domestic loans only</th>
<th>Foreign loans only</th>
<th>Domestic and Foreign Debt</th>
<th>All firms</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total yearly sales (% GDP)</strong></td>
<td>122.2</td>
<td>2.8</td>
<td>32.7</td>
<td>157.7</td>
</tr>
<tr>
<td><strong>Total yearly sales (% F29 total sales)</strong></td>
<td>56</td>
<td>1.3</td>
<td>14.9</td>
<td>72.3</td>
</tr>
<tr>
<td><strong>Number of firms</strong></td>
<td>282922</td>
<td>465</td>
<td>703</td>
<td>284090</td>
</tr>
</tbody>
</table>
### Table: Interest rates 2020 vs 2019

<table>
<thead>
<tr>
<th></th>
<th>March - July 2019</th>
<th>March - July 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean $i$ (CHP - %)</td>
<td>15.9</td>
<td>5</td>
</tr>
<tr>
<td>Mean $i^*$ (USD - %)</td>
<td>4.3</td>
<td>3.5</td>
</tr>
<tr>
<td>Mean $i^*$ (CHP Ex-Post UIP - %)</td>
<td>11.5</td>
<td>22.6</td>
</tr>
<tr>
<td>CEMBI (USD %)</td>
<td>2.5</td>
<td>5.1</td>
</tr>
<tr>
<td>Number of firms (i)</td>
<td>59479</td>
<td>174010</td>
</tr>
<tr>
<td>Number of firms (i*)</td>
<td>64</td>
<td>75</td>
</tr>
<tr>
<td>Mean 2019 sales UF (i)</td>
<td>16153</td>
<td>14587</td>
</tr>
<tr>
<td>Mean 2019 sales UF (i*)</td>
<td>864459</td>
<td>1360514</td>
</tr>
</tbody>
</table>
FOGAPE details

<table>
<thead>
<tr>
<th>Características</th>
<th>Jan-20</th>
<th>Apr-20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financiamiento</td>
<td>US$100 millones</td>
<td>US$3.000 millones</td>
</tr>
<tr>
<td>Límite</td>
<td>350.000 UF (1)</td>
<td>1.000.000 UF</td>
</tr>
<tr>
<td>Tasa</td>
<td>-</td>
<td>tpm+3%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Límite por tramos (porcentaje - monto)</th>
<th>Jan-20</th>
<th>Apr-20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hasta 25.000 UF</td>
<td>80% - 5.000 UF</td>
<td>85% - 6250 UF</td>
</tr>
<tr>
<td>Entre 25.000 y 100.000</td>
<td>50% - 15.000 UF</td>
<td>80% - 25.000 UF</td>
</tr>
<tr>
<td>Entre 100.000 y 600.000</td>
<td>30% - 50.000 (2)</td>
<td>70% - 150.000 UF</td>
</tr>
<tr>
<td>Entre 600.000 y 1.000.000</td>
<td>-</td>
<td>60% - 250.000 UF</td>
</tr>
</tbody>
</table>

(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
# RDD Estimates

**Table:** Estimate - Regression Discontinuity Design

<table>
<thead>
<tr>
<th></th>
<th>Baseline (degree 0, tri)</th>
<th>Alternative 1 (degree 1, tri)</th>
<th>Alternative 2 (degree 0, epa)</th>
<th>Alternative 3 (degree 0, epa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment estimate</td>
<td>-0.09422**</td>
<td>-0.12271*</td>
<td>-0.09773**</td>
<td>-0.13589*</td>
</tr>
<tr>
<td>Standard Error</td>
<td>0.05115</td>
<td>0.06666</td>
<td>0.0505</td>
<td>0.06699</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>665</td>
<td>665</td>
<td>665</td>
<td>665</td>
</tr>
</tbody>
</table>
 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
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

<table>
<thead>
<tr>
<th></th>
<th>Baseline (degree 0, tri)</th>
<th>Alternative 1 (degree 1, tri)</th>
<th>Alternative 2 (degree 0, epa)</th>
<th>Alternative 3 (degree 0, epa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment estimate</td>
<td>-0.00131</td>
<td>0.00144</td>
<td>0.0003</td>
<td>-0.0023</td>
</tr>
<tr>
<td>Standard Error</td>
<td>0.05025</td>
<td>0.04697</td>
<td>0.0856</td>
<td>0.08585</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>652</td>
<td>652</td>
<td>652</td>
<td>652</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R^*$</td>
<td>1</td>
<td>$e_{1,H}$</td>
<td>$1.4768-e_{1,CB}$</td>
</tr>
<tr>
<td>$A_2$</td>
<td>3</td>
<td>$\theta_d$</td>
<td>0.25</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>$\frac{1}{2}$</td>
<td>$e_{1,CB}$</td>
<td>0.5</td>
</tr>
<tr>
<td>$k^*$</td>
<td>2.25</td>
<td>$\psi$</td>
<td>10</td>
</tr>
<tr>
<td>$\lambda$</td>
<td>0</td>
<td>$\Delta e_{CB}$</td>
<td>0.05</td>
</tr>
<tr>
<td>$\bar{\lambda}$</td>
<td>$k^* - 0.2$</td>
<td>$\Delta \theta_d$</td>
<td>0.05</td>
</tr>
</tbody>
</table>

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

$$\hat{\lambda} = R^* \left( k^* - \frac{\theta_d A_2 k^*}{R_2} \right)$$
Effects of a global shock in more detail

- **Equilibrium gross interest rate ($R_2$)**
- **Domestic interest rate**
- **Threshold firm**
- **Domestic debt share, constrained firm ($\lambda=1$)**
- **Domestic debt share, unconstrained firm ($\lambda=2$)**
Effects of FOGAPE in more detail (without supply effect)

Effect of FOGAPE ($\theta_d$ increase) and a global shock ($R^*=1.1$)

- Domestic interest rate
- Threshold firm
- Domestic debt share for constrained firms ($\lambda=1$)
- Domestic debt share for unconstrained firms ($\lambda=2$)