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

Miguel Acosta-Henao[†], Andrés Fernández [‡]
Patricia Gomez-Gonzalez[§], Şebnem Kalemli-Özcan[¶]

June 1, 2023

Abstract

We study the interaction between government's fiscal support policies and firms' market financing. Using regulatory data on the universe of Chilean firms, we test the role of Central Bank's special credit line to domestic banks and government-backed credit guarantees provided during COVID-19. Through a regression discontinuity design, we find that firms with access to government support policies increased their domestic debt relative to foreign debt, even though foreign debt in foreign currency is much cheaper than domestic debt in local currency under deviations from the UIP. Further results document how policies reduced UIP premia for firms eligible of guarantees. An open economy model with heterogeneous firms helps rationalize these facts. A shock to the cost of external financing leads to a higher mass of firms with access to domestic credit when the government subsidizes the cost of domestic credit. The government's credit guarantees loosen domestic collateral constraints and reduce banks' risk aversion, while the central bank's special credit line increases the aggregate supply of credit in the economy.

[*]We thank comments and discussions by Rodrigo Alfaro, Sofia Baudduco, Hein Bogaard, Mauricio Calani, Egemen Eren, Juanpa Nicolini, Juan Francisco Martínez, Benoit Mojon, Steve O'Connell, Patricio Toro and participants in conferences held by the Central Bank of Chile, the BIS, CEBRA, and RIDGE. Camila Gomez and Montserrat Marti provided outstanding technical support. The views expressed in this paper are those of the authors and do not represent those of the Central Bank of Chile or their Board, nor those of the the IMF, IMF Managment, or its Executive Board.

[†]Central Bank of Chile. E-mail: macosta@bcentral.cl

[‡]International Monetary Fund. E-mail: afernandez3@imf.org

[§]Fordham University. E-mail: pgomezgonzalez@fordham.edu

[¶]University of Maryland: kalemli@econ.umd.edu

Keywords: Capital flows, firm financing, unconventional policies, COVID-19
JEL Codes: F32, F41

1 Introduction

Since at least the Global Financial Crisis of 2008, the use of unconventional policies has gradually gained relevance among the stabilization tools available to policymakers when confronting large macroeconomic shocks. As the COVID-19 shock hit in 2020, their use took central stage in the policy packages deployed across countries as capital flows retrenched, conventional monetary policies became constrained by the ZLB and fiscal spaces shrank. Indeed, as the pandemic wreaked havoc on human lives and economies worldwide, governments, central banks, and regulators came up with a panoply of new and unconventional policies to counteract its economic impact. Our work draws lessons from the use of these policies as stabilizing devises when confronted with a large simultaneous demand, supply, and financial shock like COVID. We do so through the analysis of granular data from Chile –a country that made use of some of these unconventional policies–, as well as from economic theory.

We focus our analysis on the interaction between firms´ financing choices –domestic and abroad–, and the type of unconventional policies deployed. Our work therefore relates to two different strands of literature. On one hand, a recent body of work focuses on how firms coped with this unprecedented COVID shock and how the policies implemented helped these firms (see Gourinchas et al. 2020; Schivardi and Romano 2020; Gourinchas et al. 2021; Hassan et al. 2021; Albagli et al. 2021; Huneeus et al. 2021; among others). Another strand, focusing on EMs, has highlighted the difficulties for EMs in dealing with the shock, given their lack of fiscal space and reduced foreign financing, due to the turmoil in international markets (see Kalemli-Ozcan 2020; OECD 2020; BIS 2021; IMF 2021; among others). Yet the intersection largely remains unknown. How did firms react to the sudden drying out of international financing? Were they able to adjust their finance mix between international and domestic finance? To what extent was this related to credit support policies implemented by central banks?

Our work provides answers to these questions. On the empirical front, we study the case of Chile with a unique administrative dataset that allows us to examine the finance mix for the universe of firms in terms of their debt issuance—bonds and loans—in both domestic and international markets, in both currencies. Therefore, we can see the finance mix between domestic and international sources pre-COVID, in different currencies, and compare it to the one observed during the pandemic, thereby quantifying the changes induced by the crisis.[1]

The specific nature of the fiscal policy package helps us identify whether government credit support was effective in changing firms' financing mix. The policy package deployed relied on two pillars: i) a series of new credit line facilities from the Central Bank to commercial banks, where access was granted conditional on the growth of credit issuance to SMEs—hence not every bank got it; and ii) the availability of sovereign guarantees on commercial bank loans to firms. The latter policy is also not for every firm—only loans to firms with sales below an exogenous cutoff were eligible. This policy lends itself naturally to the kind of regression discontinuity design (RDD) analysis that we undertake on the effects of these policies on the finance decisions of firms. With the RDD analysis, we study the local average treatment effect of the sovereign guarantees, comparing firms eligible to access the policy with those ineligible.

We show that sovereign guarantees help firms increase their domestic debt. A firm just to the left of the eligibility cutoff has a domestic debt share 10 percentage points (pp) larger than a firm just to the right. The key mechanism underlying this result is the pricing of credit. Even though foreign credit is cheaper during the risk-off shock of COVID-19, given the deviations in Uncovered Interest Parity (UIP) condition and the rise in the UIP premia (e.g., Kalemli-Ozcan and Varela (2021)), government support counteracted this market-pricing. We observe loan rates by different currencies and hence can test explicitly if borrowing in domestic currency became cheaper after the government support, even domestically.[2] We

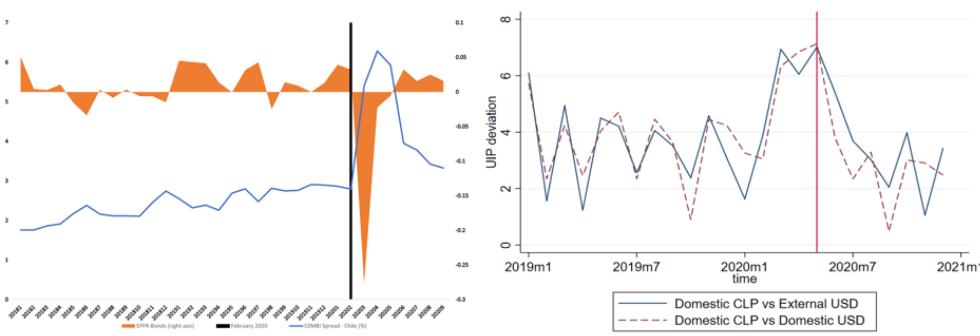
[1] The Central Bank has access to anonymized information from various public and private entities through collaboration agreements signed with various institutions.

[2] In Chile, firms can borrow both in domestic and foreign currency from domestic banks and in foreign

find that the UIP premium reversed for firms eligible for sovereign guarantees.

Figure 1, panel (a) shows capital inflows experienced a sharp reversal while corporate FX debt risk more than doubled as the pandemic spread throughout Chile between March and June 2020. Panel (b) plots the UIP premia (in red and blue). While CEMBI spread in panel (a) captures purely default risk on FX bonds issued internationally, the UIP premia in panel (b) capture the local currency premia on borrowing in domestic currency domestically or internationally. While CEMBI captures only default risk, UIP captures both default and currency risk, a fast-depreciating asset for foreign investors.

Figure 1: A picture of the pandemic: Capital flows and risk premium



Notes. Panel (a) depicts the fund flows' EPFR measure (right axis) and the CEMBI spread for Chile (blue line). The vertical line denotes February 2020, the month before the first COVID case in Chile. The data sources are, respectively, Informa PLC and Bloomberg. Panel (b) depicts our data's average UIP premia in blue and red.

On the theoretical front, we model firms' external borrowing in foreign currency in a small open economy in the wake of a large global shock that raises the cost of debt issuance in foreign currency in international markets due to higher default risk as the COVID pandemic shock did (Figure 1). The model features heterogeneous firms that borrow domestically and abroad, facing different collateral constraints in each market à la Caballero and Krishnamurthy (2001). Furthermore, firms are heterogeneous in their endowment of collateral pledgeable to international investors. This setup can deliver three stylized facts observed in Chile. First, larger firms (by sales) borrow more abroad. Second, larger firms are relatively

currency in internationally issued bonds.

more leveraged.[3] Third, borrowing rates in domestic markets are higher than foreign rates, given the UIP deviations, since most of the domestic borrowing is in domestic currency. In the model, the endogenous wedge between domestic and international rates stems from the differential collateral constraints in both markets, leading to endogenous UIP deviations. The wedge can also capture the risk premium associated with exchange rate movements (Kalemli-Ozcan 2019; Kalemli-Ozcan and Varela 2021).

Our model helps rationalize the empirical findings on firms' finance mix due to the interplay of two forces. On the one hand, an increase in the cost of borrowing abroad–akin to the one triggered by COVID–makes firms move away from foreign debt and towards domestic debt, increasing the domestic debt share. Absent domestic credit support policies, however, the model predicts a counterfactual increase in domestic rates given the risk in UIP premia as a response to the risk-off shock of COVID-19. The calibrated version of the model can reproduce the change in the finance mix observed among Chilean firms and the aggregate behavior of interest rates only when credit support policies are active. In the model, a policy of sovereign guarantees loosens firms' collateral constraints, increasing credit demand, and decreases banks' risk-aversion, increasing aggregate credit supply. The credit line facility complements the sovereign guarantees in increasing the credit supply.

The rest of the paper is divided as follows. Section 2 briefly describes the credit support policies implemented in Chile in the wake of COVID-19. Section 3 provides the empirical results of the paper. Section 4 lays out the model. Concluding remarks are in Section 5.

2 Credit Support Policies Implemented

Like most countries, Chile experienced a sharp decrease in economic activity as the pandemic triggered by COVID-19 spread. In the second quarter of 2020, output and private consumption fell by 14.2% and 20.4%, respectively, relative to the same quarter of 2019. This was

[3] Gopinath et al. (2017) also find that larger firms are more leveraged in Spain.

the trough of the crisis, with the largest drop in economic activity in recent history.[4]

The COVID crisis had a different nature than any other recent downturns, amplified through both supply and demand channels. Due to the sanitary restrictions and lockdowns enforced–well justified to minimize contagion and the loss of lives–, output fell initially because of a large drop in aggregate supply. With subsequent job losses and the fear of contagion, aggregate demand also fell. In this context, policy responses included new measures focused on minimizing potential scarring effects on firms and supporting household consumption.

As highlighted by Costa (2021) and the Central Bank of Chile's Monetary Policy Reports in 2020 and 2021, such policy responses were considerable in Chile. The Central Bank lowered the monetary policy rate (MPR) to its effective lower bound of 0.5% at the onset of the crisis in March 2020 and launched a series of special credit line facilities of more than 10% of GDP. Crucially, such credit programs were complemented by sovereign guarantees on commercial bank loans to firms that allowed to cover loans of up to 9% of GDP.[5]

We study the two main unconventional policies implemented at the onset of the COVID crisis to support credit to firms in Chile: 1) FCIC: a new credit line facility from the Central Bank to commercial banks conditional on the growth of credit issuance to small and medium firms;[6] and 2) FOGAPE-COVID: a program aimed at extending sovereign credit guarantees on commercial banks' loans to firms–below a chosen pre-determined size–for working-capital purposes.[7] We explain such policies in greater detail next.

[4]During the global financial crisis, the trough of GDP growth in Chile was −3.32% during the first quarter of 2009. In 1999, during the crisis triggered in East Asia, the largest yearly fall in output was −3.43% during the first quarter of 1999.

[5]By the second half of 2020, the government also implemented policies aimed at supporting households via transfers, and Congress passed a law authorizing early withdrawals of pension savings, all of which are beyond of the scope of this paper. See Costa (2021) for a thorough explanation of the policies implemented during the COVID-19 crisis in Chile.

[6]There were other policies implemented by the Central Bank of Chile to ease financial conditions (e.g., bank bond purchases), but the size of FCIC was considerably larger than the rest.

[7]The Spanish acronym FCIC translates: Credit Facility Conditional on Lending, while FOGAPE translates as Guarantee Fund for Small Entrepreneurs

2.1 Special Central Bank Credit Lines to Commercial Banks: FCIC

FCIC was a policy of unprecedented size and was implemented in various stages. It started in March 2020 as a credit line to commercial banks for four years at a fixed interest rate equal to the MPR. Most of these credits were given at the effective lower bound of the MPR (0.5%).

The first stage of FCIC was worth USD 24 billion, about 8.4% of Chile's 2019 GDP. Banks could access up to 15% of the loans in their balance sheets, out of which 3% had unconditional access to stimulate the demand for this credit line. To use the rest of the credit line, banks had to show an increase in their lending to either firms or households. There were additional incentives to credits given to small and medium firms. Access to FCIC required collateral. Part of it could be bank reserves held at the Central Bank; the rest required other assets. Access to this credit line was open for six months, after which 95% of it was used.

In June 2020, the Central Bank launched a second phase of FCIC with nearly USD 16 billion available and accessible for eight months. This second rollout of FCIC, FCIC-2, was conditional on the increase in either FOGAPE-COVID loans or loans to other non-banking credit institutions. The use of FCIC-2 was 30%. The other 70% was used in FCIC-3, triggered in March 2021, and tied to another FOGAPE program called "FOGAPE Reactiva" (aimed at stimulating firms' demand for investment).

2.2 Sovereign Credit Guarantees on Loans: FOGAPE-COVID

The FOGAPE program dates back to 1980 and makes government resources available for small and medium firms to use as collateral in bank loans, with the loan fraction accessible depending on firm size. Crucially, FOGAPE eligibility depends on yearly sales, defined in UF, an inflation-indexed unit of reference in Chile that varies daily.[8]

Resources used as guarantees come from a government fund with the sole purpose of acting

[8] By January 31^{st}, 2019, $1UF = 34.5USD$.

as collateral for firm loans. The fund has been capitalized over the years. Before November 2019, firms with yearly sales below 25,000 UF were eligible to access FOGAPE loans. The program was expanded in October 2019 after the drop in economic activity due to the episode of social unrest in Chile. By January 2020, it had been capitalized with USD 100 million, and the sales eligibility threshold increased to 350,000 UF.

On April 25, 2020, the government launched the FOGAPE-COVID program, which included a massive recapitalization of the fund by USD 3 billion, guaranteeing up to USD 24 billion in credits. It would only cover new and working-capital loans, providing guarantees between 60% and 85% of each credit depending on firm size.

Table 1 presents a summary of the main FOGAPE-COVID characteristics and compares them to the standard FOGAPE program that existed before the onset of the pandemic. Some institutional changes are worth highlighting. First, and critically for our empirical work, FOGAPE-COVID increased the cutoff required to access the typical FOGAPE credit from 350,000 UF to 1 million UF. Second, contrary to the previous version of the program, where the interest rate was the market rate, FOGAPE-COVID had an interest rate ceiling of the MPR plus 300 basis points. Finally, the fraction of the loan guaranteed and the maximum FOGAPE loan increased for all firm sizes.

An important feature of FOGAPE-COVID, not included in Table 1, is that eligibility for the program was based on past sales from 2019.

The details of how FOGAPE-COVID was implemented provide an adequate setup to evaluate the effect of becoming eligible for these loans over a specific outcome variable. The fact that firms in the neighborhood of the cutoff were never treated with FOGAPE eligibility before and that such a cutoff is exogenous and based on a past outcome(sales of 2019) led us to use a Regression Discontinuity Design (RDD) for this purpose, as presented in the next Section.

Table 1: FOGAPE in April 2020 vs January 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

Notes: FOGAPE-COVID was triggered at the very end of April 2020. Sources: Chilean Financial Markets Commission and the Chilean Congress.

3 Empirics

3.1 Data

The information used in this work comes from merging various administrative datasets owned by the State. The Central Bank of Chile created and maintains the repository with this data to support policy-making, statistics, and research.

For this project, we merged five administrative anonymized datasets from the universe of firms in Chile which allow us to document the entire spectrum of firms' finance mix: 1) Deudex: a foreign debt dataset, which contains all foreign debt loans (both stocks and flows) including a rich set of loan characteristics such as interest rates, maturity, currency, etc., between April 2012 and December 2020; 2) D32: a credit registry on firm-to-domestic bank new loans and their conditions, which we complement with that of firm-to-bank FOGAPE-COVID loans during 2020; 3) D10: consolidated debt stocks of firms with the domestic banking system; 4) Domestic Bond Issuance: records the value of each firm's bond issuance in the domestic bonds market; and 5) F29: firms' total monthly sales from value-added tax records.

The primary source for Deudex is the Central Bank of Chile; D32, D10, and the Domestic Bond Issuance are collected by the Chilean Financial Markets Commission, and F29 by the Chilean IRS.[9] To our knowledge, we are the first to merge those datasets to study how credit support policies implemented during the COVID-19 crisis affect the firms' finance mix between domestic and foreign debt.[10]

The merged dataset has a monthly frequency between April 2012 and December 2020. For firms that borrow abroad directly, we keep only non-trade credit loans and bond issuance. We keep foreign credits in US Dollars, Euros, Japanese Yen, or Chilean Pesos, which represent more than 98% of total external borrowing. We also keep only credits with positive spreads to avoid distorting the data with credits that are not likely to represent a real need for credit.[11]

Table 2: 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	39530000 USD	13.2	3.3	10.2
Standard Deviation	1164683 USD	184548000 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	

Notes: The moments presented in both panels of the Table are from the merge of Deudex, D32, Foreign Debt, D10, and F29 datasets. The moments are averages for April 2012 to December 2020. Ratios to GDP are calculated on a yearly basis from 2013 to 2020 using Chile's nominal GDP, and then taking averages across years. The foreign interest rate measured in Chilean Pesos is calculated using ex-post UIP such that $i_t = i_t^\star + \frac{e_t}{e_{t-12}} - 1$, where t is the corresponding month.

Table 2 presents the most relevant descriptive statistics of our merged dataset. The top panel shows statistics regarding domestic and foreign credit conditions in our merged dataset.

[9]Disclaimer: Officials of the Central Bank of Chile processed the disaggregated data from the Chilean IRS and the Chilean Financial Markets Commission. The information contained in the databases of the Chilean IRS is of a tax nature originating in self-declarations of taxpayers presented to the Service; therefore, the data's veracity is not the Service's responsibility.

[10]Our work complements that of Albagli et al. (2021), which, unlike us, studies the real effects of credit support policies in Chile on firms' sales, employment, and investment. However, this work does not study firms' finance mix, which is our main focus. Huneeus et al. (2021) also studies access to credit support policies by firms in Chile during COVID and its impact on aggregate risk, but does not analyze changes in the finance mix.

[11]These are likely to be another type of transaction such as movement of resources between parent companies and their subsidiaries or temporary credits that work only for tax purposes, among others.

While the mean domestic peso loan has a size of about USD 150 thousand (using the spot exchange rate), the mean foreign loan is almost USD 40 million. This difference is natural since larger firms have access to foreign markets. The standard deviations show that domestic loans exhibit a higher dispersion in size than foreign loans.

The mean interest rate on a domestic loan in pesos is 13.2%, while for foreign loans in dollars, it is 3.3%. Correcting the latter by (ex-post) uncovered interest rate parity (UIP) yields a mean of 10.2%. Hence, on average, it is cheaper to borrow abroad once you have access to external financial markets. Furthermore, fewer firms have access to foreign credit as the number of domestic loans is about 200 times larger than the number of foreign loans. The yearly debt stock-to-GDP ratio is 34.6% for domestic loans and 31.13% for foreign loans.

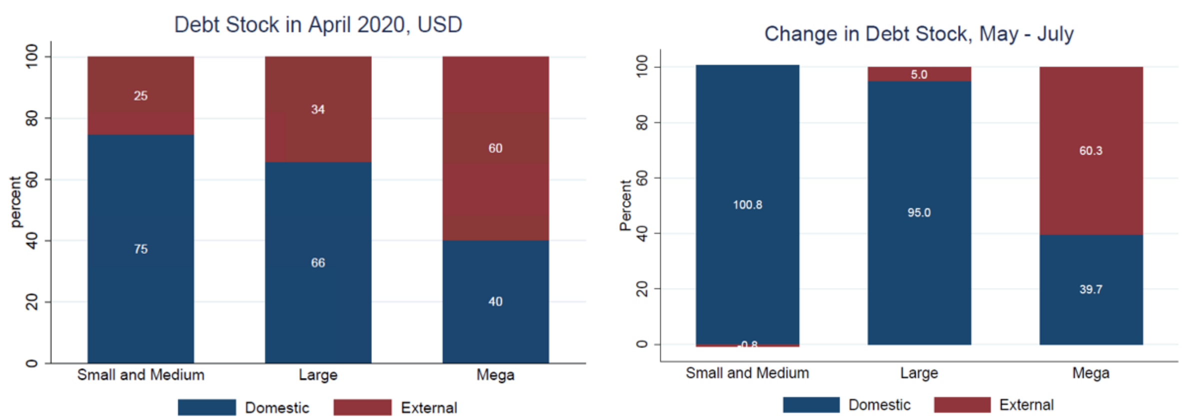
The last row of the bottom panel in Table 2 shows that, in our data, out of a total of 284,090 firms, 282,922 borrow only domestically, 465 only abroad, and 703 in both markets. The first two rows of the bottom panel compare sales among the firms studied as a share of GDP, confirming that large firms borrow abroad since their sales account for 15% of total sales despite being much smaller in number relative to those that do not have access. As the last column shows, the mean yearly sales of all firms is 157.7% of GDP, and they represent on average 72.3% of total sales as recorded in the tax information before applying the filters.

3.2 Debt Composition and Interest Rate Behavior during COVID

We uncover two facts on the foreign-for-domestic debt substitution and the behavior of interest rates during COVID.

First, regarding firms' debt composition, the left panel in Figure 2 plots the domestic and external debt stock shares across firms' size in April 2020, right before implementing the FOGAPE-COVID policy. The finance mix of firms was such that the share of domestic debt in the total stock of debt was decreasing in size. Indeed, while the domestic debt share of small-and-medium firms was 75% and 66%, respectively, mega firms had a considerably smaller share of 40%. Yet, as the right panel in Figure 2 depicts, between April and July 2020, when credit support policies were deployed, firms tilted their new debt issuance much more towards domestic debt issuance.[12] Importantly, this relatively higher increase in the domestic debt share was entirely concentrated in small, medium, and large firms, which were the ones eligible for loans with the sovereign guarantees. Indeed, small-medium and large firms increase their share of domestic debt issuance to 99% and 95%, respectively. The share of domestic debt share for Mega firms–those that did not qualify for FOGAPE-COVID loans–remained virtually unchanged at 40%.[13] Furthermore, between April and July 2020, about 80% of credit flows are in pesos and 20% in dollars, showing that most of the substitution was from foreign dollar-denominated debt to domestic peso-denominated debt.

Figure 2: Stock and change in firms' finance mix - April to July 2020



Notes: The left-hand-side plot depicts the domestic (blue) and external (red) debt share over total debt for three groups of firms in April 2020: 1) Small and medium (yearly sales of less than 100,000 UF). 2) Large (yearly sales greater than 100,000 UF and less than 1,000,000 UF). 3) Mega (yearly sales greater or equal to 1,000,000 UF). The right-hand-side plot shows the change of each type of debt, domestic and foreign, as a share of the total change in the debt stock between May and July 2020. All calculations convert all debt to dollars using the spot exchange rate.

[12] We take July 2020 as our last period because from August 2020 onward, the government implemented another set of policies (such as direct subsidies and approval for direct withdrawal from pension funds, among others) that could considerably distort our analysis.

[13] Figure 12 in the Appendix shows that this fact also holds when we consider the initial stock of debt in January 2020, right before the onset of the pandemic crisis, and when we measure the change in the stock of debt between February and July 2020.

Second, regarding the behavior of interest rates, the first two rows of Table 3 document that the mean domestic interest rate considerably fell to 5% between March and May 2020, from 15.9% in the same period of 2019. The mean foreign interest rate for newly issued debt in dollars also fell, but considerably less in relative terms, from 4.3% to 3.5%. Conversely, the third row of the table shows that when we measure the mean foreign interest rate in Chilean pesos (ex-post UIP corrected), it displays a sharp increase from 11.5% to 22.6%.

Notice from the last row of Table 3 that the mean 2019 sales of firms that borrowed abroad was higher in 2020 than in 2019. This means there is likely selection among the firms with access to foreign credits. This is, better-performing firms seem to have had access to foreign markets at relatively lower foreign interest rates in dollars. This fact, together with the increase in the ex-post UIP corrected foreign interest rate and the increase in the CEMBI spread from 2.5% to 5.1%, suggests that a larger risk faced by firms that had already issued bonds abroad–accompanied by a sharp currency depreciation during 2020–crowded out other firms from foreign markets.

The drivers behind the sharp fall in the average domestic interest rate are a very expansive monetary policy through the MPR and the implementation of FCIC and FOGAPE-COVID loans, which had a ceiling interest rate of 3.5% during that period. When we remove those loans from the sample, the average domestic interest rate is close to 9% instead of 5%, which still represents a significant drop in domestic interest rates. This documented fall in the relative domestic interest rate vis-à-vis the foreign one aligns with a fall in the average UIP deviation firms faced after the policies were implemented.

Lastly, as documented the Introduction, Figure 1, panel (b) depicted two average UIP deviations across firms each month since January 2019: 1) between domestic debt in pesos and foreign debt in dollars; and 2) between domestic debt in pesos and domestic debt in dollars. The vertical line represents May 2020, when FOGAPE-COVID was in place. The figure shows how the UIP deviation between (domestic) debt in pesos and debt in dollars (be it domestic or foreign) increases at the onset of COVID in March 2020 and remains high until May when the credit support policies were implemented, dropping again to pre-COVID levels.[14]

Table 3: Interest rates 2019 vs 2020

	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

Notes: The table shows, using the merged dataset, the mean domestic and foreign interest rates for the March-July period in both 2019 and 2020. The foreign interest rate measured in Chilean Pesos is calculated using ex-post UIP such that $i_t = i_t^\star + \frac{e_t}{e_{t-12}} - 1$, where t is the corresponding month. The rest of the variables are from the merged dataset. The last two rows are the mean sales of 2019 for firms that borrowed in domestic and foreign markets, respectively.

We argue that the facts described by Figure 1, Figure 2, and Table 3 point out to an environment of higher risk in international markets, lower domestic interest rate triggered by credit support policies, and foreign-for-domestic debt substitution. We now turn to a more formal approach to establish causality from the policies implemented to the finance mix of firms.

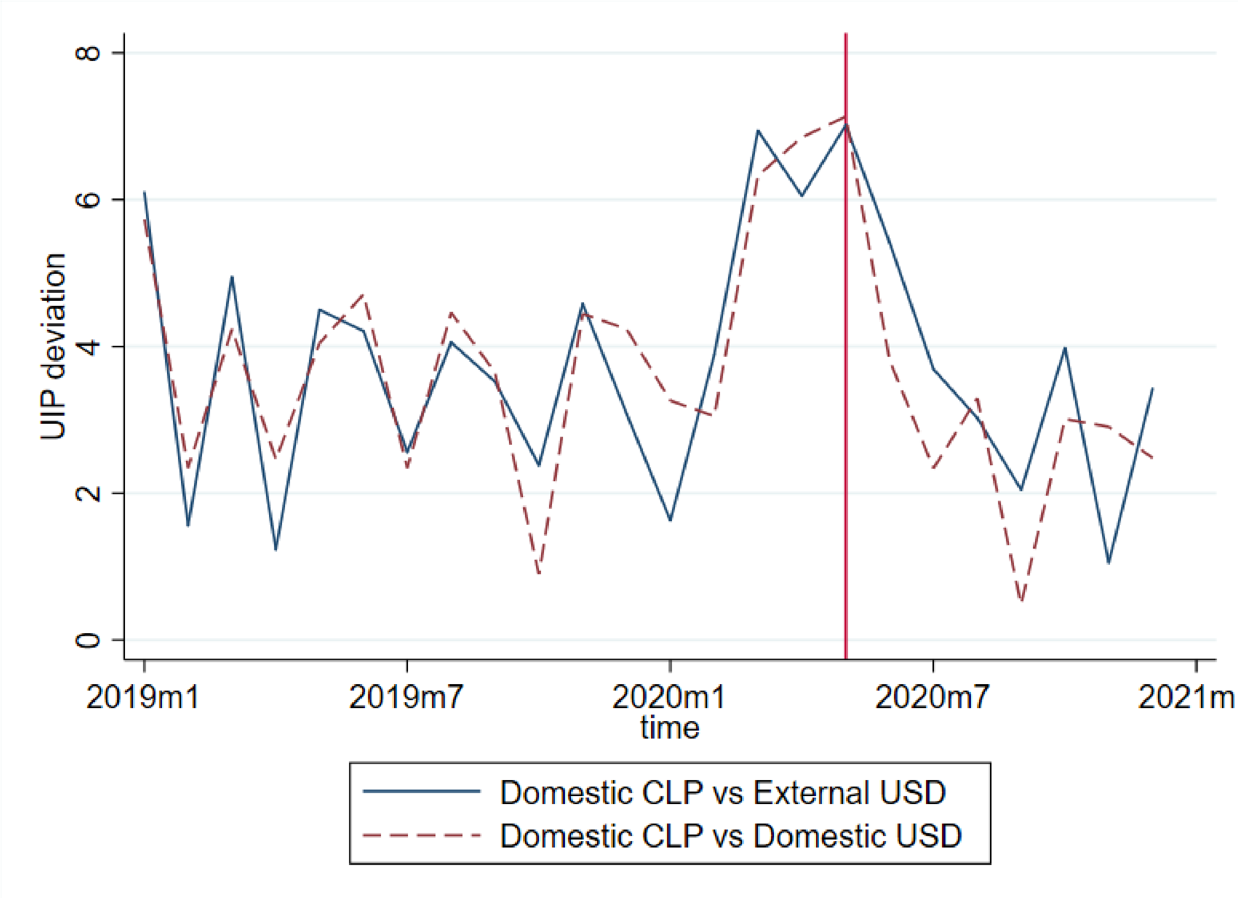
3.3 Empirical Design

We use a regression discontinuity design (RDD) to estimate the causal effect of becoming eligible to receive a FOGAPE-COVID credit on firms' domestic debt share.[15] This approach is natural since we have exogenous changes in the sales thresholds required to be eligible for FOGAPE-COVID credits. Specifically, before May 2020, firms with annual sales between

[14] Figure 11 in the appendix shows Figure 3 extended to the whole period in our sample. The same pattern holds in both figures.

[15] Mullins and Toro (2018) applies a similar approach to study the effects of becoming eligible for FOGAPE credits in 2011 and 2012 over domestic debt growth and the number of new bank-firm relationships. They find positive and significant effects on both outcomes.

Figure 3: Average UIP deviation of firms



Notes: Each line corresponds to the average UIP deviation across firms each month. The solid line (blue), dotted line (red), and green line (yellow) represent, respectively: 1) the UIP deviation between domestic borrowing in local currency and foreign borrowing in dollars, 2) the UIP deviation between domestic borrowing in local currency and domestic borrowing in dollars, and 3) Domestic borrowing in dollars and external borrowing in dollars. The vertical line corresponds to May 2020, when FOGAPE-COVID was in place.

350,000 UF and 1 million UF were not eligible for this type of credit. However, as described before, the threshold was increased to 1 million UF as part of the credit-supporting policies. Since the annual sales to determine the cutoff are those of 2019, firms are quasi-randomly assigned around the new eligibility threshold in May 2020. In RDD terms, the assignment variable (2019 sales) is observable to the econometrician, and depends on a threshold due in the past, leaving small room for firms to conveniently sort themselves right below that threshold, an issue that we explore further below. Therefore, firms on the left-hand side of the cutoff (1 million UF in sales) that are eligible for the program are treated, and those on the right-hand side are controls. The causal effect of this policy over the domestic debt share is then estimated as the size of the discontinuity at the cutoff. In the absence of the cutoff, there would not be any type of discontinuity in the domestic debt share. Below we investigate this formally using alternative years as placebo tests, among other robustness tests.

We define the treatment as *being eligible to obtain FOGAPE-COVID loans*. This is, having sales in 2019 lower than 1 million UF. This implies that all firms to the left of this threshold that did not have access to FOGAPE credits before (i.e., firms with more than 350,000 UF) are treated, and those to the right are not. In this sense, we estimate a sharp RDD.[16] The specification is the following:

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

The outcome variable in the left-hand side of Equation 1 is calculated by dividing the domestic debt over the total debt (i.e., domestic plus foreign debt) of firm i. For this, we transformed the foreign debt to dollars at the spot exchange rate and then calculated the share of domestic debt over the total.[17] Although domestic debt includes US dollar-denominated loans issued in the domestic market, more than 80% of domestic debt is peso-denominated debt. Furthermore, FCIC, capitalized in pesos, was the largest source of funds for banks during April and July 2020, as the right-hand-side panel of Figure 6 shows. Thus, we often use domestic debt and peso-denominated domestic debt almost interchangeably.

[16]One could think about a fuzzy RDD where the instrument is the probability of obtaining FOGAPE-COVID loans. However, we choose the sharp RDD for two reasons. The first one is grounded in economics: becoming eligible implies knowledge from the banks that firms could access the program either way. Thus, especially around this cutoff, which is the limit between large and mega firms, banks would simply charge lower interest rates to already eligible firms. The second is statistical: the number of firms that take FOGAPE-COVID loans around the cutoff is low, around 15, limiting the power of the fuzzy-RDD estimation.

[17]Evidently, our dependent variable will be affected by exchange rate movements such as the large Chilean peso depreciation observed during the period studied. However, if anything, this would bias results against the hypothesis tested, because a large depreciation implies a larger share of foreign debt over the total.

The right-hand side in Equation 1 has the assignment variable, 2019 sales in logs, and the treatment, $Eligible_i$, which takes the value of 1 when firms have sales below the 1 million UF cutoff and 0 otherwise. Both the outcome and the treatment variables are firm-level averages between May and July 2020. As mentioned before, we choose this period because the cutoff was increased in May and, starting in August 2020, other policies were launched which could distort our estimation.[18] Thus, the estimate of δ is the estimated causal effect of becoming eligible for a FOGAPE-COVID loan–the average effect of the treatment over firms close to the cutoff.

We estimate a local RDD with a triangular kernel. We do this for degrees zero (i.e., $\beta_1 = 0$) and 1 (i.e., $\beta_1 \neq 0$), and both Triangular and Epanechnikov kernel functions. As Cattaneo et al. (2021) recommends, we do not use controls other than log of sales, since we are not looking to define parameters of interest or to increase the efficiency of the estimation.

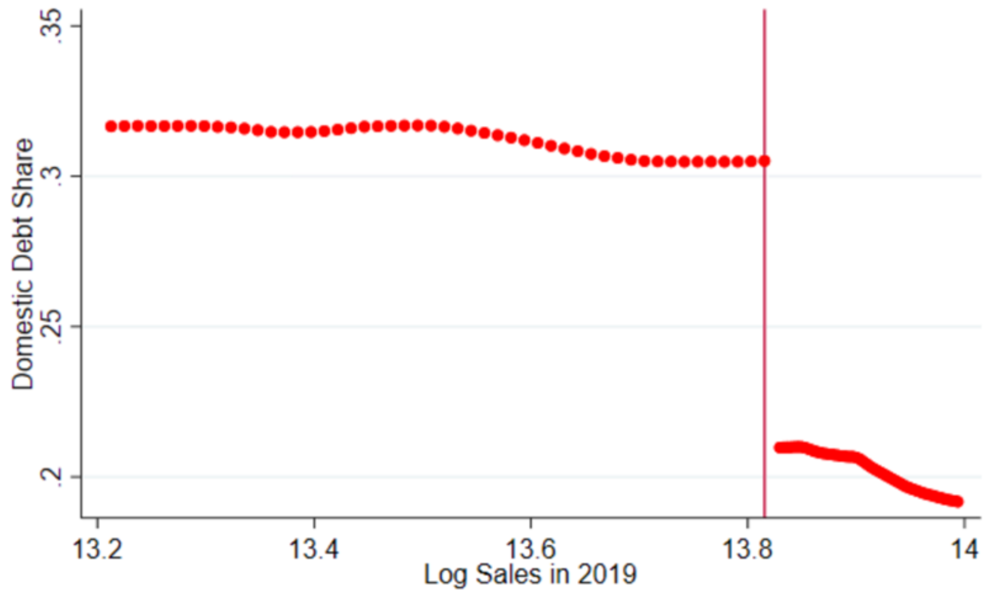
3.4 RDD Results

Table 4 presents the results of the RDD analysis described in Equation 1. There are 665 firms around the cutoff, with 442 to the left and 223 to the right. The first row reports the estimate of δ, and the other rows report the standard errors and the number of observations. The stars denote (robust) standard levels of significance. The first column corresponds to a baseline estimation, with a local regression of a degree-0 polynomial and triangular (tri) kernel. The second column is an estimate implementing a degree-1 polynomial and a Triangular Kernel. The third and fourth columns report the estimates with degree-0 and degree-1 polynomials using an Epanechnikov (epa) Kernel. Figure 4 shows a graphical representation of the local regression using the baseline specification. The vertical line depicts the cutoff of 1 million UF sales (in logs). At each side of the cutoff, the plot shows the estimated polynomial, where

[18] Two prominent examples of these additional policies implemented in since August 2020 were a law that allowed workers to withdraw a fraction of their pension funds and direct cash transfers to households. Because these policies may evidently have brought about general equilibrium effects over domestic interest rates–among other variables–, we believe it is best to carry out our analysis for the period before these additional measures were implemented.

the gap at the discontinuity is the estimated effect of the treatment.

Figure 4: Domestic debt share vs Sales - Estimated polynomial May to July of 2020



Notes: The red dots depict local polynomial approximations around the cutoff (vertical line). The specification shown in the figure is a degree-0 polynomial with a Triangular Kernel.

Table 4: 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

Notes: The table shows the estimates of becoming eligible for FOGAPE-COVID loans, represented by δ in Equation 1 under different specifications. The domestic debt share is the firm-level average between May and July of 2020. *,**, *** are robustly significant coefficients at the three standard levels of significance. Each specification shows the degree of the polynomial and the type of kernel function used to estimate the local polynomial, where tri refers to Triangular Kernel and epa to Epanechnikov Kernel.

All estimates are significant at the 10% level–with baseline and alternative 2 being significant at 5%. Considering the baseline specification, we interpret the result as follows: becoming eligible for FOGAPE-COVID credits has an average effect of increasing the domestic debt share by 9.4$p.p$ for firms around the cutoff. We interpret this result as evidence of *debt substitution*: firms that became eligible to receive FOGAPE-COVID, altered their finance mix by taking on more domestic debt relative to foreign debt. That is, treated firms recomposed their liabilities towards less exposure to external foreign-currency debt relative to domestic local-currency debt.[19]

The debt-substitution channel we are identifying is not only statistically significant, but it has also relevant macroeconomic implications. Indeed, the total sales of those firms that became eligible represent 18% of GDP and 8% of the total sales in the F29 database. Moreover, the increase in domestic credit by these firms at the beginning of the crisis reached about 1% of 2020's GDP.

3.5 Mechanism: The Role of Interest Rates

The estimates of the RDD described in the previous subsection provide evidence of a foreign-for-domestic debt substitution by firms in the wake of COVID, fostered by becoming eligible for FOGAPE-COVID loans. Because this result focuses on credit volumes, it is silent about prices. In this subsection, we study the role of interest rates in the mechanism that drove such debt substitution.

For this purpose, we rely on the well-established finding in the literature that a UIP premium exists for dollar loans in emerging markets (Kalemli-Ozcan and Varela, 2021). We follow this work and explore the following three things. First, we investigate if there is a UIP premium in the Chilean data pre-COVID. Second, we document the extent to which COVID-19 altered the UIP premium and, third, what role credit support played.

For the first two tests, we estimate the following specification:

$$i_{f,b,d,m} = \alpha_{f,b} + \lambda Trend_m + \delta FX_{f,b,d,m} + \Theta_1 X_{f,m} + \Theta_2 Z_{b,m} + \Theta_3 Macro_{m-1} + \epsilon_{f,b,d,m} \quad (2)$$

[19] It can still be argued that changes in the dependent variable in Equation 1 are driven by foreign debt falling. To address this, Figure 6 below shows the decomposition in the change of firms' debt, providing evidence that the change in the finance mix was due to a considerable increase in domestic liabilities with respect to the total.

where $i_{f,b,d,m}$ is the nominal interest rate on a loan taken by firm f, lent by bank b, in currency denomination d, in month m; $\alpha_{f,b}$ are bank-by-firm fixed effects; $Trend_m$ is a monthly deterministic trend; $FX_{f,b,d,m}$ is a dummy that takes the value of 1 if the loan is in foreign currency and 0 otherwise. We restrict foreign currency loans to those in dollars, which represent more than 95% of domestic credits in foreign currency. We control for a vector of firm-level characteristics, $X_{f,m}$, a vector of bank-level characteristics, $Z_{b,m}$, and a vector of lagged macro controls, $Macro_{m-1}$. The variables in each of the first two vectors are value-added, market share (within the correspondent 2-digit economic sector), and leverage for both firms and banks. The macro controls are the price of copper (which is, by far, Chile's main export), the MPR, and a monthly indicator of economic activity in Chile. The last term of the equation is the mean-0 $i.i.d$ disturbance.

The specification in Equation 2 follows di Giovanni et al. (2021), who argue that the estimate of δ is the UIP premium. Thus, we run this estimation for domestic credits since we have information about each lender. The standard errors are clustered at the firm level.[20] In the next section, we show that our results hold both when we include foreign credits and alternative sets of fixed effects.

The first two columns of Table 5 show the results of estimating Equation 2 in two different periods. The first column reports results covering the beginning of our sample, April 2012, until September 2019, immediately before the October 2019 episode of social unrest. During this period, we find a UIP premium of 3.95 p.p (relative to an average domestic rate in pesos of 13.2%), broadly in line with the literature. Indeed, di Giovanni et al. (2021) find a UIP premium of 6.9 p.p for Turkey, and Gutierrez et al. (2022) find a UIP premium of 2 p.p for Peru.

The second column of Table 5 covers the onset of COVID in Chile from March to July 2020. For this period, the coefficient on FX becomes statistically insignificant, suggesting that the

[20] Our results also hold clustering the standard errors at the firm-time level, and when we estimate the regression by OLS instead of WLS.

UIP premium disappears and that, on average, during the beginning of the COVID-19 crisis, borrowing in dollars was not cheaper than borrowing in pesos.

To evaluate the role of policy, we run the following specification from March to July 2020:

$$i_{f,b,d,m} = \alpha_{f,b} + \lambda Trend_m + \delta FX_{f,b,d,m} + \psi E_{f,m} FX_{f,b,d,m} + \Theta_1 X_{f,m} + \Theta_2 Z_{b,m} + \Theta_3 Macro_{m-1} + \epsilon_{f,b,d,m}, \tag{3}$$

where $E_{f,m}$ is a dummy that takes the value of one if firm f in month m is eligible for a FOGAPE-COVID loan and zero otherwise. The remaining variables are the same as in Equation 2. Notice that $E_{f,m}$ is interacted with $FX_{f,b,d,m}$, meaning that if the coefficient of such interaction, ψ, is positive and significant, the reduction in the UIP premium is linked to this policy.[21]

The third column of Table 5 shows the results of estimating Equation 3. Two relevant results emerge here: first, for firms ineligible for FOGAPE-COVID, the UIP premium reappears, though it is one order of magnitude smaller than in the normal-times period; and second, such premium disappears for firms eligible for FOGAPE-COVID, as evidenced by the positive and significant estimated ψ. In other words, the apparent disappearance of the UIP premium shown in the second column of Table 5 is driven by those firms affected by the FOGAPE-COVID policy.

It is important to note that the reduction in the UIP premium for eligible firms is mainly due to an average reduction in the domestic interest rate, as opposed to an increase in the foreign interest rate. The first row of Table 3 shows how both the mean domestic interest rate in pesos and the foreign interest rate in dollars that firms faced fell between March-July 2019 and same period in 2020.[22]. Furthermore, Table 10 in the Appendix, documents that

[21] The eligibility dummy, $E_{f,m}$, is not included without the interaction because, given the subsamples studied, $E_{f,m}$ is time-invariant.

[22] Table 3 shows the interest rates aggregated at the firm level, calculating the weighted average by loan size. When taking the simple mean interest rate by loan, the domestic interest rate decreased from 8.7% to 5.9% between March-July 2019 and the same period in 2020, and the foreign interest rate dropped from 4.4% to 3% during the same period.

Table 5: Interest Rate Regression, UIP Premium and policy effect

Variables	(1) April 2012 to Sept 2019	(2) March 2020 to July 2020	(3) March 2020 to July 2020
Fx	-0.0395***	0.00115	-0.00377*
	(0.00345)	(0.00131)	(0.00215)
Fx·elegible			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

Notes: The first two columns of the table show the estimates the interest rate premium of USD-denominated domestic debt, represented by δ in Equation 2. Column 1 corresponds to the April 2012 - Sept 2019 period and column 2 to the March 2020 - July 2020 period. Column 3 adds the estimate of the effect that becoming eligible to FOGAPE-COVID loans has over the interest rate on USD-denominated domestic debt, represented by ψ in Equation 3, between March 2020 and July 2020. *,**, *** are significant coefficients at the three standard levels of significance. Standard errors are displayed in parenthesis and clustered at the firm level.

interest rates of domestic debt in pesos fell considerably more than those of foreign debt issued in pesos. Therefore, our main takeaway is that changes in domestic interest rates were crucial in the mechanism behind the observed debt substitution, for they dropped more than rates in dollars, considerably reducing the UIP premium in dollar loans. Specifically, this result can be traced back to the FOGAPE-COVID credits enacted during the crisis.

The next section performs robustness on these regression results, after discussing robustness for the RDD regression.

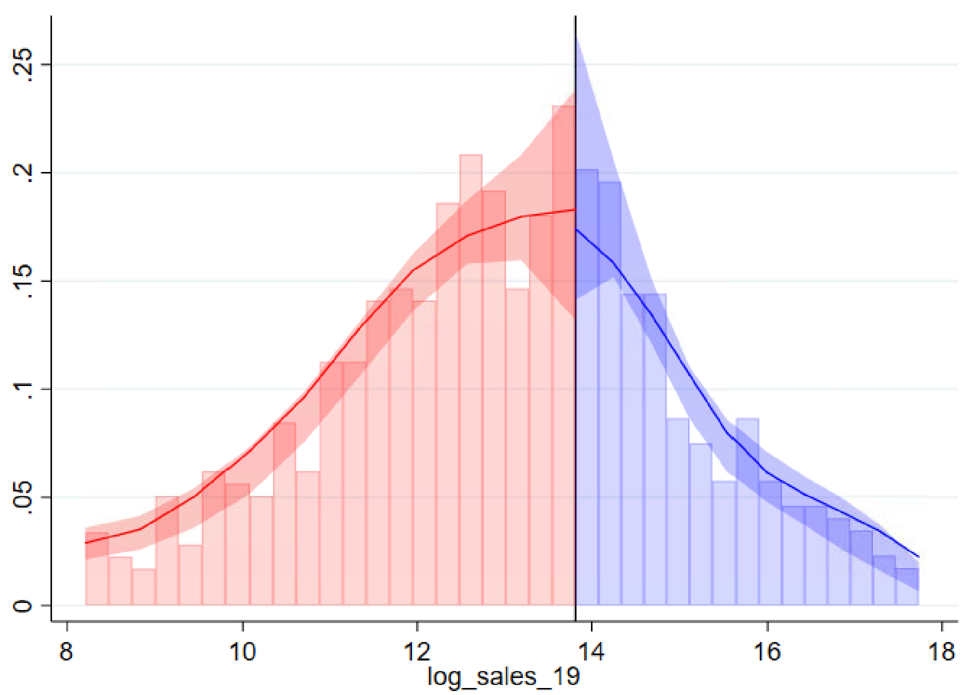
3.6 Robustness

3.6.1 RDD Robustness

The results presented in the RDD regression are evidence of a significant discontinuity at the sales cutoff set by the FOGAPE-COVID support program. An important requirement for the validity of a RDD like the one implemented in our work, is that firms do not self-select into the policy. Since the cutoff of 1 million UF was determined based on 2019 sales recorded by the Chilean IRS, while the policy was implemented in May 2020, it is unlikely that firms could manipulate their sales to sort into the treated group. However, the implementation challenges associated with a large-scale policy like this may still allow for some form of manipulation. We thus decided to formally test for this next.

To test for self-selection that leads to firms sorting themselves to the left of the cutoff, we implement the test developed by Cattaneo et al. (2020).[23] Figure 5 shows in the confidence bands, at the 95% level, the results of the test. Statistically, the mass of firms just to the left of the cutoff is similar to that just to its right. This is, we do not find evidence of manipulation.[24]

Figure 5: Manipulation test around the cutoff



Notes: Cattaneo et al. (2020) manipulation test. The histogram (bars) is computed with default variables in Stata. The local polynomial and its robust confidence bands is estimated under the baseline specification at the 10% level of significance.

[23]Cattaneo et al. (2020) develop a manipulation test that builds upon the seminal work of McCrary (2008). This new test is more flexible since it only requires the choice of one tuning parameter and allows for different local polynomial specifications.

[24]The results of the test at the 95% level of confidence lead a p-value of 0.68. This is, we reject the null hypothesis of manipulation in the running variable (log of sales).

Another critical test on the RDD is to assess if, in absence of the treatment, there is evidence of discontinuity around the cutoff. For this purpose, we run a placebo test by re-estimating Equation 1 between May and July 2019. As in the baseline RDD, we take the firm-level average of the domestic debt share across those three months. Table 6 shows that the estimate of δ is not significant under the baseline specification or under any of the three alternative specifications. Therefore, we do not find evidence of lack of continuity in absence of the treatment.

Table 6: Placebo test: Domestic debt share vs Sales - Estimated polynomial May to July of 2019

	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
Clustered Standard Error	0.05025	0.04697	0.0856	0.08585
Number of Observations	652	652	652	652

Notes: The table shows the estimates of a placebo test of becoming eligible for FOGAPE-COVID credits one year before the policy measure was implemented, represented by δ in Equation 1 under different specification. The domestic debt share is the firm-level average between May and July of 2019. *,**, *** are robustly significant coefficients at the three standard levels of significance. Each specification shows the degree of the polynomial and the type of kernel function used to estimate the local polynomial, where tri refers to Triangular Kernel and epa to Epanechnikov Kernel.

In sum, our results of debt substitution towards the relatively cheaper domestic debt caused by credit support policies are robust to a placebo period, and to testing for manipulation. Also, as shown in Table 4, they are robust to different specifications of the polynomial regression.

3.6.2 Robustness of the Interest Rates Mechanisms

One potential caveat of the results obtained in Table 5–that show how the normal-times UIP premium disappears during the pandemic, and how this is driven by those firms eligible for FOGAPE-COVID loans–is that we estimate Equation 2 and Equation 3 with bank-by-firm fixed effects ($\alpha_{f,b}$). These fixed effects control for time-invariant unobserved heterogeneity at the firm-bank relationship level. However, although our rich dataset allows us to control for both firm-level and bank-level characteristics, there could be relevant unobserved time-variant heterogeneity.

To overcome this issue, we estimate Equation 2 and Equation 3 with different fixed-effects specifications. Aside from bank-by-firm fixed effects ($\alpha_{f,b}$), we also use the following: bank-by-firm and firm-by-month ($\alpha_{f,b}+\alpha_{f,m}$); firm-by-month ($\alpha_{f,m}$); bank-by-month ($\alpha_{b,m}$); firm-month-bank ($\alpha_{f,m,b}$); firm-by-month and bank-by-month ($\alpha_{f,m}+\alpha_{b,m}$). The top panel of Table 7 shows the results of these exercises. Each fixed effects specification listed above has two correspondent columns: one for the normal-times period, and another for the crisis period. The first specification in the table is our baseline, and the rest are displayed in the aforementioned order. Our main results here are twofold. First, there is always a UIP premium on foreign currency loans during the normal-times period, as shown by the first column of each estimation. Second, regardless of the type of fixed effects used, this premium considerably falls in the crisis period, which is explained by a positive effect of the FOGAPE-COVID eligibility as shown by the second column of this estimation.[25] Our results from Table 5 are thus robust to the fixed-effects specification considered, as shown by Table 7.

A second potential caveat to the interest rate mechanism behind the foreign-for-domestic debt substitution in our baseline results is that it is pinned down using only domestic debt in both pesos and dollar loans. As explained above, the main reason for this is the lack of micro-level data on foreign lenders which prevents us from running the baseline specifications Equation 2 and Equation 3 using the foreign debt portion of our data. Even if the domestic supply of dollar loans comes directly from banks' access to dollars abroad, one could argue that the mechanism observed in the UIP reduction premium in the local credit market does not necessarily hold when we incorporate the foreign-credit market due, for example, to temporary frictions in the foreign exchange markets.

[25]Notice that whenever there are fixed effects at the firm-time level, the firm-level controls disappear since there is no variation anymore within the firm-time group. The same happens for bank controls, and for the macro controls.

Table 7: Interest Rate Regression Robustness: alternative fixed effects and inclussion of external debt

Fixed Effects	BankxFirm		BankxFirm & FirmxMonth		FirmxMonth		BankxMonth		FirmxMonthxBank		FirmxMonth & BankxMonth	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Variables	Until Sept 2019	March to July	Until Sept 2019	March to July	Until Sept 2019	March to July	Until Sept 2019	March to July	Until Sept 2019	March to July	Until Sept 2019	March to July
Panel A: Domestic Debt												
fx	-0.0395***	-0.00377*	-0.0425***	-0.00299	-0.0422***	-0.00637***	-0.0652***	-0.0286***	-0.0465***	-0.00376	-0.0429***	-0.00703***
	(0.00345)	(0.00215)	(0.00650)	(0.00276)	(0.00636)	(0.00216)	(0.00168)	(0.00345)	(0.00833)	(0.00342)	(0.00581)	(0.00222)
fx_elegible		0.0117***		0.00694**		0.00712***		0.0199***		0.00750**		0.00760***
		(0.00239)		(0.00312)		(0.00245)		(0.00200)		(0.00376)		(0.00251)
Macro Controls	Yes	Yes	No	No	No	No	No	No	No	No	No	No
Firm Controls	Yes	Yes	No	No	No	No	Yes	Yes	No	No	No	No
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No
Observations	5,929,453	348,550	5,140,684	312,865	5,166,051	329,039	6,087,838	457,751	4,981,579	307,515	5,166,004	329,039
R-squared	0.869	0.646	0.918	0.717	0.900	0.698	0.243	0.092	0.924	0.720	0.904	0.699
Panel B: Domestic and Foreign Debt												
fx	-0.0397***	-0.00361*	-0.0424***	-0.00303	-0.0432***	-0.00613***	-0.0650***	-0.0286***	-0.0464***	-0.00377	-0.0435***	-0.00705***
	(0.00328)	(0.00215)	(0.00610)	(0.00275)	(0.00594)	(0.00211)	(0.00160)	(0.00351)	(0.00814)	(0.00342)	(0.00518)	(0.00222)
fx_elegible		0.0119***		0.00695**		0.00693***		0.0199***		0.00751**		0.00760***
		(0.00243)		(0.00312)		(0.00240)		(0.00202)		(0.00376)		(0.00250)
Macro Controls	Yes	Yes	No	No	No	No	No	No	No	No	No	No
Firm Controls	Yes	Yes	No	No	No	No	Yes	Yes	No	No	No	No
Bank Controls	No	No	No	No	No	No	No	No	No	No	No	No
Observations	6,078,364	348,952	5,272,467	313,216	5,302,026	329,425	6,242,648	458,215	5,081,652	307,844	5,301,975	329,425
R-squared	0.870	0.646	0.919	0.717	0.899	0.698	0.248	0.092	0.925	0.720	0.904	0.699

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

Notes: The table estimates Equation 2 for the April 2019 - Sept 2019 period and Equation 3 for the March 2020 - July 2020 period under different fixed-effect specifications. Each type of fixed effect is displayed in each column of the first row, where the first one corresponds to the baseline case shown in Table 5. *,**, *** are significant coefficients at the three standard levels of significance. Standard errors are displayed in parenthesis and clustered at the firm level.

To tackle this issue, we re-estimate Equation 2 and Equation 3 by adding to the database foreign loans, assigning to foreign loans a unique lender identifier when controlling for bank fixed effects. The lower panel of Table 7 shows the results of this exercise with the same set of fixed-effects specifications explored before and shown in the upper panel of the table.[26] Once again, our baseline results are robust. There is always a UIP premium during normal times, and it considerably falls during the crisis due to eligibility of the FOGAPE-COVID loans.

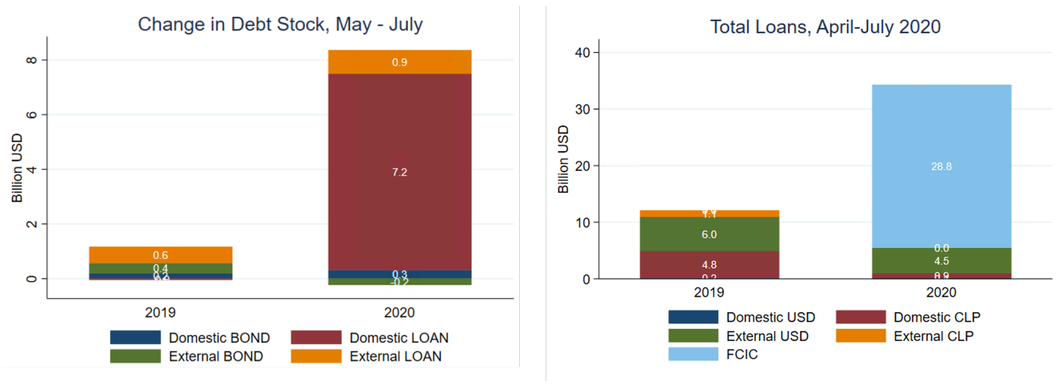
A third concern regarding the interest rate mechanism behind our baseline results is that, alternatively, there may have been an external credit dry-out for banks. This would have lowered the domestic supply of dollar-denominated loans, increasing their interest rate, lowering the UIP premium, and leading firms to borrow more in domestic currency.

The left panel of Figure 6 shows the net change in lending (in billion of USD) by banks in Chile, split between the type of liability between May and July of 2019 (first bar) and of 2020 (second bar). The main takeaway from this panel is that the net increase in foreign borrowing (i.e., bonds and loans) was similar in 2020 than in the same period of 2019, which lends no support to the hypothesis that banks faced a credit dry out abroad. The right panel of Figure 6 shows the gross increase in domestic and foreign borrowing by currency, all expressed in billion of USD. On the one hand, it shows that new external borrowing in dollars was lower in 2020 than in 2019 (4.5 vs 6 billion USD), albeit still a significant amount. On the other hand, it shows how large the FCIC policy was in terms of new lending. Out of a total of USD 42.2 billion, FCIC represents more than two thirds of the new credit banks take. This suggests that, even though banks still had access to considerable foreign borrowing, they also substituted some for domestic loans, mainly due to FCIC. Indeed, that increase in FCIC explains the net increase in domestic loans for banks exhibited in the second bar of the left-hand side panel (red area).

[26] In this case, we do not have bank-level controls in any specification because we do not have microeconomic information on foreign lenders.

Finally, if banks had faced a foreign credit dry-out, interest rates on the few credits taken should have increased. This was not the case: the average interest rate banks faced on foreign dollar-denominated debt was 2.8% between May and July 2019, and it fell to 1.3% in the same period of 2020.[27]

Figure 6: Total Loan and Change in Debt Stock by banks'



Notes: The left plot breaks down the change in banks' debt stock according to its origin (domestic or external) and type (bond or loan). The right plot breaks down the total bank loan amount according to its origin and currency (CLP or USD), including FCIC in 2020. All calculations are made by measuring the debt in dollars at the spot nominal exchange rate and comparing 2020 with 2019.

Altogether, the evidence points to foreign-for-domestic debt substitution triggered by unconventional policies. On the one hand, since the spread between domestic and foreign interest rates falls, firms were likely less willing to take on the exchange rate risk derived from borrowing abroad. On the other hand, there was a selection channel through which smaller firms did not tap international markets since the foreign borrowing costs were too high, making them switch to the local debt market. This selection channel left better firms borrowing abroad during the crisis than before. The last row of Table 3 shows evidence of this channel, where the mean sales of firms that borrowed abroad during the crisis is higher than before the crisis.

The model developed in the following section rationalizes these facts by focusing on the

[27]This concern is akin to the possibility of mismatches in the local currency swap markets due to a lack of counterparties. If this were the case, due to regulation requiring zero balance sheet miss matches in swaps for banks, banks would have supplied fewer dollar-denominated loans, and their interest rate would have increased, which did not happen as evidenced in Table 10 in the Appendix.

selection channel associated with financial frictions in the form of collateral constraints.

4 Model

4.1 Overview

This section presents a stylized model of firms' debt financing to rationalize the mechanisms behind the documented debt-substitution effect, including the unconventional credit support policies implemented and their impact on the finance mix of firms as the COVID shock unfolded.

Our setup has three key elements. First, the model delivers an *endogenous firms' finance mix* between domestic and foreign debt issuance, with which we can study responses in this mix to shocks in international capital markets (e.g., COVID) and policies that affect domestic credit conditions akin to the aforementioned FCIC & FOGAPE-COVID programs. A second key ingredient of the model is to allow for *heterogeneity* in this finance mix across firms, with larger firms issuing relatively more debt abroad and smaller firms borrowing in domestic markets, akin to what we documented in the data. Lastly, as observed in the data, the model will feature an *endogenous interest rate wedge* between debt issued in domestic and global markets, generating incentives for firms to borrow abroad in equilibrium.

4.2 Setup and Equilibrium

Time, agents, and utility We consider a real two-period small open economy, with time indexed, $t = 1, 2$, a single good, and no aggregate uncertainty. The economy is populated by a unit mass of identical households and a unit mass of firms that differ in their endowment of international collateral. Abroad, foreign financiers have access to a savings technology that transfers goods one-to-one between periods, which pins down the gross foreign interest rate to one. Utility is linear in consumption and equals $U(c_1, c_2) = c_2$ for all agents, implying that all agents want to consume only in period 2.

Endowments and technology In period 1, foreign financiers have a large endowment and households get endowment e_1. Similarly to Caballero and Krishnamurthy (2001) (CK henceforth), in period 2, firm i gets international collateral, $\lambda^i_{f,2}$, which can be used to borrow in foreign capital markets in period 1, when types are revealed. Following CK, we take the extreme assumption that international lenders do not accept firms' output as collateral. Unlike CK, in this model, first, there is no aggregate uncertainty about international collateral, and second, international collateral, $\lambda^i_{2,f}$, is heterogenous across firms and drawn from a uniform distribution with bounds $\left[0, \bar{\lambda}\right]$, where $\bar{\lambda}$ is a parameter.

Firms produce by investing capital k^i_1 in a concave technology with productivity $A_2 > 1$, common to all firms:

$$A_2(k^i_1)^\alpha \tag{4}$$

with $\alpha = 1/2$. We impose the following relationship between $\bar{\lambda}$, α, and A_2:

$$\bar{\lambda} < (A_2\alpha)^{\frac{1}{1-\alpha}}, \tag{5}$$

which ensures that, as we will see below and consistent with the empirical evidence, all firms have some domestic debt[28].

Borrowing and collateral constraints Because firms have no endowment in period 1, they need to borrow the capital stock used for production. Firm i borrows $d^i_{1,d}$ from domestic households and $d^i_{1,f}$ from foreign financiers with interest rates R_2 and $R^\star = 1$, respectively. Consistent with the empirical evidence in the first three rows of Table 3, the model's solution will feature a (positive) wedge between R_2 and $R^\star$, determined endogenously in equilibrium as described below.

[28] In our dataset, the number of firms with no domestic debt is very small. For example, for the largest firms (with more than 600,000 UF in sales), which tend to be those with less domestic debt, only 37 firms out of 1386 have no domestic debt.

Firm i's objective function equals:

$$\lambda^i_{2,f} + A_2(d^i_{1,d} + d^i_{1,f})^\alpha - R_2 d^i_{1,d} - R^\star d^i_{1,f} \tag{6}$$

Borrowing is subject to the following collateral constraints:

$$R^\star d^i_{1,f} \leq \lambda^i_{2,f} \tag{7}$$

$$R_2 d^i_{1,d} \leq \theta_d * A_2 * (d^i_{1,d} + d^i_{1,f})^\alpha + \lambda^i_{2,f} - R^\star d^i_{1,f} \tag{8}$$

which are similar to the ones in CK. Foreign borrowing must be backed up by international collateral. Only domestic lenders have access to a share $\theta_d < 1$ of firms' output as well as the international collateral not pledged to foreign financiers. The domestic collateral constraint resembles the one in Gennaioli et al. (2014).

First-best level of capital In the absence of collateral constraints, firms wish to finance

$$(A_2\alpha)^{\frac{1}{1-\alpha}} \equiv k^\star \tag{9}$$

which can be found maximizing Equation 6 with $R^\star = 1$.

Firms' decisions Consistent with the empirical evidence in the first three rows of Table 3, we solve the model for the case where $R_2 > R^\star$[29], which implies that firms will always want to tap international debt markets before they go to the domestic debt market.

Because $R^\star < R_2$ and Equation 5 holds, all firms borrow up to their foreign collateral constraint, Equation 7, implying that foreign debt for firm i equals:

$$d^i_{1,f} = \frac{\lambda^i_{2,f}}{R^\star} \tag{10}$$

[29] The next section makes parametric assumptions for this to be the case.

which can be zero for firms with $\lambda^i_{2,f} = 0$. Using Equation 10, the domestic collateral constraint becomes:

$$R_2 d^i_{1,d} \leq \theta_d A_2 (d^i_{1,d} + \frac{\lambda^i_{2,f}}{R^\star})^\alpha \tag{11}$$

for firm i, which might bind or not, giving rise to two groups of firms, depending on whether they can finance the first-best level of capital, $k^\star$.

First, if the domestic collateral constraint is slack, firms finance the first-best level of capital, $k^\star$, and domestic borrowing equals:

$$d^i_{1,d} = k^\star - \frac{\lambda^i_{2,f}}{R^\star} \tag{12}$$

for firm i. Firms in this group are those with high enough international collateral,

$$\lambda^i_{2,f} > R^\star \left(k^\star - \frac{\theta_d A_2 (k^\star)^\alpha}{R_2} \right) \equiv \hat{\lambda} \tag{13}$$

obtained operating on Equation 11, making $d^i_{1,d}$ equal to its expression in Equation 12, and making the constraint slack. International collateral determines which firms are unconstrained domestically too because higher international collateral implies higher foreign borrowing, which is invested in the productive technology, implying higher output too. We call these firms domestically unconstrained or, simply, unconstrained. Note that, in equilibrium, firms that produce more also borrow more abroad, consistent with the Chilean evidence presented in the left-hand-side panel of Figure 2.

Second, if the domestic collateral constraint binds, firms cannot finance $k^\star$ and domestic borrowing for firm i is given by the solution to its domestic collateral constraint with equality:

$$d^\star_{1,d}(\lambda^i_{2,f}) = \frac{\theta_d A_2 \left(\theta_d A_2 + \sqrt{(\theta_d A_2)^2 + 4R_2^2 \frac{\lambda^i_{2,f}}{R^\star}} \right)}{2R_2^2}, \tag{14}$$

where we use the formula for the quadratic equation since the domestic collateral constraint with equality is a quadratic equation and we focus on the positive solution. The Appendix shows the derivations. We call these firms domestically constrained or, simply, constrained.

In equilibrium, firms' total leverage–defined as domestic and international debt over output–is increasing in output. This is consistent with additional empirical evidence for Chile, as shown in Figure 13 in the Appendix.[30] To see this, note that constrained firms' leverage equals:

$$\ell = \frac{\theta_d}{R_2} + \frac{\lambda^i_{2,f}/R^\star}{A_2(d^\star_{1,d}(\lambda^i_{2,f}) + \lambda^i_{2,f}/R^\star)^\alpha} \tag{15}$$

where the first summand in the right-hand size of Equation 15 is the domestic leverage, pinned down by the domestic collateral constraint, and the second is the international leverage. Equation 15 is increasing in $\lambda^i_{2,f}$ because the production function, which is in the denominator, features diminishing marginal returns, $\theta_d \in (0,1)$, and R_2, $R^\star$, and A_2 are all positive. Because firms' output is increasing in $\lambda^i_{2,f}$, firms that produce more also have a higher leverage ratio. The next subsection will make parametric assumptions to ensure this finding also holds between constrained and unconstrained firms.

Equilibrium The only equilibrium price in the model is R_2 and can be found equating firms' demand for domestic credit to the supply of credit, e_1.

$$\underbrace{\int_0^{\hat{\lambda}} d^\star_{1,d}(\lambda^i_{2,f})d\lambda^i_{2,f}}_{\text{Demand from constrained firms}} + \underbrace{\int_{\hat{\lambda}}^{\bar{\lambda}} \left(k^\star - \frac{\lambda^i_{2,f}}{R^\star}\right) d\lambda^i_{2,f}}_{\text{Demand from unconstrained firms}} = e_1 \tag{16}$$

where $\hat{\lambda}$ is the endogenous threshold that separates firms into constrained and unconstrained, given in Equation 13, and $d^\star_{1,d}$ is given in Equation 14. The Appendix solves the integrals in Equation 16.

[30] Gopinath et al. (2017) also find this fact in the Spanish data.

4.3 Parametrization

Table 8 lists the parameters used for the baseline quantitative exercises. A few of them are worth highlighting. First, in the baseline equilibrium, the foreign interest rate, $R^{\star}$, is pinned down by the savings technology and, hence, equal to one. The first quantitative exercise explores the effect of an increase in foreign financing costs, parameterized by an increase in $R^{\star}$. Second, the upper bound on the international collateral, $\bar{\lambda}$, satisfies Equation 5. The exact difference between $k^{\star}$ and $\bar{\lambda}$, 0.2, is arbitrary. Third, credit supply, e_1, is chosen so that the domestic interest rate is 10%, approximately the average domestic real interest rate, for the whole sample, from Table 3.[31] Finally, the pledgeable share of output, θ_d, is small enough to ensure that firms that produce more have a higher leverage ratio, defined as total debt over output, than firms that produce less, consistent with empirical evidence for Chile (see Figure 13 in Appendix), and found in Gopinath et al. (2017) for Spain.

Under the parametrization of Table 8, the total leverage ratios of unconstrained firms, which produce the first-best level of output, $y^{\star} = A_2(k^{\star})^{\alpha}$, and the constrained firm $\lambda = 1.22$ right below the threshold firm, $\hat{\lambda} = 1.2273$, which produces less than $y^{\star}$, are given, respectively, by:

$$
\begin{aligned}
\ell_U &= \frac{k^{\star}}{A_2(k^{\star})^{\alpha}} = A_2^{-1}(k^{\star})^{1-\alpha} = 0.5 \\
\ell_C(\lambda = 1.22) &= \underbrace{\frac{\theta_d}{R_2}}_{\text{Domestic leverage}} + \underbrace{\frac{1.22}{A_2\tilde{k}^{\alpha}}}_{\text{International leverage}} = 0.2273 + \frac{1.22}{(A_2)(2.24)} = 0.499
\end{aligned}
$$

which satisfies $\ell_U > \ell_C$ and where $\tilde{k}$ is the level of capital for firm $\lambda = 1.22$ which is smaller than $k^{\star}$. In the model, all unconstrained firms, regardless of their international collateral, have the same leverage ratio because they all produce the same output level, $y^{\star} = A_2(k^{\star})^{\alpha}$.

[31] We calculate the real rate as the average nominal interest rate in Table 3 minus the Central Bank's target inflation in Chile, which is 3%.

Table 8: Parameters used in baseline quantitative experiments.

Parameter description	Symbol	Value
Foreign interest rate (gross)	$R^{\star}$	1
Firms' productivity	A_2	3
Concavity of the technology	α	$\frac{1}{2}$
First-best capital	$k^{\star}$	2.25
Upper bound on international collateral	$\bar{\lambda}$	$k^{\star} - 0.2$
Credit supply	e_1	1.4781
Pledgeable share of output	θ_d	0.25

4.4 A Global COVID-type Shock

This section studies the effect of an increase in the cost of foreign financing, $R^{\star}$. It captures a global shock like COVID-19, which, as documented in Figure 1 and Table 3, implied an initial increase in the cost of foreign borrowing for Chilean firms. [32]

Figure 7 shows the equilibrium effect of increasing $R^{\star}$ on four variables of interest: the domestic interest rate, the threshold firm, constrained firms' domestic debt share, and unconstrained firms' domestic debt share. Note that the domestic debt shares plotted are those for two representative firms. For constrained (unconstrained) firms, we consider the case of a firm with $\lambda = 1$ ($\lambda = 2$). Taking another constrained or unconstrained firm will change the level of the domestic debt share but not the qualitative effect the global shock has on it. Next, we explain the effects of a global shock on each variable in turn.

First, a rise in the foreign interest rate ($R^{\star}$) puts upward pressure on the domestic interest rate via increases in the demand for domestic debt from unconstrained firms, as Equation 14 shows, and decreases in the demand for domestic debt from constrained firms. The latter happens because an increase in $R^{\star}$ decreases foreign debt and hence output, tightening domestic collateral constraints. If the value of θ_d is high enough, the effect from unconstrained firms dominates, and the market demand for domestic debt increases, increasing R_2 as well,

[32] Evidently, the COVID-19 shock in Chile had far many more repercussions than the increase in $R^{\star}$ that we are modeling. An extension we consider in the Appendix along those lines is a drop in A_2, motivated by the mandatory lockdowns in Chile. Results show that a drop in A_2 decreases firms' demand for domestic debt, decreasing the domestic interest rate. The share of constrained firms and the total domestic debt share both decrease.

as depicted in the upper left panel of Figure 7.

Second, the threshold firm increases as shown in the upper right plot in Figure 7, implying that the group of unconstrained firms shrinks. It is clear from Equation 13 that an increase in $R^\star$ and R_2 increases $\hat{\lambda}$. Intuitively, the higher foreign and domestic borrowing costs are, the fewer firms will have enough collateral for constraints to be slack (Equation 8).

Third, an increase in $R^\star$ decreases foreign debt for all firms, as it is apparent from Equation 10. Domestic debt from constrained firms decreases too. This decrease happens for two reasons. First, as $R^\star$ increases, foreign debt decreases, decreasing output and tightening domestic collateral constraints. Second, as $R^\star$ increases, R_2 increases too, making domestic debt more expensive and making firms want to borrow less domestically. The share of domestic debt over total debt remains approximately constant because both domestic and foreign debt decrease at a similar rate, as shown in the bottom left plot in Figure 7.

Finally, an increase in $R^\star$ increases the domestic debt share for unconstrained firms. For these firms, foreign debt decreases as it becomes more expensive (Equation 10). Consequently, these firms have more capital left to finance domestically (Equation 12), increasing the share of domestic debt over total debt (bottom right plot in Figure 7).

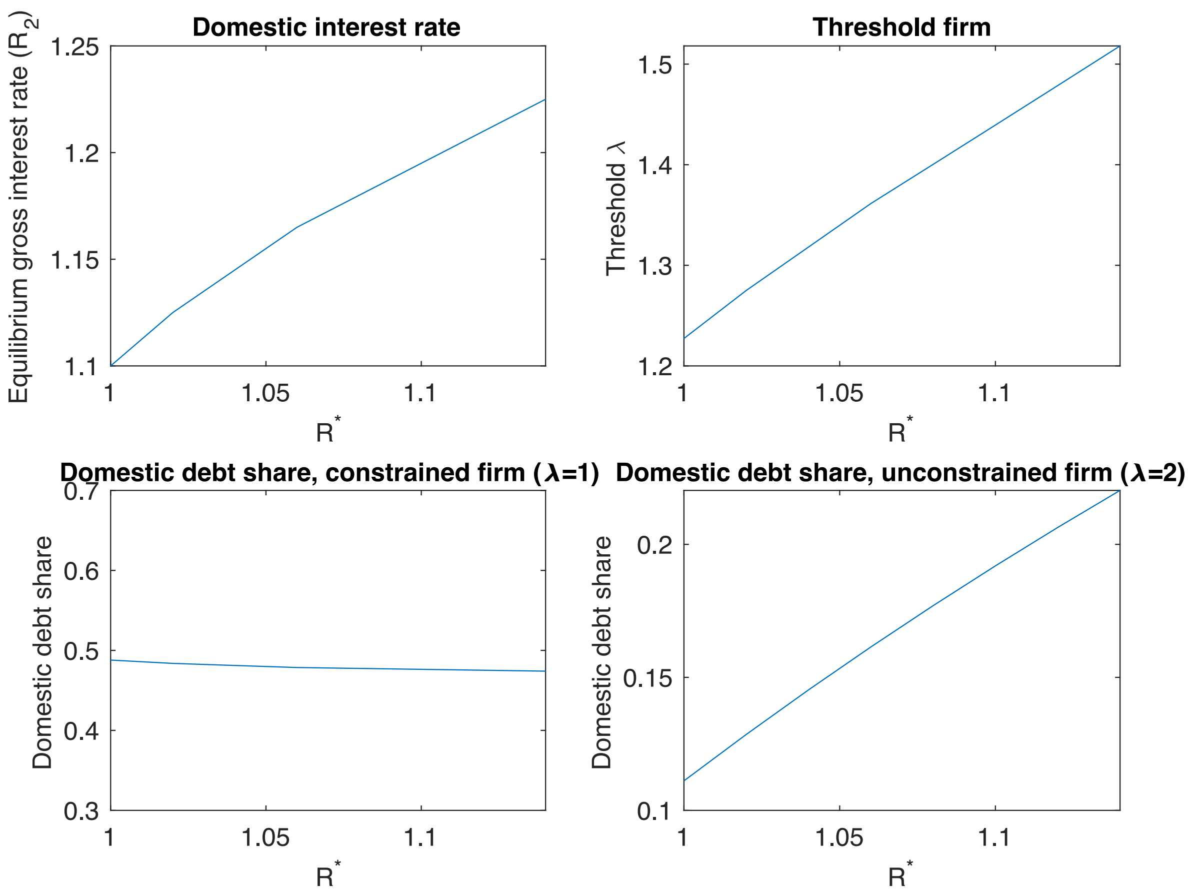
The following proposition summarizes the findings in this section:

Proposition 1. *An increase in the cost of foreign borrowing increases the cost of domestic borrowing, shrinks the mass of unconstrained firms, and increases the share of domestic debt over total debt for unconstrained firms.*

4.5 Credit Policies

This section studies the effects of credit support policies akin to FOGAPE-COVID and FCIC on the model's equilibrium. We begin by discussing how the model captures these policies.

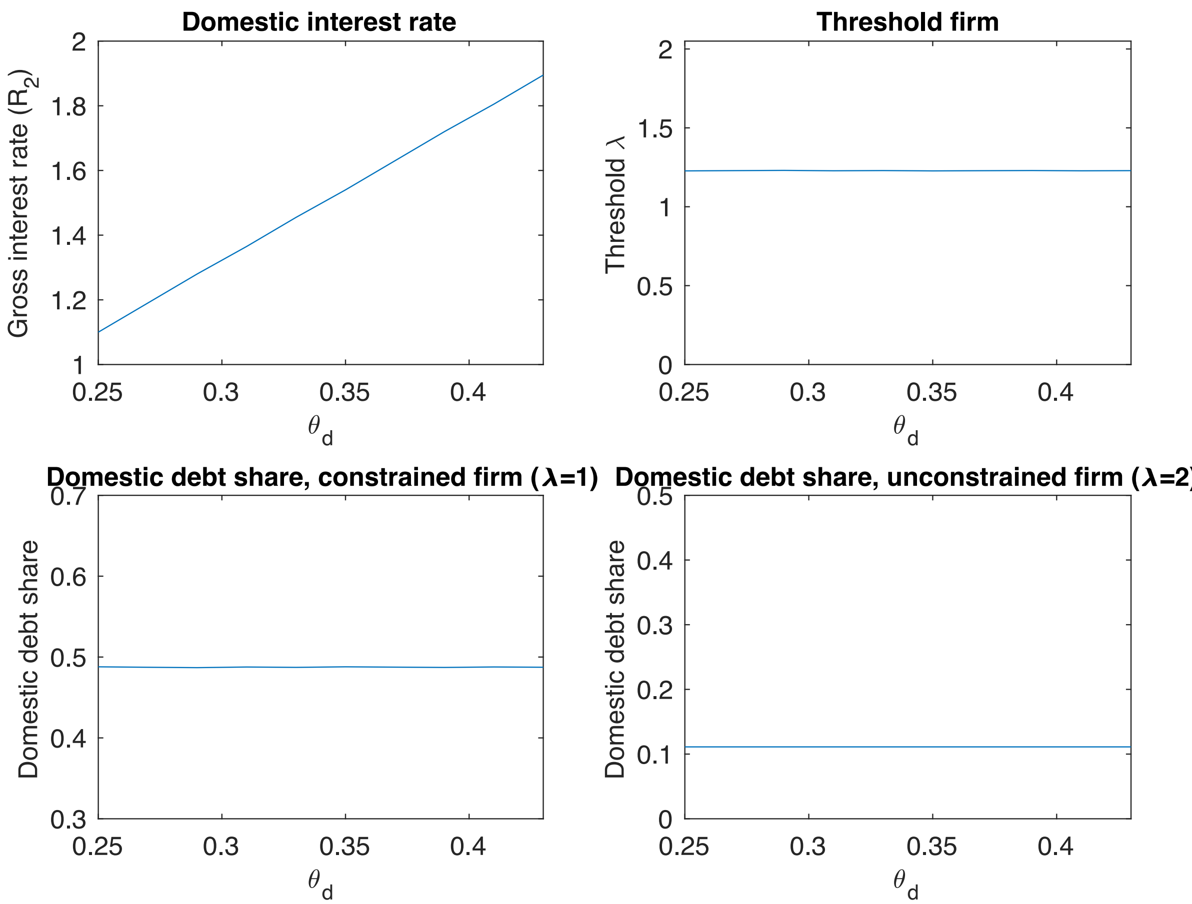
Figure 7: Effect of a global shock: an increase in $R^\star$



Note: Effect of a global shock on the domestic interest rate (R_2) (top left panel), on the threshold firm ($\hat{\lambda}$) (top right panel), and the domestic debt shares for a constrained and an unconstrained firm (bottom left and right panels, respectively).

Government Guarantees A policy that, like FOGAPE-COVID, provides government-backed guarantees on commercial bank loans is akin to an increase in θ_d in our model, for it increases firms' access to borrowing by relaxing their collateral constraint. Figure 8 shows the effect of increasing θ_d on our four variables of interest. We explain each in turn.

Figure 8: Effect of an increase in θ_d



Note: Effect of an increase in θ_d on the domestic interest rate (R_2) (top left panel), the threshold firm ($\hat{\lambda}$) (top right panel), and the domestic debt shares for a constrained and an unconstrained firm (bottom left and right panels, respectively).

First, an increase in θ_d increases the domestic interest rate because it increases constrained firms' demand for domestic debt by relaxing their collateral constraint. Thus, absent a change in credit supply, this policy puts upward pressure on the domestic interest rate.

Second, an increase in θ_d leaves the threshold firm unchanged. The increase in the domestic interest rate dampens the positive effect of θ_d on $\hat{\lambda}$. Indeed, increases in both θ_d and R_2 leave the domestic collateral constraint, Equation 8, unchanged.

Third, the domestic debt share for constrained firms also remains unchanged. This finding is again a consequence of the counteracting effect the increase in R_2 has on constrained firms' domestic debt. Although they can borrow more, due to the higher θ_d, the increase in R_2 makes them unwilling to do so, leaving the domestic debt unchanged.

Finally, θ_d does not affect unconstrained firms since the domestic collateral constraint is slack for them. Hence, changes in θ_d do not affect unconstrained firms' domestic debt share.

Summing up, the simulated effects of a policy that, as FOGAPE-COVID, relaxes collateral constraints are counterfactual to the evidence presented above for the case of Chile during COVID. Indeed, as was documented, the set of unconventional policies in Chile *decreased* domestic interest rates and caused firms' debt substitution. Therefore, within the model, a policy that relaxes collateral constraints akin to the FOGAPE-COVID program alone is not enough to generate a drop in the domestic interest rate and firms' debt substitution as observed in the data. We turn to FCIC next.

Central Bank's Credit Line Facility To study a program like FCIC, we augment the model to enrich the credit supply side and capture the Central Bank's provision of funds to commercial banks. The total supply of credit in the economy, $e_{1,T}$, has now two parts: one coming from households, $e_{1,H}$, and one coming from the Central Bank, $e_{1,CB} < 1$. The expression for $e_{1,T}$ equals:

$$e_{1,T} = e_{1,CB}^{\phi} + e_{1,H} \tag{17}$$

where ϕ is a parameter that depends on the global shock and policies. In particular, we assume:

$$\phi = e^{R^{\star}-1} - \psi(\Delta\theta_d) \tag{18}$$

where Δ denotes change.

Equations 17 and 18 capture, albeit in reduced form, the behavior of financial intermediaries when a shock like COVID materializes (e.g., increases in $R^\star$) and, crucially, the extent to which policies can alter credit supply.

Financial intermediaries lend to firms what they obtain from households as deposits, $e_{1,H}$, and what they borrow from the Central Bank. In the baseline equilibrium without a COVID shock and no credit support policies, where $R^\star = 1$ and $\Delta\theta_d = 0$, $\phi = 1$, total credit supply, $e_{1,T} = e_{1,CB} + e_1$.

During periods of distress in world capital markets–akin to those observed at the onset of COVID via increases in $R^\star$–, financial intermediaries might contract their credit supply. In the model, an increase in $R^\star$ increases ϕ. Because $e_{1,CB} < 1$ an increase in ϕ decreases the Central Bank funds that get to firms, decreasing the total credit supply in the market.

Parameter ϕ can be interpreted as capturing financial intermediaries' risk aversion. Around a global shock that increases ϕ, triggered by a rise in $R^\star$, financial intermediaries lend out less of the Central Bank's funds to firms due to higher risk-aversion.

In this set-up, a new central bank liquidity provision program like FCIC is akin to an increase in $e_{1,CB}$. However, depending on the size of the global shock, an increase in $e_{1,CB}$ might not translate into an increase in credit supply for firms, $e_{1,T}$. Crucially, a program of sovereign guarantees (e.g., FOGAPE-COVID) can complement and amplify the central bank's credit line facility by decreasing ϕ, that is, decreasing banks' risk-aversion and facilitating the central bank's funds to be channeled to firms. In other words, in the extended model, both FOGAPE-type and FCIC-type policies increase credit supply.

It is important to highlight at this point that the main takeaway of this reduced-form extension of the credit supply in the model is robust to having a structural banking model. The Appendix provides a micro foundation for financial intermediaries à la Curdia and Woodford (2011), featuring loan origination costs decreasing in FOGAPE and FCIC, delivering that credit supply increases when the two policies are jointly implemented. The Appendix provides further details on the derivations.

To perform quantitative exercises on the extended model, we need to pick additional parameters, which we summarize in Table 9.

Table 9: Parameters used in the extended model

Parameter description	Symbol	Value
Responsiveness of financial intermediaries' risk-aversion to FOGAPE	ψ	17
Initial Central Bank supply of credit	$e_{1,CB}$	0.5
FCIC size	$\Delta e_{1,CB}$	0.1
FOGAPE size	$\Delta \theta_d$	0.05

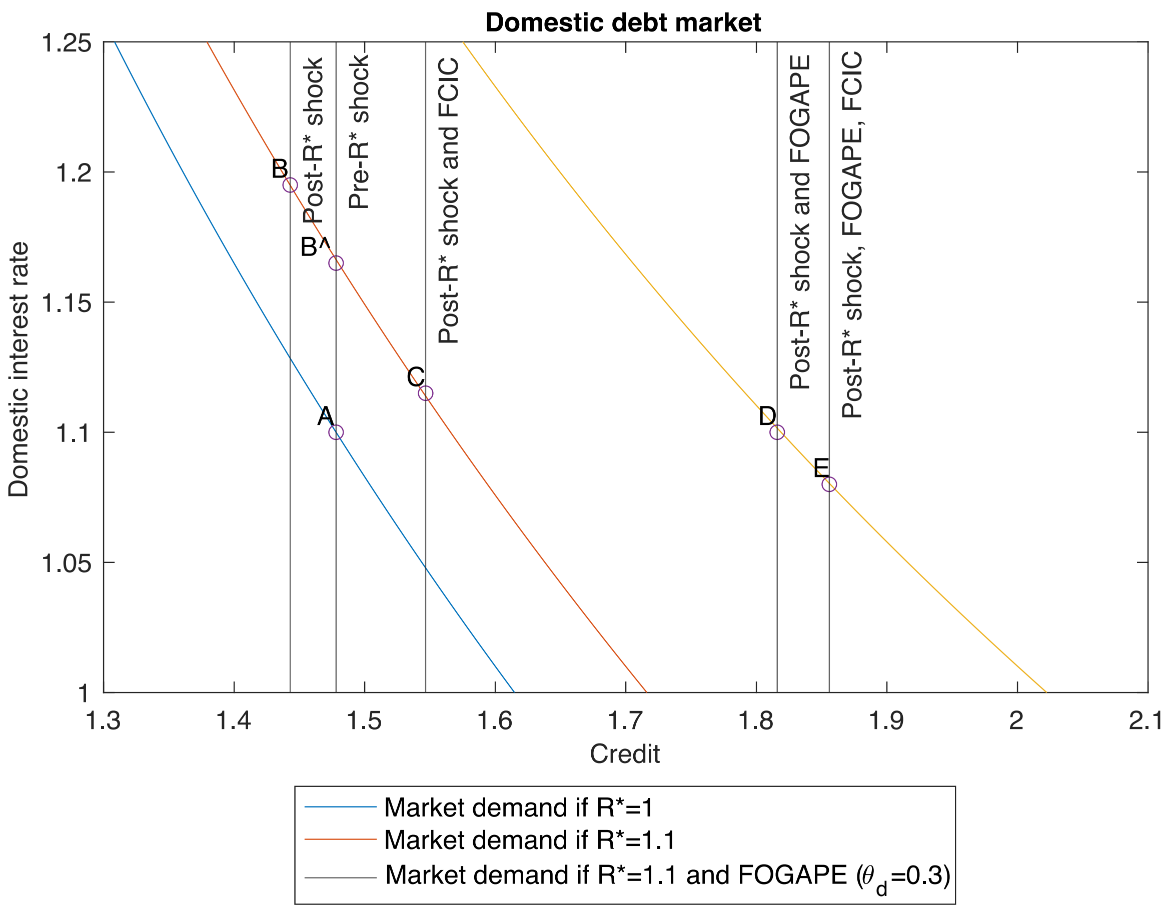
We pick a value of ψ equal to 17, an increase in an initial supply of Central Bank credit of 0.5 (which satisfies the constraint that $e_{1,CB} < 1$), an FCIC funding of 0.1, and an increase in θ_d from 0.25 to 0.3. As explained below, we choose this parametrization to qualitatively match the observed equilibrium in the domestic credit market after the implementation of both policies together. This is a higher level of domestic credit and a lower interest rate than the initial before the shock.

Figure 9 shows the effects of a global shock, FOGAPE-COVID, and FCIC on the market for domestic debt in the extended model. To disentangle each mechanism, we sequentially describe the different equilibria, starting with the effects of the global shock and continuing with the effect of each policy in isolation and then combined.

The initial equilibrium in the absence of shocks and policies is labeled with an "A" in Figure 9.[33] the equilibrium changes to point Bˆ in the graph after a COVID-type global shock. As described in subsection 4.4, the demand for domestic debt increases because unconstrained firms move away from foreign debt towards domestic, increasing the domestic interest rate to $R_2 = 1.165$. Note, however, that in the augmented model with a minimal structure on the credit supply, Bˆ is no longer an equilibrium, as a new force puts further upward pressure on the domestic interest rate, bringing the equilibrium to point B. Indeed,

[33]The parametrization we use is the one in the baseline equilibrium: $R_2 = 1.1$ and $e_{1,T} = 1.4781$, where $e_{1,CB} = 0.5$ and $e_{1,T} - e_{1,CB}$ comes from households.

Figure 9: Effect of a global shock, FOGAPE, and FCIC on the market for domestic debt



Note: Vertical lines are market supply of credit in different scenarios (labeled on the graph) and the downward-sloping lines are market demand for credit in different scenarios (labeled on the legend below the graph) a global shock increases financial intermediaries' risk aversion, contracting the supply of credit, as seen by the leftward shift of the credit supply to the post-global shock supply. With the chosen parametrization, the interest rate increases $R_2 = 1.195$. Next, we analyze what FOGAPE and FCIC can do to mitigate the effects of a COVID-like shock.

Consider, first, a policy like FCIC alone, parametrized by a 20% increase in the Central Bank's credit supply. It causes the equilibrium to shift from B to the one labeled as C in the graph by producing a rightward shift of the credit supply to the vertical line labeled post-global shock and FCIC. An FCIC of this magnitude has limited power to lower domestic interest rates and expand credit.

Consider now a policy akin to FOGAPE-COVID alone, parametrized by an increase of θ_d to 0.3 ($\Delta\theta_d = 0.05$). Under this calibration, the equilibrium moves from B to the one labeled as D in Figure 9. An increase in θ_d shifts the credit demand curve from the red line to the yellow line, which imposes an upward pressure on the interest rate, as described before. Crucially, however, in the augmented model with a minimal structure on the credit supply, credit supply increases too due to the impact FOGAPE-COVID has on financial intermediaries' risk aversion, shifting the credit supply rightward. Such a rightward shift also holds in the richer setup of financial intermediaries à la Curdia and Woodford (2011) who optimize over their credit supply decision, as shown in the Appendix. With the parametrization in Table 9, the interest rate decreases to $R_2 = 1.1$ in the model with the minimum structure.

Lastly, consider now FCIC and FOGAPE-COVID-type policies *jointly* in the model. This equilibrium is labeled E in Figure 9. Importantly, this is the only case where the interest rate drops below the baseline equilibrium interest rate of $R_2 = 1.1$. Both policies activated simultaneously cause the largest rightward shift of the credit supply, causing a drop in the interest below pre-pandemic levels to $R_2 = 1.08$.

The main takeaway of this case is that the kind of policies we have modeled as FOGAPE-COVID and FCIC *complement* each other. Both expand the group of unconstrained firms, that is, $\hat{\lambda}$ decreases. An increase in θ_d decreases $\hat{\lambda}$ as it is clear from equation (13). The beginning of this section explains how the increase in the domestic interest rate dampens this effect in the baseline model. However, in the extended model, the credit supply increase cause the domestic interest rate to decrease, resulting in a drop in $\hat{\lambda}$. Intuitively, the lower the cost of borrowing, the more firms will have enough collateral to be unconstrained.

Finally, activating the two policies causes the largest firms' debt substitution towards domestic debt. Constrained firms increase their domestic debt due to the domestic interest rate drop.

The following proposition summarizes the findings in this section:

Proposition 2. *Under the parametrization in Table 9, only when the two credit support policies –sovereign guarantees and central bank liquidity provision– are activated jointly the model accounts for a drop in the domestic interest rate below the initial equilibrium, as observed in the Chilean case following the implementation of FOGAPE-COVID and FCIC policies. These policies jointly generate the biggest expansion of unconstrained firms and the most pronounced debt substitution towards domestic debt.*

5 Conclusion

This article examines the COVID-19 shock and government policies implemented to counteract its effect on firms' financing in a small open economy. We focus on Chile for which we have a unique administrative dataset that allows us to see the full spectrum of firms' financing. We document that, during early 2020, firms tilted their finance mix towards domestic debt and away from foreign debt. The firms that exhibited more pronounced changes in the composition of their borrowing were those eligible to access governmental credit support policies.

Our first contribution is to empirically identify the effect of government debt guarantees

(FOGAPE-COVID) using a regression discontinuity design that exploits the program's exogenous eligibility thresholds. The estimation shows that becoming eligible for FOGAPE-COVID credits has an average effect of increasing the domestic debt share by 9.2 pp for firms around the eligibility cutoff.

Detailed loan-level regression analysis allows us to conclude that the well-known UIP premium in emerging economies, namely that borrowing in USD is cheaper than borrowing in local currency, holds in Chile during our pre-COVID sample. Interestingly, we find that this UIP premium gets reduced by an order of magnitude in Chile during the COVID-19 crisis and that this disappearance is driven by firms that were eligible for FOGAPE-COVID credits. Uncovering the interest rate mechanism that explains the observed debt substitution during COVID is the second contribution of our empirical analysis.

The third contribution of our work is to provide a simple model of heterogeneous firms' financing. The theoretical framework sheds light on the mechanisms behind the observed changes in the financing mix and allows us to study another credit support policy implemented during COVID in Chile, namely, credit line facilities (FCIC). The model underscores the *complementarity* between sovereign guarantees and central bank liquidity provisions to produce the increases in the domestic debt share *and* lower domestic rates in the wake of a large global shock that pushes up the cost of borrowing for EMEs, in line with what was observed during COVID.

Exploring the real effects on firms' investment and labor decisions from the observed change in the financing mix is a promising avenue for future research. Equally important for a more normative analysis of the policies is the potential debt overhang that an increase in domestic leverage may have on firms' outcomes after the pandemic shock.

References

Albagli, E., A. Fernandez, J. Guerra-Salas, and F. Huneeus (2021). Anatomy of firms' margins of adjustment: Evidence from the covid-19 pandemic. Mimeo.

BIS (2021). Changing patterns of capital flows. CGFS Paper No 66.

Caballero, R. J. and A. Krishnamurthy (2001, December). International and domestic collateral constraints in a model of emerging market crises. *Journal of Monetary Economics 48*(3), 513–548.

Cattaneo, M. D., M. Jansson, and X. Ma (2020). Simple local polynomial density estimators. *Journal of the American Statistical Association 115*(531), 1449–1455.

Cattaneo, M. D., L. Keele, and R. Titiunik (2021). Covariate adjustment in regression discontinuity designs. Mimeo.

Costa, R. (2021). Crisis covid-19 y sus desafios. Speech prepared for the Monetary Club.

Curdia, V. and M. Woodford (2011). The central-bank balance sheet as an instrument of monetary policy. *Journal of Monetary Economics 58*, 54–79.

di Giovanni, J., S. Kalemli-Ozcan, M. F. Ulu, and Y. S. Baskaya (2021, 10). International Spillovers and Local Credit Cycles. *The Review of Economic Studies*. rdab044.

Gennaioli, N., A. Martin, and S. Rossi (2014). Sovereign default, domestic banks, and financial institutions. *Journal of Finance 69*(2), 819–866.

Gopinath, G., S. Kalemli-Ozcan, L. Karabarbounis, and C. Villegas-Sanchez (2017). Capital allocation and productivity in south europe. *Quarterly Journal of Economics 132*(4), 1915–1967.

Gourinchas, P.-O., S. Kalemli-Ozcan, V. Penciakova, and N. Sander (2020). Covid-19 and sme failures. National Bureau of Economic Research.

Gourinchas, P.-O., Ş. Kalemli-Özcan, V. Penciakova, and N. Sander (2021). Covid-19 and small-and medium-sized enterprises: A 2021" time bomb"? In *AEA Papers and Proceedings*, Volume 111, pp. 282–86.

Gutierrez, B., V. Ivashina, and J. Salomao (2022). Why is dollar debt cheaper? Evidence from Peru. Mimeo.

Hassan, T. A., S. Hollander, L. van Lent, M. Schwedeler, and A. Tahoun (2021). Firm-level exposure to epidemic diseases: Covid-19, sars, and h1n1. *Manuscript*.

Huneeus, F., J. Kaboski, M. Larrain, S. Schmukler, and M. Vera (2021). The distribution of crisis debt: Effects on firm and aggregate indebtedness. Mimeo.

IMF (2021). World economic outlook. April.

Kalemli-Ozcan, S. (2019). Us monetary policy and international risk spillovers. *Proceedings of the Jackson Hole Symposium, 2019*.

Kalemli-Ozcan, S. (2020). Emerging market capital flows under covid: What to expect given what we know. Technical report, International Monetary Fund.

Kalemli-Ozcan, S. and L. Varela (2021). Five facts about the uip premium. Mimeo.

McCrary, J. (2008). Manipulation of the running variable in the regression discontinuity design: A density test. *Journal of econometrics 142*(2), 698–714.

Mullins, W. and P. Toro (2018). Credit guarantees and new bank relationships. *Banco Central de Chile, Documento de trabajo* (820).

OECD (2020). Covid-19 and global capital flows.

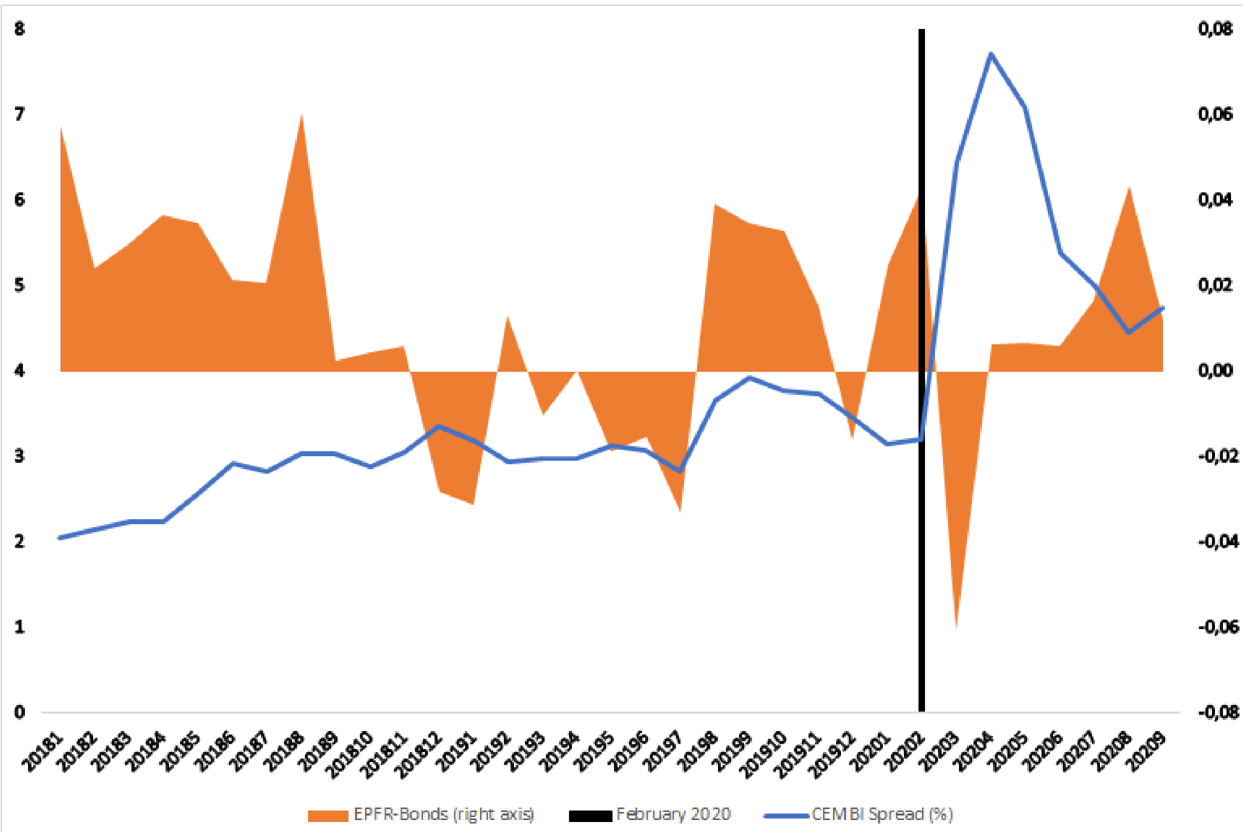
Schivardi, F. and G. Romano (2020). A simple method to estimate firms' liquidity needs during the covid-19 crisis with an application to italy. *COVID Economics*.

Appendix

A.1. Additional Tables and Figures

Figure 10 extends Figure 1 for a broader set of countries. It shows the cross-country means for EPFRs and CEMBI spreads of Argentina, Brazil, Colombia, Chile, Mexico, and Peru.

Figure 10: A picture of the pandemic: Capital flows and risk premium

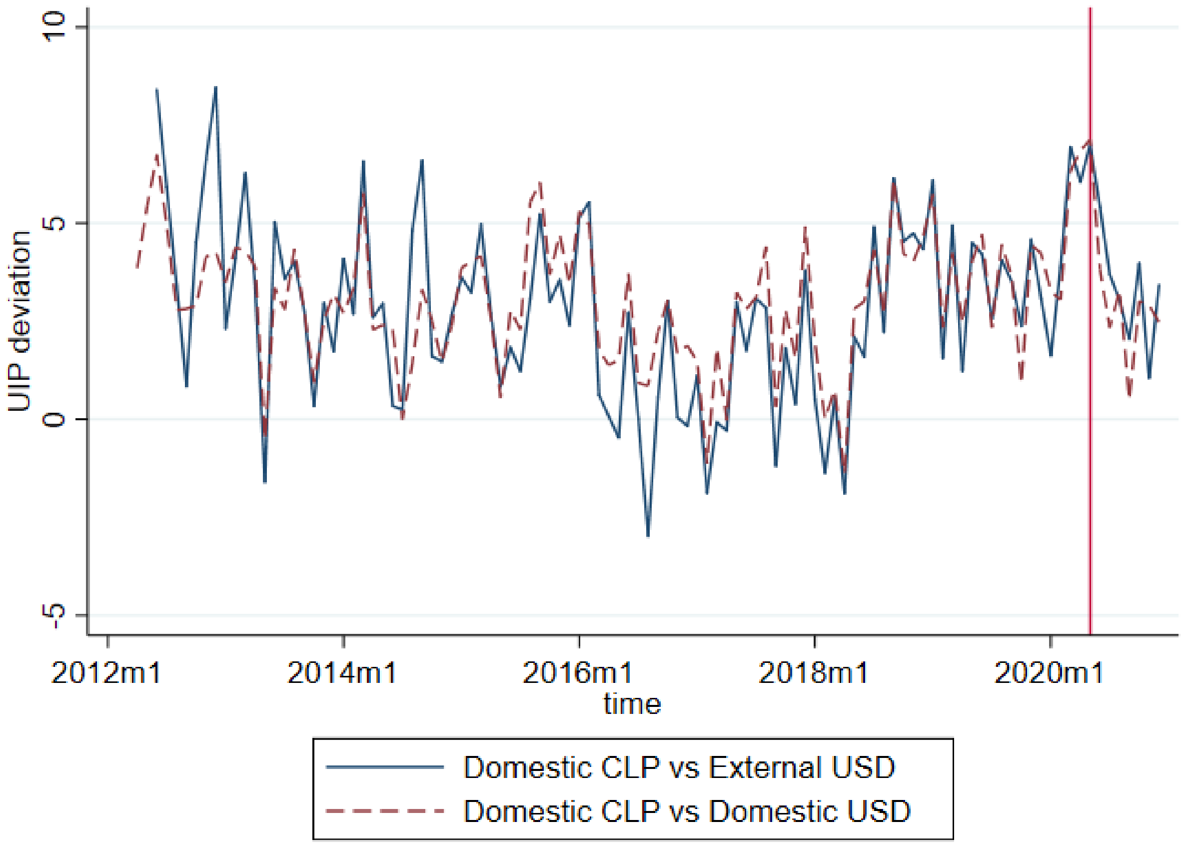


Notes. The figure depicts the fund flows' mean EPFR measure (right axis) and the mean CEMBI spread for: Argentina, Brazil, Chile, Colombia, Mexico, and Peru. Vertical line denotes February/2020, the month prior to the first COVID case in Chile. The data sources are, respectively, Informa PLC and Bloomberg.

Figure 11 shows the behavior of the firm-level UIP deviation as in Figure 3 for the whole time period in our sample. The pattern holds, and the peak UIP deviation is right before the implementation of the FOGAPE-COVID credit.

Table 10 shows the comparisson between interest rates of debt issued either in Chilean pesos

Figure 11: Average UIP deviation of firms



Notes: Each line corresponds to the average UIP deviation across firms on each month. The solid line (blue), doted line (red), and green line (yellow) represent, respectively: 1) the UIP deviation between domestic borrowing in local currency and foreign borrowing in dollars. 2) the UIP deviation between domestic borrowing in local currency and domestic borrowing in dollars. 3) Domestic borrowing in dollars and external borrowing in dollars. The vertical line corresponds to May 2020, the month when the FOGAPE-COVID credit policy was implemented.

or follars, both domesticaly and abroad. It has the mean across firms for the whole sample, and the periods March-July 2019 and March-July 2020.

Figure 12 is akin to Figure 2, but considering the period between January and July 2020.

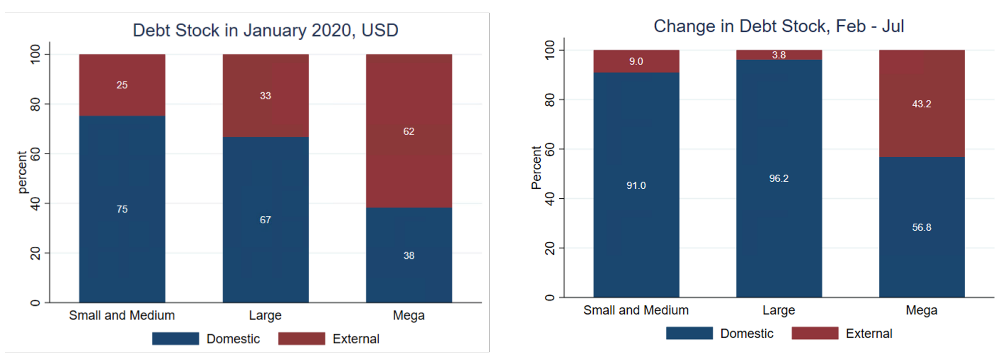
Figure 13 shows the average total leverage by firm size n 2019. The blue line depicts total leverage (i.e. foreign plus domestic debt over revenue), and the red line depicts domestic leverage. The shaded areas are 95% level confidence intervals.

Table 10: Interest rates of debt issued in CHP and USD

	Whole Sample	March - July 2019	March - July 2020
Mean i (CHP Domestic Debt - %)	13.2	15.9	5.0
Mean i (CHP Foreign Debt - %)	4.5	3.8	3.2
Mean i (USD Domestic Debt - %)	4.7	6.3	5.5
Mean i (USD Foreign Debt - %)	3.3	4.3	3.5

Notes: The first two rows are the mean interest rates of, respectively, domestic and foreign debt issued in Chilean pesos. The last two rows respectively correspond to the mean interest rates of domestic and foreign debt issued in dollars.

Figure 12: Stock and change in firms' finance mix



Notes: The left plot depicts the domestic (blue) and external (red) debt share over total debt for three groups of firms: 1) Small and medium (yearly sales of less than 100,000 UF. 2) Large (yearly sales greater than 100,000UF and less than 1,000,000 UF.). 3) Mega (yearly sales greater or equal than 1,000,000 UF). The right plot shows the change of each type of debt, domestic and foreign, as a share of the total change. All calculations are made by measuring the debt in dollars at the spot nominal exchange rate.

A.2. Model Derivations and Additional Results

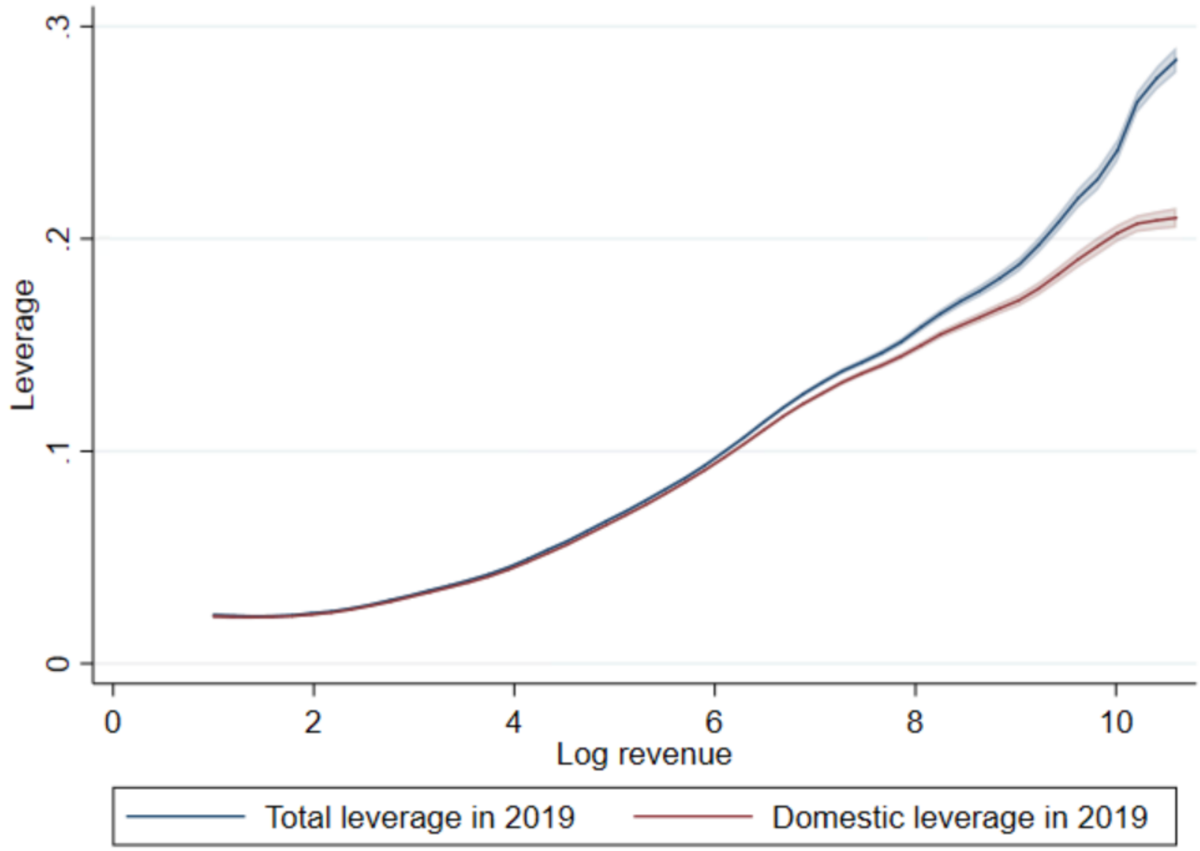
Domestic debt derivation To find Equation 14, we operate on the domestic collateral constraint with equality as follows:

$$R_2 d^i_{1,d} = \theta_d A_2 \left(d^i_{1,d} + \frac{\lambda^i_{2,f}}{R^\star} \right)^{\frac{1}{2}}$$

$$R_2^2 (d^i_{1,d})^2 - (\theta_d A_2)^2 d^i_{1,d} - (\theta_d A_2)^2 \frac{\lambda^i_{2,f}}{R^\star} = 0, \tag{19}$$

where to get to the second equation we have squared both sides of the first equation and moved all terms to the left-hand side. Using the quadratic formula on Equation 19, we

Figure 13: Mean leverage per firm size in 2019



Notes: The lines are constructed by taking average across different sales bins in 2019. Sales (revenue) are in UFs. The shades areas are 95% level confidence intervals.

obtain:

$$d^i_{1,d} = \frac{(\theta_d A_2)^2 \pm \sqrt{(\theta_d A_2)^4 + 4R_2^2(\theta_d A_2)^2 \frac{\lambda^i_{2,f}}{R^\star}}}{2R_2^2} =$$

$$\frac{(\theta_d A_2)^2 \pm \theta_d A_2 \sqrt{(\theta_d A_2)^2 + 4R_2^2 \frac{\lambda^i_{2,f}}{R^\star}}}{2R_2^2} = \frac{\theta_d A_2 \left(\theta_d A_2 \pm \sqrt{(\theta_d A_2)^2 + 4R_2^2 \frac{\lambda^i_{2,f}}{R^\star}}\right)}{2R_2^2}$$

To see why we rule out the negative solution, note that for $\frac{\theta_d A_2\left(\theta_d A_2 - \sqrt{(\theta_d A_2)^2 + 4R_2^2 \frac{\lambda^i_{2,f}}{R^\star}}\right)}{2R_2^2}$ to be positive it must be that:

$$
\begin{aligned}
\theta_d A_2 - \sqrt{(\theta_d A_2)^2 + 4R_2^2 \frac{\lambda^i_{2,f}}{R^\star}} &> 0 \\
\implies 0 &> 4R_2^2 \frac{\lambda^i_{2,f}}{R^\star},
\end{aligned}
$$

which is impossible because all the terms in the right-hand side of the last inequality are positive.

Credit market equilibrium Equation 16 can be solved using the power rule of integration, yielding:

$$
\left[\frac{1}{2}\left(\frac{\theta_d A_2}{R_2}\right)^2 \lambda^i_{2,f}\right]_0^{\hat{\lambda}} + \left[\frac{\theta_d A_2 R^\star}{8R_2^4}\left(\sqrt{(\theta_d A_2)^2 + \frac{4R_2^2}{R^\star}\lambda^i_{2,f}}\right)^3\right]_0^{\hat{\lambda}} + \left[k^\star \lambda^i_{2,f} - \frac{\left(\lambda^i_{2,f}\right)^2}{2R^\star}\right]_{\hat{\lambda}}^{\bar{\lambda}} = e_1 \tag{20}
$$

where the first two expressions in large brackets come from constrained firms, and the third expression in large brackets comes from unconstrained firms.

After evaluating the integrals at their respective upper and lower limits, Equation 20 becomes:

$$
\frac{1}{2}\left(\frac{\theta_d A_2}{R_2}\right)^2 \hat{\lambda} + \frac{\theta_d A_2 R^\star}{8R_2^4}\left(\sqrt{(\theta_d A_2)^2 + \frac{4R_2^2}{R^\star}\hat{\lambda}}\right)^3 - \frac{R^\star}{8}\left(\frac{\theta_d A_2}{R_2}\right)^4 + k^\star\left(\bar{\lambda} - \hat{\lambda}\right) - \frac{1}{2R^\star}\left(\bar{\lambda}^2 - \hat{\lambda}^2\right) = e_1 \tag{21}
$$

with $k^\star = (A_2\alpha)^{\frac{1}{1-\alpha}}$ and $\hat{\lambda} = R^\star\left(k^\star - \frac{\theta_d A_2 (k^\star)^\alpha}{R_2}\right)$.

TFP shock Figure 14 and 15 show the effect of a decrease in TFP (A_2) on the domestic interest rate, the threshold, and domestic debt share of a constrained firm, of an unconstrained firm, and total.

A negative TFP shock decreases the first-best level of capital that firms wish to finance, decreasing unconstrained firms' demand for domestic debt and, hence, also the interest rate. The share of constrained firms decreases slightly when TFP falls. A lower TFP has two effects on $\hat{\lambda}$. First, it tightens firms' domestic collateral constraints, increasing the share of constrained firms. Second, a lower domestic interest rate slackens domestic collateral constraints. The second effect dominates, decreasing the share of constrained firms and increasing the share of unconstrained firms. A lower domestic interest rate makes constrained firms increase their domestic debt. Because their foreign debt remains unchanged (i.e., $\lambda^i_{2,f}/R^\star$), the domestic debt share increases. Unconstrained firms behave very differently. They decrease their domestic debt because their desired level of capital (i.e., $k^\star$) is lower. On aggregate, the domestic debt share decreases when TFP falls. The domestic debt share is calculated dividing the market domestic debt over the sum of the domestic debt and foreign debt. Total foreign debt equals:

$$D_f = \int_0^{\bar{\lambda}} \frac{\lambda^i_{2,f}}{R^\star} d\lambda^i_{2,f} = \frac{1}{R^\star} \int_0^{\bar{\lambda}} \lambda^i_{2,f} d\lambda^i_{2,f} = \frac{1}{R^\star} \frac{(\lambda^i_{2,f})^2}{2}\Big|_0^{\bar{\lambda}} = \frac{(\bar{\lambda})^2}{2R^\star} \tag{22}$$

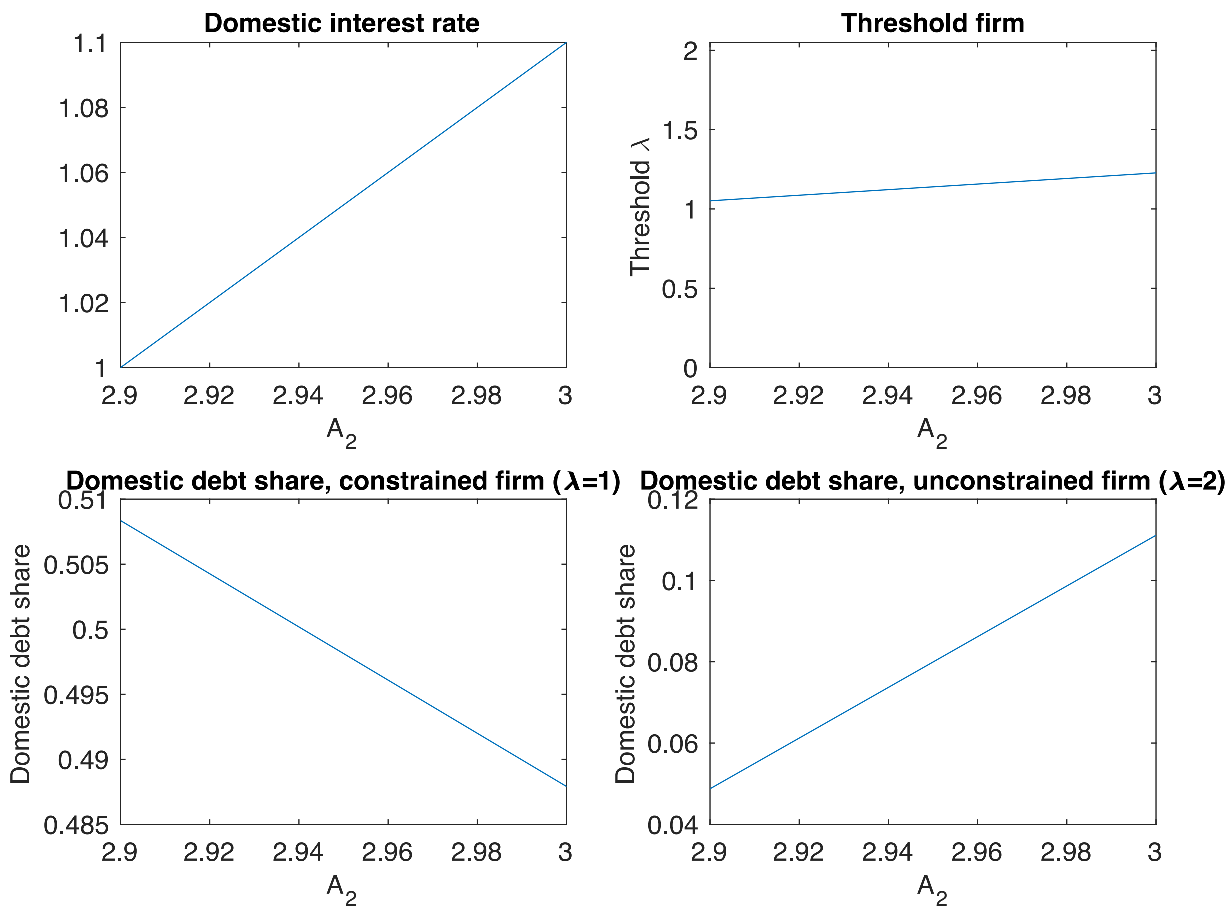
Credit supply microfoundation The microfoundation for the credit supply in the main body of the paper features financial intermediaries akin to the ones in Curdia and Woodford (2011), hereafter CW.

Financial intermediaries make loans L^i_1 to domestic firms i at rate R^b_2 and accept deposits s_1 from domestic households at a risk-less gross deposit return R^s_2 in period 2.

Similarly to CW, financial intermediaries also demand reserves m_1 and get paid an interest rate on reserves R^m_2. Differently from CW, they also demand FCIC, denoted as e^{CB}_1, and pay an interest rate R^{CB}_2 to access the public liquidity. Finally, some of the loans financial intermediaries issue have public sector guarantees backing them up (FOGAPE).

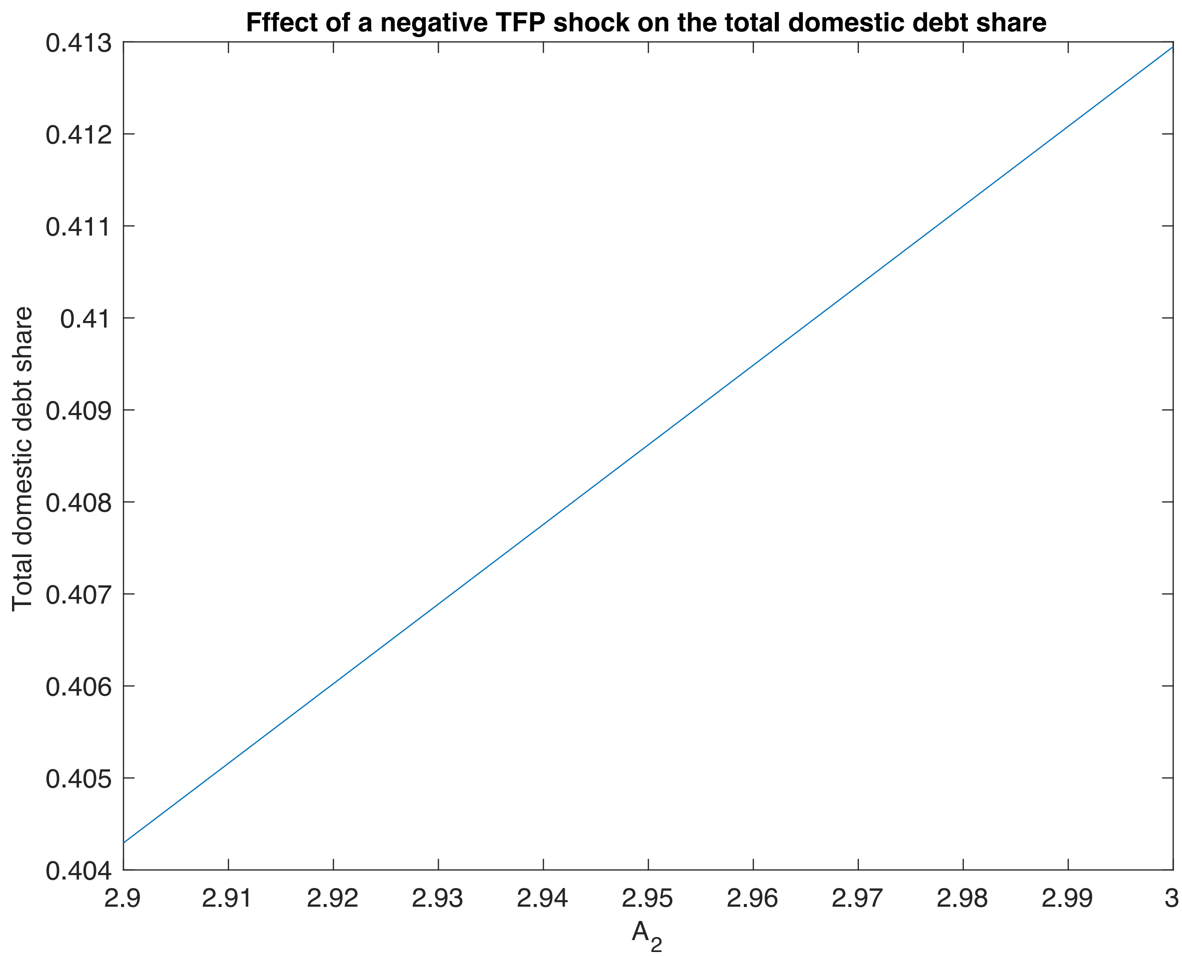
As in CW, financial intermediaries have loan origination costs. Namely, we assume the

Figure 14: Effect of a drop in A_2



Note: Effect of a decrease in A_2 on the domestic interest rate (R_2) (top left panel), the threshold firm ($\hat{\lambda}$) (top right panel), and the domestic debt shares for a constrained and an unconstrained firm (bottom left and right panels, respectively).

Figure 15: Effect of a drop in A_2 on the total domestic debt share



Note: Effect of a decrease in A_2 on the total domestic debt share following loan origination cost function:

$$\Xi(\int L_1^i di - e_1^{CB}, \theta_d, m_1) \tag{23}$$

which satisfies $\Xi_L(\int L_1^i di - e_1^{CB}, \theta_d, m_1) \geq 0$, $\Xi_{\theta_d}(\int L_1^i di - e_1^{CB}, \theta_d, m_1) \leq 0$, and $\Xi_m(\int L_1^i di - e_1^{CB}, \theta_d, m_1) \leq 0$. We also assume that financial intermediaries have a satiation point for reserves, $\Xi_m(\int L_1^i di - e_1^{CB}, \theta_d, m_1) = 0 \implies \bar{m_1}(\int L_1^i di - e_1^{CB}, \theta_d)$.

Equation 23 modifies CW's loan origination costs in two ways. First, loans with public sector guarantees (FOGAPE) decrease loan origination costs. Intuitively, public sector guarantees require less information acquisition about the quality of collateral. Second, only loans coming from private resources generate loan origination costs. In this way, we capture a benefit of the Central Bank's credit policy (FCIC). In CW, the credit policy given directly to domestic households also does not generate any loan origination costs for the Central Bank.

In this environment, financial intermediaries' problem is given by:

$$\begin{aligned} max_{L_1^i, s_1, m_1, e_1^{CB}} \qquad & R_2^b \int L_1^i di + R_2^m m_1 - R_2^d s_1 - R_2^{CB} e_1^{CB} \\ & -\Xi(\int L_1^i di - e_1^{CB}, \theta_d, m_1) && (24) \\ s.t \qquad & s_1 = m_1 + \int L_1^i di && (25) \end{aligned}$$

The constraint is financial intermediaries' balance sheet constraint.

Substituting Equation 25 into Equation 24 gives the following expression for financial intermediaries' objective function:

$$R_2^b \int L_1^i di + R_2^m m_1 - R_2^d (m_1 + \int L_1^i di) - R_2^{CB} e_1^{CB} - \Xi(\int L_1^i di - e_1^{CB}, \theta_d, m_1) \tag{26}$$

Taking FOC wrt L_1^i and m_1, we obtain:

$$\Xi_L(\int L_1^i di - e_1^{CB}, \theta_d, m_1) = R_2^b - R_2^d \equiv \omega_2 \tag{27}$$

$$-\Xi_m(\int L_1^i di - e_1^{CB}, \theta_d, m_1) = R_2^d - R_2^m \equiv \delta_2^m \implies m^d(L_1^i) \tag{28}$$

These are analogous to equations (15) and (16) in CW. Equation 27 determines the equilibrium credit spread, ω_2, that hinges upon the operating costs being increasing in loan volume. It also defines an implicit credit supply. Equation 28 states that the spread between interest rate paid on deposits and the interest rate paid on reserves are determined by those aggregate quantities. It also defines an implicit demand function for reserves.

The FOC for e_1^{CB} equals:

$$\Xi_L(\int L_1^i di - e_1^{CB}, \theta_d, m_1) = R_2^{CB} \tag{29}$$

which equates the private benefits of FCIC, that is, lowering loan origination costs, against its cost to financial intermediaries, that is, the interest rate they need to pay the Central Bank. R_2^{CB} is pinned down by the equilibrium credit spread, $R_2^b - R_2^d$ since the left-hand sides of Equation 27 and Equation 29 are identical.

Households and firms are identical to the model in the main body of the paper. Market clearing in Equation 16 changes because credit supply in the right-hand side is $\int L_1^i di$ in the model's extension instead of e_1.

From Equation 27, it is clear that credit supply is increasing in R_2^b, θ_d, and e_1^{CB}. Not surprisingly, in our baseline model, credit supply was not increasing in R_2^b because we did not have optimizing agents on the supply side. Crucially, in the current microfoundation, both FOGAPE and FCIC *complement* each other in increasing credit supply.