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

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Abstract

We study the interaction between government finance and market finance during COVID-19 in an emerging market. We use the experience of Chile as a natural experiment, as the government support policies lend themselves naturally to an RDD design. By reducing the cost of local currency domestic debt drastically, up to a threshold, support policies incentivized certain firms to switch from foreign debt to domestic debt. We document that the switch is not due to replacing foreign lenders with domestic lenders but rather replacing foreign currency debt with local currency debt. The only difference between two firms where one switched the financing and the other one did not is the fact that the switcher can make use of the policy. We build a simple small open economy model with heterogeneous firms and endogenous financing, that helps us rationalize these empirical facts, where government policy worked against the natural tendency to borrow abroad by making local debt cheaper than foreign debt only for certain firms in an environment where COVID-19 increased the cost of external financing for all firms.

Keywords: Capital flows, firm financing, unconventional policies, COVID-19

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1 Introduction

The COVID-19 pandemic shock has propagated to the aggregate economy through various channels. One strand of the literature has focused on how firms coped with this unprecedented 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 of the literature has documented how the pandemic brought about large movements in cross-border capital flows, with several EMEs exhibiting sharp current account reversals, curtailing their ability to absorb the shock by borrowing in international markets originally (see Kalemli-Ozcan 2020; OECD 2020; BIS 2021; IMF 2021; among others). Yet the intersection between the two strands of literature remains still largely unexplored, which is first order for small open economies. How did firms react to the sudden drying out of international capital markets? Were they able to adjust their finance mix between international and domestic finance? To what extent was this related to credit support policies implemented by central banks as external finance came back quickly thanks to large support by the US Federal Reserve that improved global liquidity conditions?

Our work provides answers to these questions. On the empirical front, we study firms in Chile with a unique administrative dataset that allows us to study 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. We are therefore able to 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 in the mix induced by the crisis.

The specific nature of COVID-19 firm support policies allows us to identify the causal role of policies in firms' finance-mix decisions. Such policies 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, particularly to small and medium-sized firms; and ii) the availability of sovereign guarantees on commercial bank loans to firms. Importantly, implementation of the latter policy was made through exogenously chosen cutoffs based on historical sales by firms, which then lends itself naturally for the kind of regression discontinuity design (RDD) analysis that we undertake on the effects of these policies for the finance decisions of firms.

In other words, we can study the local average treatment effect of the exogenous change in the maximum value of a firm's sales–the cutoff–required to access the policy in the neighborhood of the new cutoff where firms with sales right below it can now access the policy but firms with sales above it remain excluded from accessing the policy.

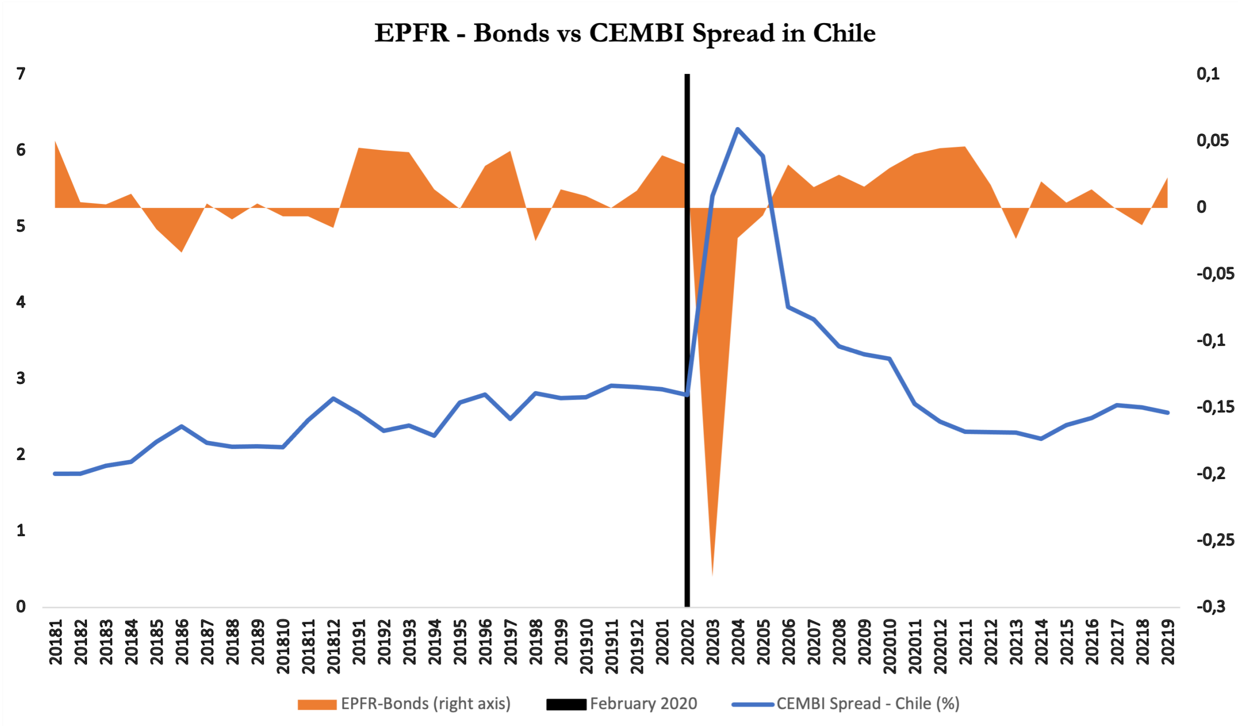
The universal coverage of our dataset also allows us to assess the role that interest rates played in this episode. Because we observe the rates for all loans in local and foreign currency we are able to test if firms' borrowing in foreign currency exhibit a preferential premium –what Kalemli-Ozcan and Varela (2021) called a UIP premium– and if it was reduced by the policies that made borrowing in local currency cheaper.

The evidence presented in Figure 1 suggests that this analysis is relevant for a country like Chile insofar as capital inflows to this country–proxy by EPFR data on external bond issuance–experienced a sharp reversal while, simultaneously, corporate debt risk more than doubled—captured with the CEMBI spread–as the pandemic was spreading throughout Chile and the rest of the world.[1] In this environment the credit support programs implemented in Chile where sizable. For instance, the size of the credit support programs financed by the expansion of the central bank of Chile's balance sheet was among the highest across countries (in relative terms), with an increase of about 10% of GDP in the initial phase of the pandemic, likely facilitating the change in the finance mix of firms.

On the theoretical front, our work provides a framework of analysis for the main determinants

[1] The first case of COVID in Chile was diagnosed on March 3, 2020.

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



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

of the domestic vis-à-vis foreign finance mix of firms in a small open economy in the wake of COVID–modeled as a rise in the cost of debt issuance in international markets–and the role played by the Chilean credit support policies.

The model features heterogeneous firms that borrow domestically and abroad, and face 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. The stylized theoretical framework delivers three stylized facts observed in Chile. First, larger firms (by sales) borrow more abroad. Second, larger firms are relatively more leveraged.[2] Third, borrowing rates in domestic markets are higher than borrowing rates abroad. In the model, the wedge between domestic and international rates stems from the

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

differential collateral constraints in both markets. Alternatively, we can interpret the wedge as stemming from a risk premium associated with exchange rate movements (Kalemli-Ozcan 2019; Kalemli-Ozcan and Varela 2021).

Our empirical findings can be summarized as follows. First, we find evidence of a change in the finance mix, with firms moving away from the (relatively) more expensive foreign debt and into cheaper domestic debt. This is concentrated mostly on the subset of large firms that got access to credit support policies implemented. Indeed, we provide evidence of a causal link from these policies to firms' choices of debt through RDD analysis, where firms' eligibility to accessing loans with sovereign guarantees is directly linked to changes in their finance mix. The macroeconomic implications of this mix are relevant. Sales of the firms studied account for a non-trivial share of GDP (18%) and their increase in domestic bank lending during the initial phase of COVID amounted nearly to 1% of 2020's GDP.

Second, changes in domestic interest rates were crucial in the mechanism behind this debt substitution, for they dropped more than rates in dollars, considerably reducing the UIP premium rate in dollar loans. Crucially, we demonstrate that this result can be traced back to the public guaranteed loan credits enacted during the crisis.

Third, our model helps rationalize the empirical findings about firms' finance mix as a result of the interplay of two forces. First, in the absence of credit support policies, an increase in the cost of borrowing abroad–akin to the one likely triggered by COVID–makes firms move away from foreign debt and towards domestic debt, increasing the domestic debt share. Absent domestic credit support policies, the model predicts an increase in domestic rates after an increase in rates abroad, which is counterfactual. Second, when considering credit support policies, the model underscores the *complementarity* between the two policies implemented in Chile (credit line facilities and sovereign guarantees) for the observed behavior in the finance mix and interest rates. The calibrated version of the model is able to reproduce the change in the finance mix observed among Chilean firms and the aggregate behavior of interest rates only when *both* policies are active. In the model, a policy of sovereign guarantees alone generates a counterfactual upward pressure on domestic interest rates, given the drop in domestic rates observed. Likewise, a policy of liquidity provisions alone is not enough to deliver an increase in available funds to firms akin to that in the data, which the model explains -albeit in reduced form- because of heightened risk aversion that prevented loans from reaching to firms.

The rest of the paper is divided as follows. Section 2 provides a brief description of 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 COVID-19 and Policies Implemented in Chile

As most countries, Chile experienced a sharp decrease in economic activity as the pandemic triggered by COVID-19 was spreading. In the second quarter of 2020 output and private consumption fell by 14.2% and 20.4%, respectively, with respect to the same quarter of 2019. This was the trough of the crisis, with the largest drop in economic activity in recent history.[3]

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 with the purpose of minimizing 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 fell as well. In this context, policy responses included new measures focused on minimizing scarring effects on firms and supporting household consumption.

As highlighted by Costa (2021) and the Central Bank of Chile's Monetary Policy Reports in

[3]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 fist quarter of 1999.

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 programs of more than 10% of GDP. Importantly, such credit programs were complemented by sovereign guarantees on commercial bank loans to firms, that allowed to cover loans for up to 9% of GDP.[4]

Our analysis focus on the two main unconventional policies implemented at the onset 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, particularly to small and medium firms;[5] and 2) FOGAPE-COVID or sovereign credit guarantees on commercial banks' loans to firms–below a chosen pre-determined size–for working-capital purposes.[6] We explain such policies below.

2.1 Special Central Bank Credit Lines to Commercial Banks: FCIC

FCIC was a policy of unprecedented size and its implementation was made through 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 USD24,000 millions. Banks could access up to 15% of their asset loans in the balance sheet, out of which 3% had unconditional access with the purpose of stimulating 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

[4]By the second half of 2020, the government also implemented policies aimed at supporting households via transfers, and Congress passed a law authorizing early withdraws 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.

[5]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.

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

Central Bank, and the rest required other assets. Access to this credit line was open for six months, after which 95% of it was used.

In June of 2020, the Central Bank launched a second phase of FCIC with close to USD24,000 millions available, and accessible for eight months. This second version of FCIC was conditioned on the increase in 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 of 2021 and tied to another FOGAPE program called "FOGAPE Reactiva" (aimed at stimulating firms' demand for investment).

2.2 Sovereign Credit Guarantees on Firm Loans: FOGAPE-COVID

The sovereign credit guarantees program, FOGAPE, dates back to 1980. Over the years it has been a program through which government resources are used as a fraction of collateral for credits taken by small firms. This fraction varies with firm size. A crucial characteristic of FOGAPE is that eligibility to borrow under the program depends on yearly sales. Such sales are defined in UF, an inflation-indexed unit of reference in Chile that varies daily.[7]

Resources used as guarantees come from a government fund with the sole purpose of acting as collateral for firm loans. The fund has been capitalized over the years. Before November of 2019 firms with yearly sales below 25,000UF were eligible to access FOGAPE loans. Then, due to the drop in economic activity related to the episode of social unrest in Chile on October 2019, the program was expanded. By January of 2020 it had been capitalized with 100 million dollars, and the threshold of sales to become eligible increased to 350,000UF.

On April 25, 2020, the government launched the FOGAPE-COVID program which included a massive recapitalization of the fund by USD3,000 millions, guaranteeing up to USD24,000 millions in credits (9% of GDP). It would only cover new and working-capital loans, providing guarantees between 60% to 85% of each credit depending on firm size. Also, contrary to the

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

previous version of the program where the interest rate was determined by the market, it was now capped at a ceiling of the MPR plus 300 basis points. Crucially, FOGAPE-COVID changed the cutoff required to access the typical FOGAPE credits before the onset of the pandemic. It increased it from 350,000UF to 1,000,000 UF.

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.

We present in Table 1 a summary of the main characteristics of the program FOGAPE-COVID implemented in April 2020 and compare it to the standard FOGAPE program that existed before the onset of the pandemic. The main feature in the upper panel of the table is the *increase in the eligibility threshold*. The lower panel also shows that the fraction of the loan guaranteed and the maximum FOGAPE loan increased for all firm sizes. An important feature of FOGAPE-COVID is that the annual sales of a firm that are used to determine eligibility to the program are those of 2019.

From Table 1 it is worth noticing that firms with sales close to 1,000,000UF were not eligible to apply for FOGAPE loans before the pandemic. Then, at the implementation of FOGAPE-COVID firms with sales of less than 1,000,000 UF became eligible. In other words, while firms to the left of this cutoff were now eligible to get FOGAPE-COVID loans, firms with sales just above the cutoff were not.

The characteristics of how FOGAPE-COVID was implemented provide an adequate set up 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 cutoff is exogenously determined and based on an outcome that occurred in the past (sales of 2019), lead us to use a Regression Discontinuity Design (RDD) for this purpose, as presented in the next Section.

3 Empirics

3.1 Data

We benefited from a massive effort by the Central Bank of Chile in creating a repository with various administrative datasets owned by the State to support policy-making, statistics and research. For this project, we merged five administrative anonymized datasets from the universe of firms in Chile: 1) Deudex: a foreign debt dataset, which contains all foreign debt loans (both stocks and flows) and their conditions (interest rates, maturity, currency) between April 2012 and December of 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: firm-to-domestic banking system credit stock; 4) Domestic Bond Issuance: records the value of each firm's bond issuance in the domestic bonds market; and 5) F29: firm's monthly sales from tax records. The first dataset is provided by the Central Bank of Chile, the next three by the financial markets commission, and the last one by the Chilean IRS ("Servicio de Impuestos Internos", SII).[8] To our knowledge, we are the first ones 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.[9]

[8] This merging was possible due to confidentiality agreements between the Central Bank of Chile and the Financial Markets Commission and the Chilean IRS. We followed all the required protocols to protect the confidentiality and anonymity of firm-level data.

[9] 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

The final merged dataset has a monthly frequency between April of 2012 until December of 2020. For firms that borrow abroad directly we keep only non-trade credit loans and bond issuance. We keep foreign credits in either U.S Dollars, Euros, Japanese Yens, or Chilean Pesos. These represent more than 98% of total external borrowing. We also keep credits that only have positive spreads to avoid distorting the data with credits that are not likely to represent a real need for credit.[10] When we merge the data of foreign debt that results after these filters with that of the sales' data set (F29), it results in a database that contains about 40% of total external borrowing, and its behavior is highly correlated with that of the full sample. We also merge these data with the databases of domestic borrowing (D32) and domestic debt stocks (D10 and Domestic Bond Issuance), which results in a monthly register of the entire spectrum firms' financial borrowing. In particular, this also allows us to obtain the finance mix in the form of total domestic debt relative to total (foreign plus domestic) debt. This last measure is the outcome variable in our empirical estimation described in the next section.

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 taken from the merge between Chile's D32, Foreign Debt, D10, and F29 dataset. The moments are taken as averages for the period of 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 data set. The top panel shows statistics regarding domestic and foreign credit conditions in our merged dataset.

firms' finance mix, which is the main focus of our work. Huneeus et al. (2021) also studies access of credit support policies by firms in Chile during COVID but does not analyze changes in the finance mix.

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

While the mean domestic loan has size of 150,166 dollars, the mean foreign loan is of 39,530,000 dollar. This is natural since larger firms have access to foreign markets. The standard deviation is 1,164,683 dollars for domestic loans, and 184,584,000 dollars for foreign loans. This means that there is more dispersion (relative to the mean) in the former type of loans, which comes from higher dispersion in the size of firms that borrow domestically than those borrowing abroad. The mean domestic-loan interest rate is 13.2%, while for foreign loans in dollars it is 3.3%. When we consider the foreign interest rate measured in pesos corrected by (ex-post) uncovered interest rate parity (UIP), the mean is 10.2%. This is evidence that, on average, it is cheaper to borrow abroad once you have access to external financial markets. Fewer firms have access to foreign credit and 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. These two facts can be reconciled as large firms are usually the ones that borrow abroad.

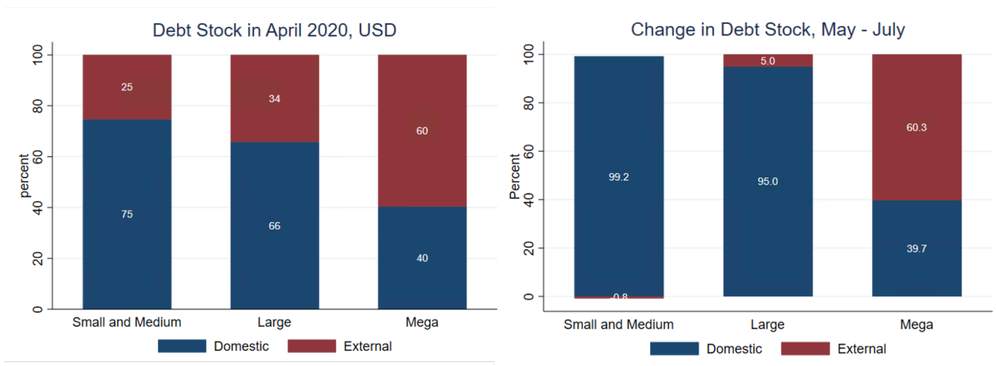
The bottom panel of Table 2 compares sales among the firms studied as share of GDP. As the last column shows, the mean yearly sales of all firms is 152.7% of GDP, and they represent on average 72.3% of total sales in the F29 dataset (i.e. the dataset without the filters applied to the merge). In total we have 284,090 firms.

From our final dataset, we uncover two facts that point out to evidence of foreign-for-domestic debt substitution during COVID. First, in Figure 2 we observe that during April of 2020–right before the implementation of the FOGAPE-COVID policy–the finance mix was such that the share of domestic debt in the total stock of debt was decreasing in size. Indeed, mega firms–with sales larger than 1,000,000UF, approximately 340 million dollars–had a considerably larger share of foreign debt than domestic. Yet, between April and July of 2020, firms had a larger increase in domestic debt than in foreign.[11] Moreover, this relatively higher increase in domestic debt was more pronounced for large firms, than for other types

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

of firms, which largely overlaps with the firms that got access to FOGAPE-COVID loans in May 2020.[12] Indeed, between April and July 2020 about 80% of credit flows are in pesos and 20% in dollars. These numbers are roughly the same for the January-July 2020 period, which shows 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 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 100,000UF. 2) Large (yearly sales greater than 100,000UF and less than 1,000,000UF.). 3) Mega (yearly sales greater or equal than 1,000,000UF. 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.

Second, the first two rows of Table 3 document that the mean domestic interest rate considerably fell to 5% during the March-May period in 2020, compared to 15.9% in the same period of 2019. The mean foreign interest rate for newly issued debt in dollars also fell but considerably less, 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%. This is in line with the increase of the CEMBI index from 2.5% to 5.1%, exhibiting higher risk during 2020. 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 that it is likely to be selection among the firms that had access to foreign credits. As the last row of the table shows, the mean sales of firms with foreign

[12] Figure 10 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 the change of debt is measured between February and July 2020.

credit in 2020 was higher than those in 2019, meaning that, on average, better-performing firms accessed foreign debt markets.

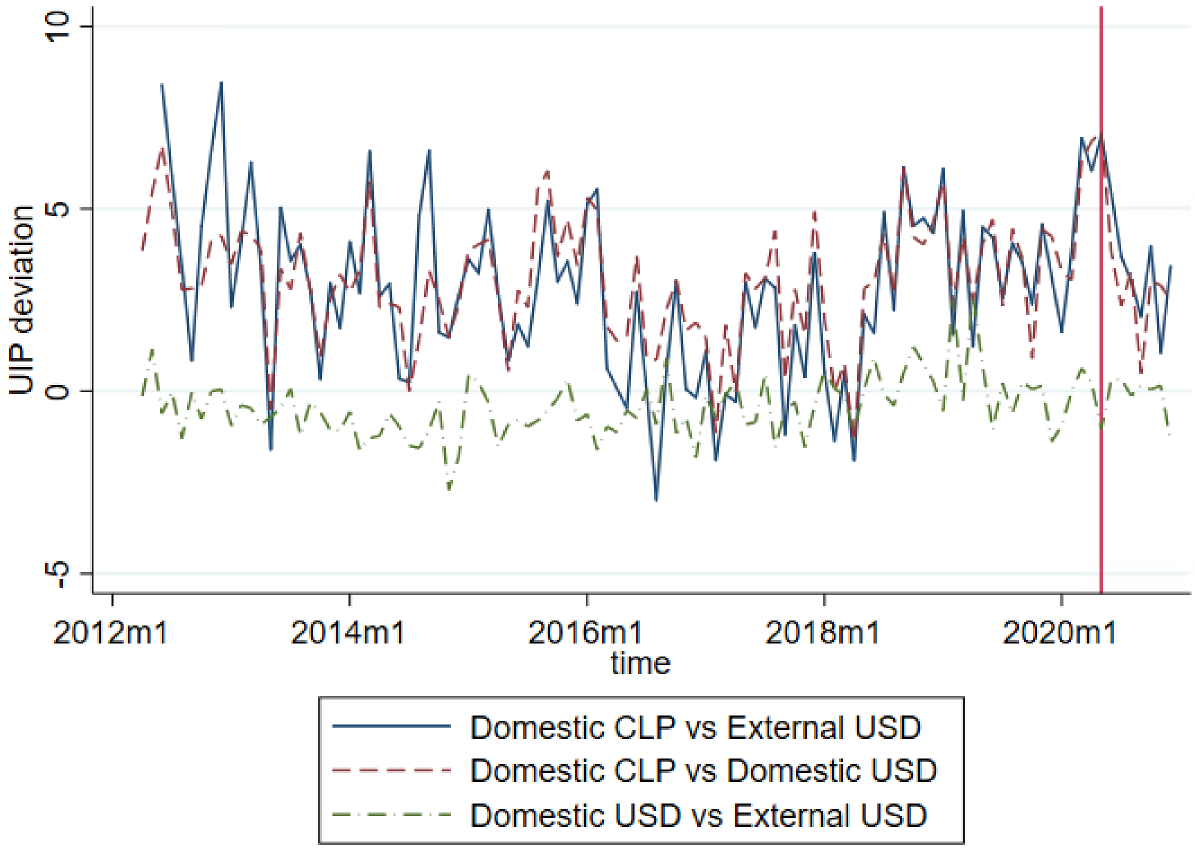
The reasons behind the sharp fall in the average domestic interest rate are a very expansive monetary policy through the monetary policy rate, the implementation of FCIC, and the implementation of FOGAPE-COVID loans which had a ceiling interest rate of 3.5% during that period. Indeed, when we remove those loans from the sample, the average domestic interest rate is close to 9% instead of 5%, which still represents a large drop in domestic interest rates. This documented fall in the relative domestic interest rate with respect to the foreign one is in line with a fall in the average UIP deviation faced by firms after the policy was implemented. Figure 3 documents three average UIP deviation across firms each month: 1) between domestic debt in pesos and foreign debt in dollars. 2) between domestic debt in pesos and domestic debt in dollars. 3) between domestic debt in dollars and external debt in dollars. The vertical line represents May 2020, the month when the COVID-FOGAPE credit policy was implemented. The figure suggests that the UIP deviation falls once the policy is implemented, after it had risen right before it led by the increase in the risk premium as documented by Figure 1.

Table 3: Interest rates 2020 vs 2019

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

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, respectively, in domestic and foreign markets.

Figure 3: 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 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.

We argue that the facts described by Figure 2, Table 3 and Figure 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.

3.2 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. We follow Mullins and Toro (2018), who employed a similar approach to study the effects of standard FOGAPE credits on different firms' outcomes.[13] This approach is natural, since we have exogenous changes in the sales' thresholds required to be included in the eligibility to FOGAPE-COVID credit. Specifically, before May of 2020, firms with annual sales between 350,000UF and 1,000,000UF were not eligible for this type of credits. However, as described before, the threshold was changed as part of the policies aimed at supporting credit, so firms with annual sales up to 1,000,000UF suddenly became eligible. Since the annual sales to determine the cutoff are those of 2019, firms are quasi-randomly assigned around the new eligibility threshold in May of 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 will be further explored below. Therefore, firms on the left-hand side of the cutoff (1,000,000UF in sales) 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 absence of the cutoff, firms were not eligible to FOGAPE-COVID on either side of it, hence those really close to the cutoff would be otherwise equal, and there would not be any type of discontinuity. We test this in the data using the previous year as a placebo. Also, for the RDD to be valid, firms should not sort themselves to the left-hand side of the cutoff, hence the densities on both sides of the threshold should be similar. We will verify this by means of empirical tests to assess whether there is evidence of firms sorting themselves below the threshold by running the Cattaneo et al. (2020) manipulation test. Evidence of those

[13] Mullins and Toro (2018) 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.

two tests is presented in the robustness part of this section.[14]

We define the treatment as *being eligible to obtain FOGAPE-COVID loans.* This is, having sales in 2019 lower than 1,000,000UF. 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 350,000UF) are treated, and those to the right are not. In this sense, we estimate a sharp RDD.[15] As Cattaneo et al. (2021) recommend, since we are not looking to define parameters of interest or to increase the efficiency of the estimation, we do not use controls other than log of sales. 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 left-hand side of Equation 1 represents the outcome variable, which is the domestic debt as a fraction of the total (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.[16] The right-hand side has the assignment variable, 2019 sales in logs, and the treatment, $Eligible_i$. This variable takes the value of 1 when firms have sales below the cutoff, and 0 otherwise. Both the outcome and the treatment variable are firm-level averages between May and July of 2020. As mentioned before, we choose this period because the increase in the cutoff was implemented in May and, starting

[14] It is worth mentioning that there could be an argument for firms sorting below this threshold. FOGAPE was also available to firms with sales below the 1,000,000UF threshold when considering the sales of the previous 12 months at the moment of applying for the credit (instead of the 2019 sales rule mentioned before). The manipulation tests presented below will also explore this.

[15] 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, specially around this cutoff which is the limit between large and mega firms, banks would simply charge lower interest rates to firms that are already eligible. The second is statistical: the number of firms that take FOGAPE-COVID loans about the cutoff is low, around 15, limiting the power of the fuzzy-RDD estimation.

[16] Evidently, our dependent variable will be affected by exchange rate movements such as the large Chilean peso depreciation observed during the period of study. 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.

in August of 2020, other policies were launched which could distort our estimation.[17] 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.

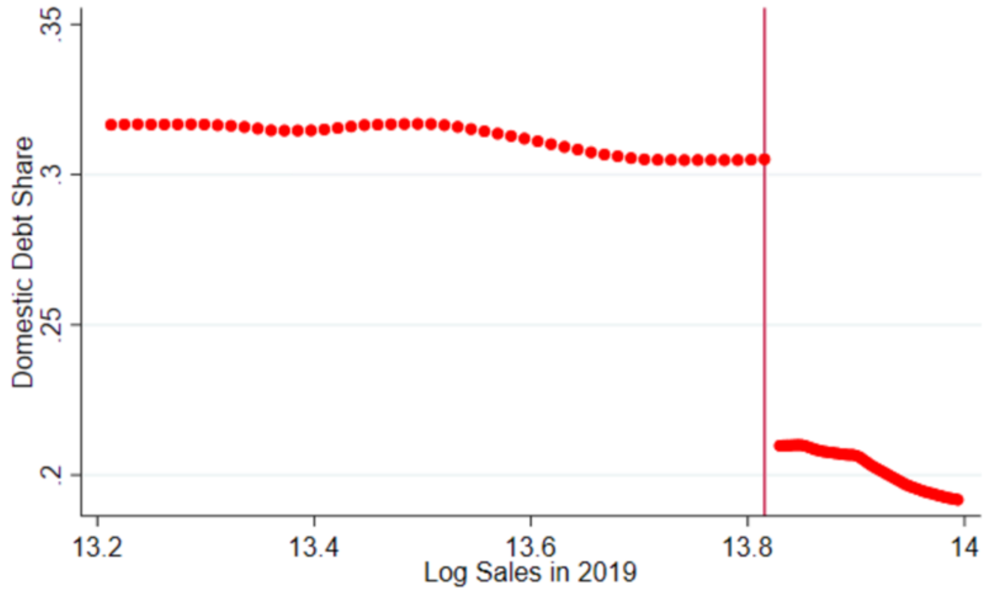
3.3 RDD Results

Table 4 presents the results of the RDD analysis described in Equation 1. There are 665 firms around the cutoff, with 442 to its left and 223 to its right. The first row reports the estimate of δ, and the other rows report, respectively, the standard error 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 graphic representation of the local regression using the baseline specification. The vertical line depicts the cutoff of 1,000,000UF sales (in logs). At each side of the cutoff the plot shows the estimated polynomial, where the gap at the discontinuity is the estimated effect of the treatment.

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 $9.4p.p$ 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

[17]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.

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 credits, represented by δ in Equation 1 under different specification. 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.

mix by taking on more domestic debt relative to foreign debt. This is, firms affected by the policy recomposed their liabilities towards less exposure to external foreign-currency debt relative to domestic local-currency debt.

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

3.4 Mechanism: The Role of Interest Rates

The estimates of the RDD described in the previous section establish the result of–foreign for domestic–debt substitution of firms fostered by becoming eligible for FOGAPE-COVID credits. Yet, this result is focused on relative credit volumes and is silent about prices. In this section, 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 there exists a UIP premium for USD loans in emerging markets (Kalemli-Ozcan and Varela, 2021). We follow this work and test the following. First, if before the COVID-19 crisis, such UIP premium result holds in the Chilean data; second, if the COVID-19 crisis altered this result in any way; and, third, if so, what is the role of policy. For the first two tests, we estimate the following specification:

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

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 and about 20% of total yearly loans. 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 the first two vectors are, for firms and banks respectively, value added, market share (within the correspondent 2-digit economic sector), and leverage. The macro controls are the price of copper (which is, by far, Chile's main export), the monetary policy rate, and a monthly indicator of economic activity in Chile (namely "IMACEC"). 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.[18] 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 is from the beginning of our sample, April 2012, when our data starts, until September 2019. This is a "normal-times" period in Chile, which was immediately followed by the social unrest of October 2019, and, subsequently, by the COVID-19 crisis in March 2020. 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. Going back to Chile, the second column of Table 5 covers March to July 2020, the midst of the COVID-19 crisis in our sample. For this period, the coefficient on FX becomes statistically insignificant, suggesting that the UIP premium disappears and that, on average, during the COVID-19 crisis, borrowing in dollars was not cheaper than borrowing in pesos.

To evaluate the role of policy in this stark difference, we run the following specification:

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

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 rest of the variables are the same as in

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

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.

The third column of Table 5 shows the results of estimating Equation 3. Two relevant results emerge here: first, the UIP premium reappears, albeit, it is one order of magnitude smaller than in the normal-times period; and, second, such premium disappears for firms that were eligible for FOGAPE-COVID credits, 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 entirely driven by those firms affected by the FOGAPE-COVID policy.

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.

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 from the March-July 2019 period to the same period in 2020.[19]. Furthermore, Table 10 in the Appendix documents

[19]Table 3 shows the interest rates aggregated at the firm level, calculating the weighted average by loan

that interest rates of domestic debt in pesos fell considerably more than those of foreign debt issued in pesos. Therefore, our main takeaway here is that changes in domestic interest rates were crucial in the mechanism behind debt substitution, for they dropped more than rates in dollars, considerably reducing the UIP premium rate 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.

3.5 Robustness

3.5.1 RDD Robustness

The results presented in the RDD regression are evidence of a significant discontinuity at the sales cutoff set by the FOGAPE support program (one million UF). Moreover, since sales are those recorded by the Chilean IRS by the end of 2019, while the policy was implemented in May 2020, firms cannot manipulate their sales so as to sort into the treated group. These features are necessary for the RDD to be valid, yet not sufficient.

An important requirement for the results of a RDD like the one implemented in our work, is that firms do not self-select into the policy. This is always possible due to the considerable implementation challenges that arise when a large scale policy such as this is put in place.

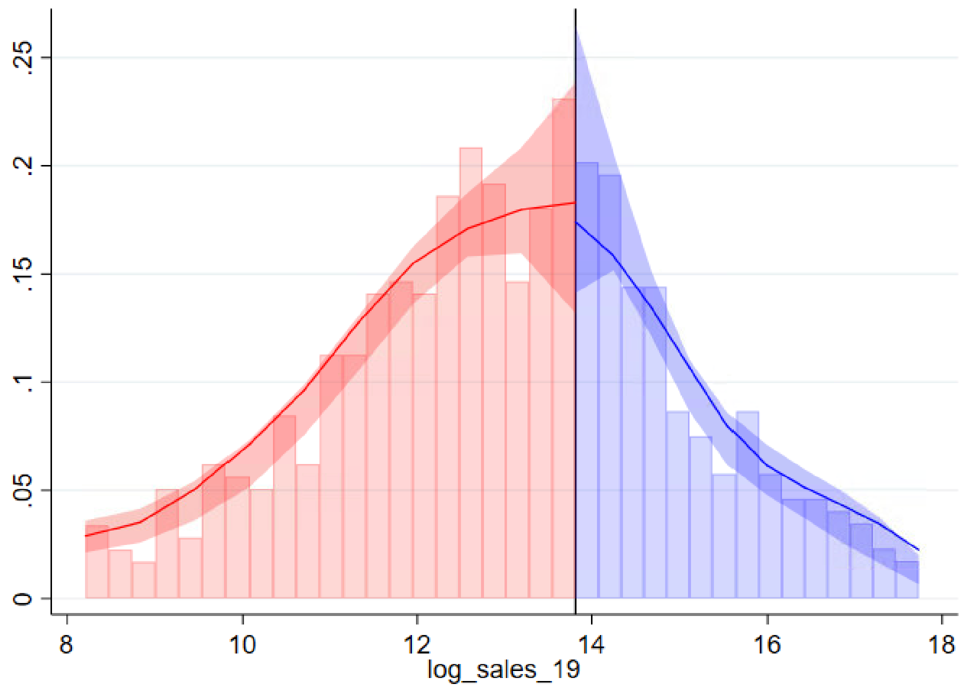
To test for self-selection that leads to firms sorting themselves to the left of the cutoff, we implement the test developed by Cattaneo et al. (2020).[20] Figure 5 shows in the confidence bands, at the 95% level, the results of the test. Statistically, the mass of firms just to the left of the cutoff is similar to that just to its right. This is, we do not find evidence of

size. When we simply take the mean interest rate by loan, the domestic interest rate fell from 8.7% in the March-July 2019 period, to 5.9% in the same period of 2020, and the foreign interest rate fell from 4.4% to 3% in the same respective periods.

[20] 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.

manipulation.[21]

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.

We also need to run a placebo test to assess that the discontinuity comes strictly from the treatment. In other words, we need to show that, in absence of the treatment, there is no evidence of discontinuity around the cutoff. For this purpose, we estimate Equation 1 again but using as time period May to 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, under the baseline specification, the estimate of δ is not significant. Neither is it under the other three alternative specifications. Therefore, we do not find evidence of lack of continuity in absence of the treatment.

In sum, our results of debt substitution towards the relatively cheaper domestic debt caused

[21]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).

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 becoming eligible for FOGAPE-COVID credits, represented by δ in Equation 1 under different specification. The domestic debt share is the firm-level average between May and July of 2029. *,**, *** 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.

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.

3.5.2 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.[22] This is, our results from Table 5 are robust to the fixed-effects specification considered, as shown by Table 7.

A second potential caveat is that we find foreign-for-domestic debt substitution, yet the interest-rate mechanism explored is based on domestic and foreign currency local debt. As explained above, the main reason for this is the lack of micro-level data on foreign lenders. 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.

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.[23] Once again, our results hold. 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 our finding could be that the documented debt substitution happened because there was an external-credit dry out for banks. This would lower the domestic supply of dollar-denominated loans, increasing their interest rate, lowering the UIP premium,

[22]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.

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

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.

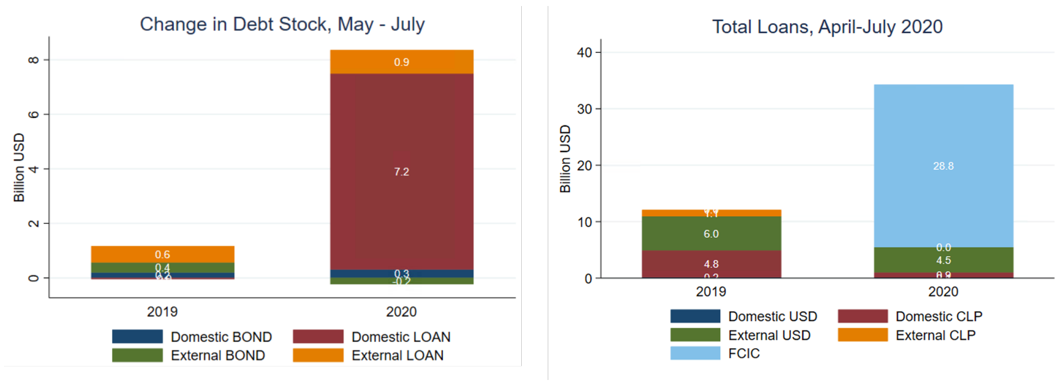
and leading firms to borrow more in domestic currency.

The left panel of Figure 6 shows the net change in lending (in billions 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. The right panel of Figure 6 shows the gross increase in domestic and foreign borrowing by currency, all expressed in billions of USD. On one hand, it shows that new external borrowing in dollars was lower in 2020 than in 2019 (4.5 vs 6 billions of 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 42.2 billions of USD, FCIC represents more than two thirds of the new credit taken by banks. This suggests that, even though banks still had access to considerable foreign borrowing, they also substituted some of it for domestic loans, mainly due to FCIC. Indeed, that increase in FCIC is what explains the net increase in domestic loans for banks exhibited in the second bar of the left-hand side panel (red area). Finally, if banks had faced some sort of foreign credit dry out from foreign credit, interest rates on the very few credits taken should have increased. This was not the case, the average interest rate faced by banks on foreign dollar-denominated debt was 2.8% between May and July of 2019, and it fell to 1.3% in the same period of 2020.[24]

Altogether, the evidence points out to foreign-for-domestic debt substitution triggered by unconventional policies. On the one hand, since the spread between domestic and foreign interest rate falls, firms are less willing to take on the exchange rate risk derived from borrowing abroad. On the other hand, there is a selection channel through which smaller firms do not tap international markets anymore since the foreign borrowing costs would be too high, making them switch to the local debt market. This selection channel leaves better

[24]This concern is akin to the possibility of mismatches in the local currency swap markets due to lack of counter parties. If this was the case, due to regulation requiring zero balance sheet miss matches in swaps for banks, banks would supply less dollar-denominated loans and their interest rate would increase, which did not happen as evidenced in Table 10 in the Appendix.

Figure 6: Total Loand 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 amount of banks' loans according to its origin and currency (CLP or USD), including FCIC amount in 2020. All calculations are made by measuring the debt in dollars at the spot nominal exchange rate and compares 2020 with 2019.

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 borrow abroad during the crisis his higher than before the crisis. The model developed in the following section abstracts from the currency-risk channel and focuses on the 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 understand the mechanisms behind the documented debt-substitution effect, emphasizing how the unconventional policies implemented affected 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 programs. A second key ingredient of the model is to allow for *heterogeneity* in this finance mix across firms, akin to what we observe in the data, with larger firms being more leveraged and issuing relatively more debt abroad, and smaller firms borrowing in domestic markets. Lastly, the model will feature an *endogenous interest rate wedge* between debt issued in domestic and global markets, as observed in the data, 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[25].

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.

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 and 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).

[25] 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.

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 $R_2 > R^\star$[26], 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:

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

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, $k^\star$, or not.

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,

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

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

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 10.

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 concentrate 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 empirical evidence for Chile, as shown in Figure 11 in the Appendix.[27] 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 summand is the international leverage. Equation 15 is increasing in $\lambda^i_{2,f}$ because the production function features diminishing marginal returns. Because 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

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

ensure that 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 and $d^\star_{1,d}$ is given in Equation 14. Using the properties of the uniform distribution, it is easy to find a closed-form solution for the second integral:

$$\int_0^{\hat{\lambda}} d^\star_{1,d}(\lambda^i{}_{2,f}) d\lambda^i_{2,f} + k^\star \left(\bar{\lambda} - \hat{\lambda} \right) - \frac{1}{2R^\star} \left(\bar{\lambda}^2 - \hat{\lambda}^2 \right) = e_1 \tag{17}$$

but, for the first integral, we perform quantitative exercises, which we describe next.

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.[28] Finally, the pledgeable share of output, θ_d, is small 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

[28]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%.

Figure 11 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 all of them produce the same level of output, $y^\star = A_2(k^\star)^\alpha$.

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 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 increase in the cost of foreign borrowing for Chilean firms.[29]

[29]Evidently, the COVID-19 shock in Chile had far many more repercussions than the increase in $R^\star$ that we are modeling. An obvious extension, given the mandatory lockdowns that took place, would be to

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, an increase in the foreign interest rate increases the domestic interest rate for this calibration. An increase in $R^\star$ increases the demand for domestic debt from unconstrained firms, as Equation 14 shows, and decreases 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, 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).

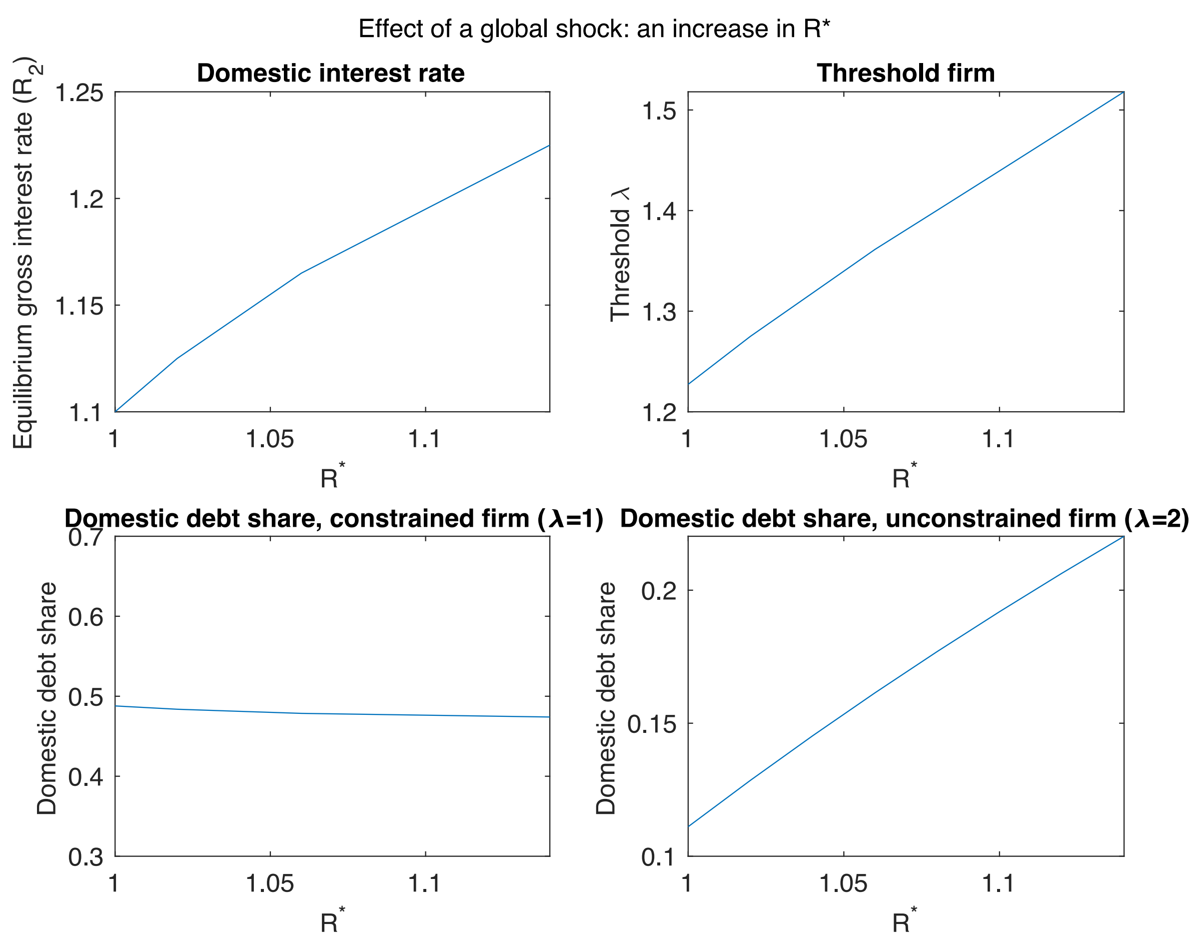
Third, an increase in $R^\star$ decreases foreign debt for all firms, as it is apparent from Equation 10. Domestic debt from constrained firms decreases too. This decrease happens for two reasons. First, as $R^\star$ increases, foreign debt decreases, decreasing output and tightening domestic collateral constraints. Second, as $R^\star$ increases, R_2 also increases, 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

consider a drop in A_2. The Appendix shows 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.

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).

Figure 7: Effect of a global shock



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).

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 FOGAPE-COVID and FCIC policies

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

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

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.

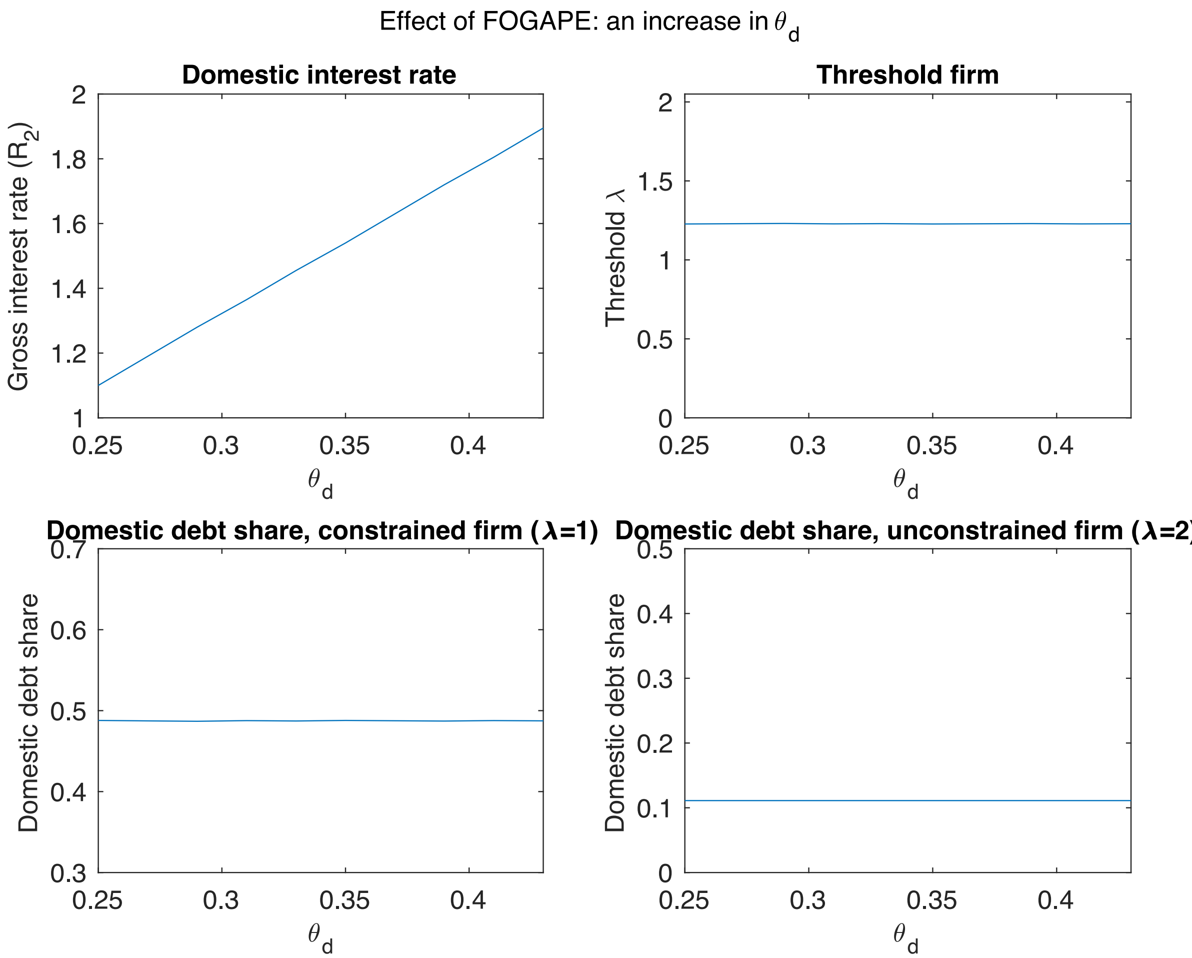
Second, an increase in θ_d leaves the threshold firm unchanged. The increase in the domestic interest rate dampens the positive effect of θ_d on $\hat{\lambda}$. Indeed, increases in both θ_d and R_2 leave the domestic collateral constraint, Equation 8, unchanged.

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. Indeed, as was documented, the set of unconventional policies in Chile *decreased* domestic interest rates and caused firms' debt substitution. Therefore,

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.

within the model, a policy like FOGAPE-COVID 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.

FCIC To study a program like FCIC, we augment the model to enrich the credit supply side. 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:

$$e_{1,T} = e^{\phi}_{1,CB} + e_{1,H} \tag{18}$$

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

$$\phi = e^{R^{\star}-1} - \psi(\Delta\theta_d) \tag{19}$$

where Δ denotes change.

Equations 18 and 19 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 obtain from the Central Bank, after keeping some reserves. 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, $e_{1,T} = e_{1,CB} + e_1$, and reserves, $e_{1,CB} - e^{\phi}_{1,CB}$, are zero.

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

Parameter ϕ can be interpreted as capturing financial intermediaries' risk-aversion. Around a global shock that increases ϕ, triggered by a raise in $R^{\star}$, financial intermediaries lend less to firms and keep more of the Central Bank's liquidity in reserves due to a higher degree of risk-aversion.

In this set-up, 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, FOGAPE can *complement and amplify* FCIC by decreasing ϕ, that is, decreasing banks' risk-aversion and facilitating Central Bank's liquidity to be channeled to firms. In other words, in the extended model, both FOGAPE and FCIC increase credit supply. A microfoundation for financial intermediaries à la Curdia and Woodford (2011), featuring loan origination costs decreasing in FOGAPE and FCIC, also delivers that credit supply increases in the two policies. The Appendix shows the derivations.

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

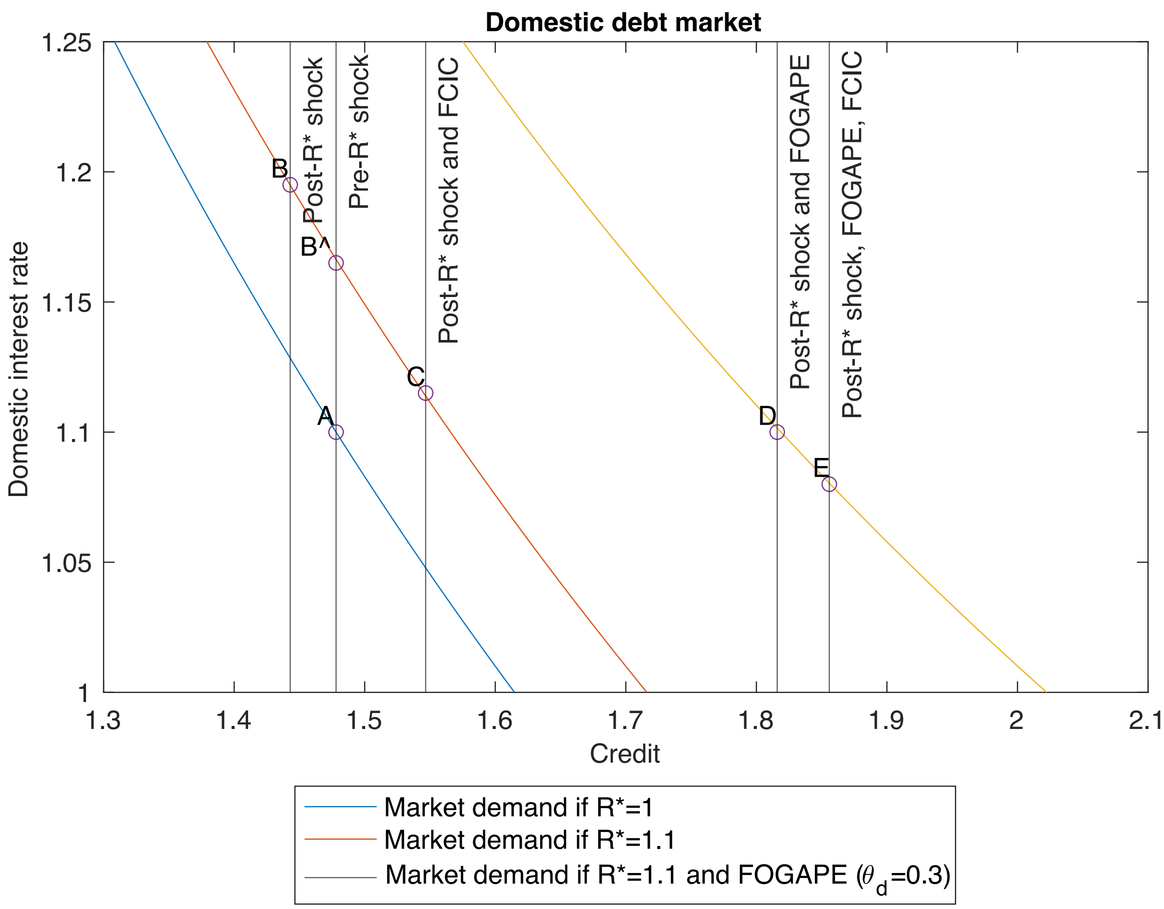
Table 9: Parameters used in model extension

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 because the increase in θ_d is small, and an initial supply of Central Bank credit of 0.5, which satisfies the constraint that $e_{1,CB} < 1$. An increase in Central Bank liquidity of 0.1 corresponds to a 20% increase in the Central Bank's supply of credit; an increase of θ_d from 0.25 to 0.3 corresponds to a 20% increase in public guarantees.

Figure 9 shows the effect of a global shock, together with the implementation of policies akin to FOGAPE-COVID and FCIC on the market for domestic debt in the extended model. In order 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.

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)

The initial equilibrium in the absence of shocks and policies is labeled with an "A" in Figure 9.[30] After a COVID-type global shock, the equilibrium changes to point Bˆ in the graph. As described in subsection 4.4, the demand for domestic debt increases because unconstrained firms increase their demand, 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,

[30]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.

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, 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 do to this equilibrium.

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 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. Implementing FCIC has limited power in terms of lowering domestic interest rates since they decrease to $R_2 = 1.115$, and expanding 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 demand for credit 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 increases too due to the impact FOGAPE-COVID has on financial intermediaries' risk-aversion, shifting the credit supply rightward. The rightward shift also holds in a richer setup of financial intermediaries à la Curdia and Woodford (2011) who optimize over their credit supply decision. With the parametrization in Table 9, the interest rate decreases to $R_2 = 1.1$ in the model with the minimum structure.

Last, consider now FCIC and FOGAPE-COVID *jointly*. This is the equilibrium labeled as E in Figure 9. Noticeably, this is the only case where the interest rate drops below the baseline equilibrium interest rate of $R_2 = 1.1$. Both policies jointly cause the largest rightward shift of the credit supply, to the post-global shock, FOGAPE, FCIC credit supply, causing a drop in the interest to $R_2 = 1.08$.

The main takeaway of this case is that FOGAPE 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 is, the more firms will have enough collateral to be unconstrained.

Finally, FOGAPE-COVID and FCIC cause 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 FOGAPE-COVID and FCIC jointly cause a drop in the domestic interest rate below the initial equilibrium. 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 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, vis-à-vis their 2019 finance mix. 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% for firms around the elegibility 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 most of our sample. Interestingly, we find that this UIP premium vanishes 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 FOGAPE and FCIC to produce the increases in the domestic debt share *and* lower domestic rates, in line with the empirical evidence.

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 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

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

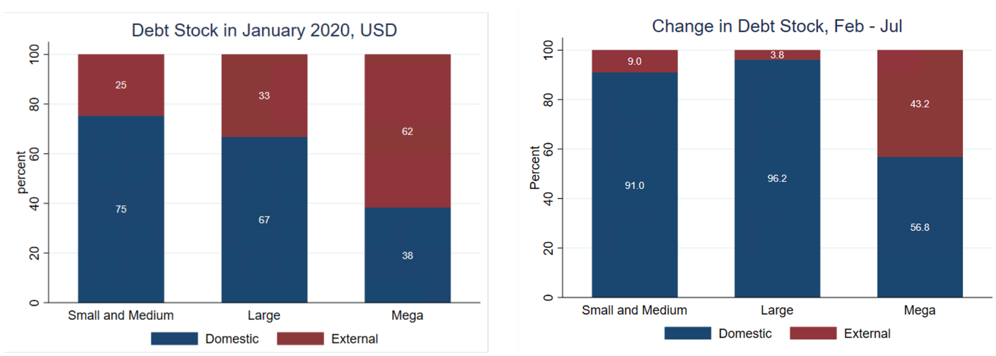
Table 10: Interest rates of debt issued in CHP and USD

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

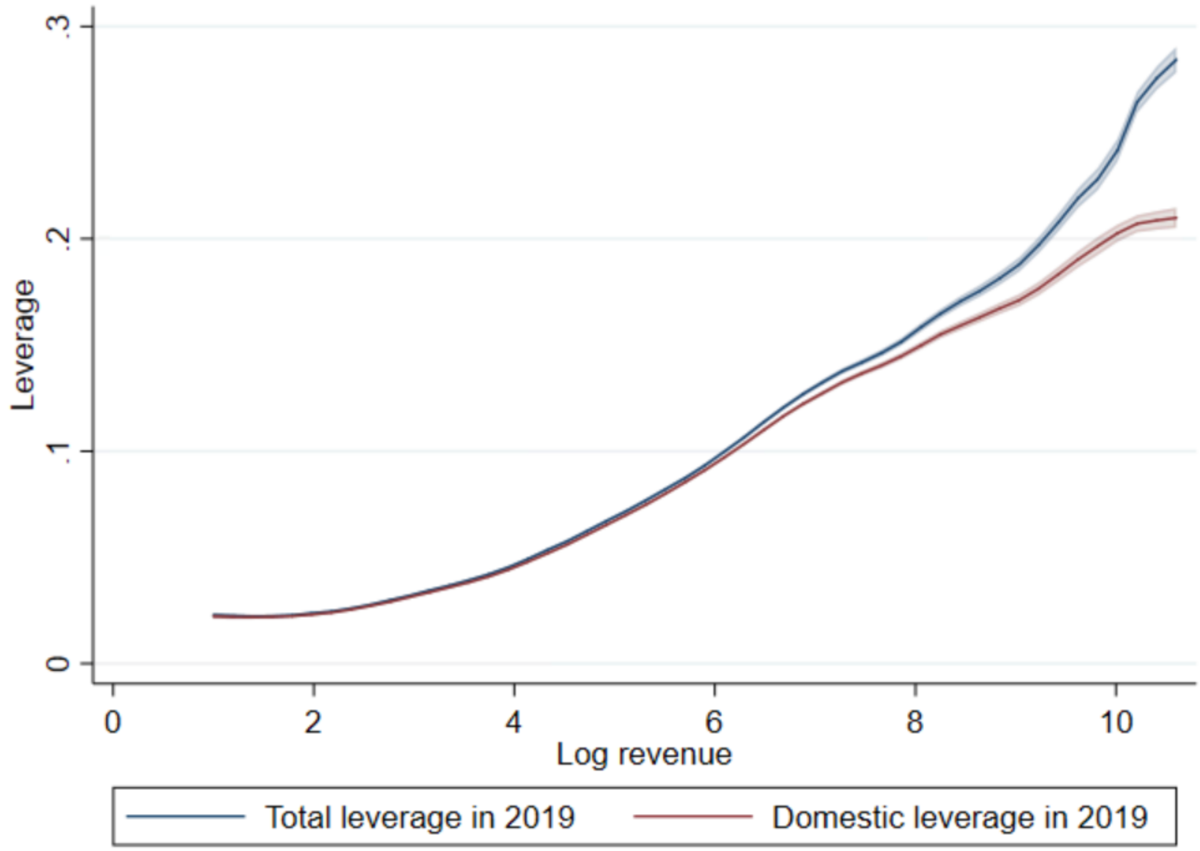
Figure 10: Stock and change in firms' finance mix



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 100,000UF. 2) Large (yearly sales greater than 100,000UF and less than 1,000,000UF.). 3) Mega (yearly sales greater or equal than 1,000,000UF). 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.

Figure 11 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.

Figure 11: 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.

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:

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

$$R_2^2 (d^i_{1,d})^2 - (\theta_d A_2)^2 d^i_{1,d} - (\theta_d A_2)^2 \frac{\lambda^i_{2,f}}{R^\star} = 0, \quad (20)$$

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 20, we 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:

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

$$\implies 0 > 4R_2^2 \frac{\lambda^i_{2,f}}{R^\star},$$

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

TFP shock Figure 12 and 13 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:

$$D_f = \int_0^{\bar{\lambda}} \frac{\lambda^i_{2,f}}{R^\star} d\lambda^i_{2,f} = \frac{1}{R^\star}\int_0^{\bar{\lambda}} \lambda^i_{2,f} d\lambda^i_{2,f} = \frac{1}{R^\star}\frac{(\lambda^i_{2,f})^2}{2}\Big|_0^{\bar{\lambda}} = \frac{(\bar{\lambda})^2}{2R^\star} \tag{21}$$

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.

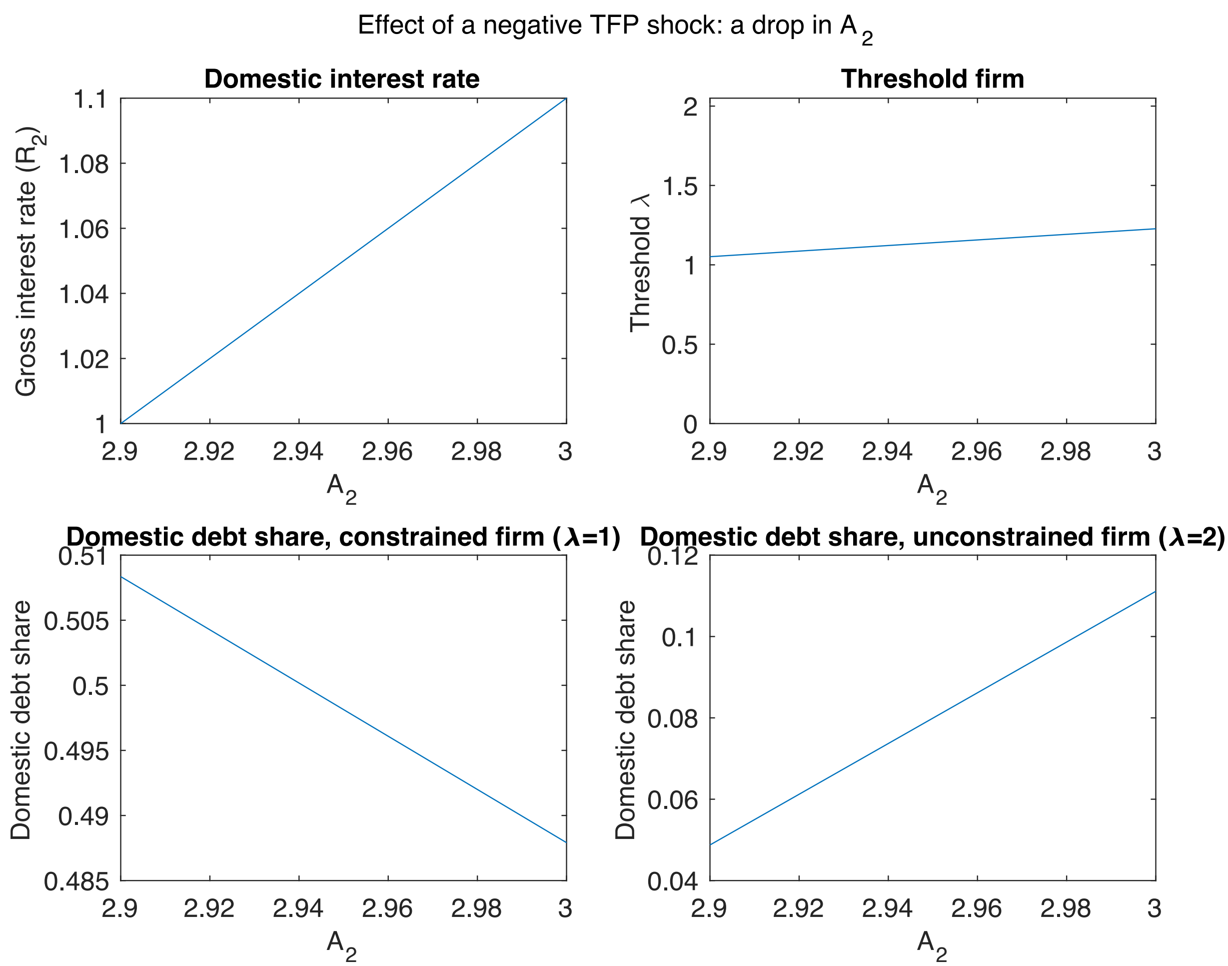
Similarly to CW, financial intermediaries also demand reserves m_1 and get paid an interest rate on reserves R^m_2. Differently from CW, they also demand FCIC, denoted as e^{CB}_1, and pay an interest rate R^{CB}_2 to access the public liquidity. Finally, some of the loans financial intermediaries issue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

As in CW, financial intermediaries have loan origination costs. Namely, we assume the following loan origination cost function:

$$\Xi(\int L^i_1 di - e^{CB}_1, \theta_d, m_1) \tag{22}$$

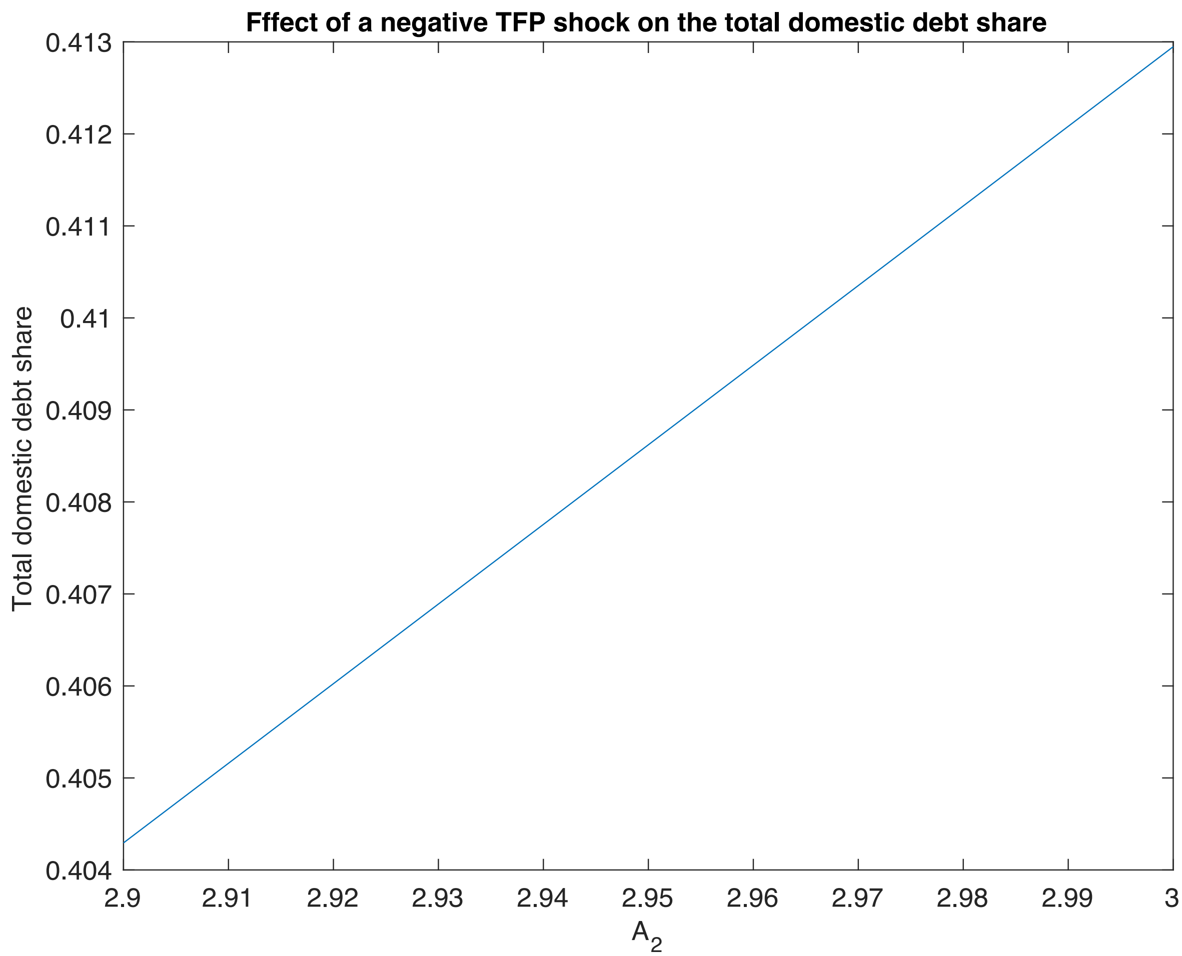
which satisfies $\Xi_L(\int L^i_1 di - e^{CB}_1, \theta_d, m_1) \geq 0$, $\Xi_{\theta_d}(\int L^i_1 di - e^{CB}_1, \theta_d, m_1) \leq 0$, and $\Xi_m(\int L^i_1 di - e^{CB}_1, \theta_d, m_1) \leq 0$. We also assume that financial intermediaries have a satiation point for

Figure 12: 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 13: 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 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 22 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:

$$max_{L_1^i, s_1, m_1, e_1^{CB}} \quad R_2^b \int L_1^i di + R_2^m m_1 - R_2^d s_1 - R_2^{CB} e_1^{CB}$$
$$- \Xi(\int L_1^i di - e_1^{CB}, \theta_d, m_1) \tag{23}$$
$$s.t \quad s_1 = m_1 + \int L_1^i di \tag{24}$$

The constraint is financial intermediaries' balance sheet constraint.

Substituting Equation 24 into Equation 23 gives the following expression for financial intermediaries' objective function:

$$R_2^b \int L_1^i di + R_2^m m_1 - R_2^d (m_1 + \int L_1^i di) - R_2^{CB} e_1^{CB} - \Xi(\int L_1^i di - e_1^{CB}, \theta_d, m_1) \tag{25}$$

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

$$\Xi_L(\int L_1^i di - e_1^{CB}, \theta_d, m_1) = R_2^b - R_2^d \equiv \omega_2 \tag{26}$$
$$-\Xi_m(\int L_1^i di - e_1^{CB}, \theta_d, m_1) = R_2^d - R_2^m \equiv \delta_2^m \implies m^d(L_1^i) \tag{27}$$

These are analogous to equations (15) and (16) in CW. Equation 26 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 27 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:

$$\Xi_L(\int L_1^i di - e_1^{CB}, \theta_d, m_1) = R_2^{CB} \tag{28}$$

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 26 and Equation 28 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 26, 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.