Firm Financing During Sudden Stops: Can Governments Substitute Markets?

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Abstract

We analyze whether central bank credit lines and government-backed guarantees helped mitigate the impact of the pandemic's sudden stop, marked by the abrupt withdrawal of international capital, using administrative data on the universe of Chilean firms. Our regression discontinuity design reveals that eligible firms increased domestic borrowing at lower costs. These policies reduced the cost of domestic debt compared to foreign debt, easing access to capital. An open economy model explains the complementarity of both interventions–credit lines and guarantees–in relaxing collateral constraints, reducing financial intermediaries' risk aversion and boosting domestic credit supply amidst shrinking international flows.

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1 Introduction

Since the Global Financial Crisis of 2008, the use of unconventional policies has gained relevance among the stabilization tools available to policymakers when confronting large macroeconomic shocks. As the COVID-19 shock hit in 2020, their use took central stage in the policy packages deployed especially across emerging markets with limited fiscal space, as capital flows retrenched. Our work studies the effectiveness of these policies. We do so through the analysis of a unique micro dataset of firms and unconventional policies deployed in Chile, that gives us clean identification through regression discontinuity design (RDD). We have also constructed a small open economy model with heterogeneous firms that can account for our empirical findings.

Figure I illustrates the magnitude of the sudden-stop shock. The left panel documents how cross-border bond flows in dollars to Chile experienced a very sharp reversal of unprecedented size while the dollar default risk premia linked to corporate debt issuance in dollars abroad–captured with the CEMBI spread–more than doubled as the pandemic spread throughout Chile between March 2020 and June of that year.[1] The pattern described in the left panel is representative of emerging markets, a classic sudden stop with reduced access to international capital markets with capital flows exhibiting a sharp contraction and increased default risk on foreign currency debt, which stayed above pre-shock levels for at least the six months horizon depicted in the Figure.[2] The important thing to notice here is that while CEMBI spread captures only default risk, Uncovered Interest Parity (UIP) wedge, plotted on the right panel, captures both default and currency risk as it incorporates external borrowing in local currency.

The average UIP wedge (calculated from our firm-level data), plotted on the right panel,

[1] The increase in the CEMBI spread and the fall in the EPFR bond flows was, respectively, about 5 and 4 standard deviations. For the UIP deviation it was about 4 standard deviations.

[2] The Appendix reproduces this figure for a panel of emerging markets and documents how the behavior observed in the left panel is robust to looking at a larger sample of countries.

also shows a sharp increase. We plot two UIP premia: one on firms' debt from foreign lenders (blue, solid) and other on debt from domestic lenders (red, dashed), both capturing the local currency risk premia that firms face by borrowing offshore and onshore, respectively. Both measures of UIP premia more than doubled at the onset of the shock (first vertical line in the right panel), from an average of about 3 percent in 2019 to 7 percent between March and May of 2020. This spike in UIP premia is reminiscent of earlier episodes of risk off and sudden stop in capital flows to emerging markets with sharp currency depreciations vis-a-vis the dollar. In this particular episode, in Chile, UIP premia came down below pre-shock levels after May 2020. Interestingly, the decrease in the UIP premia coincides with the month when the credit support policy package was deployed (second vertical line in the right panel), suggesting that their transmission channel might have operated through decreasing the UIP premia, something that we study in depth in our work.[3]

The administrative dataset that we analyze allows us to examine the finance mix for the universe of firms in Chile, in terms of their debt issuance—bonds and loans—in both domestic and international markets, and in both local and foreign currencies. We study two types of policies: a new Central Bank credit line facility for commercial banks, where access was granted conditional on the growth of credit issuance to firms below a certain size threshold; and the availability of government guarantees on commercial banks' loans to firms, for firms below a certain size threshold. The unique designs of both policies lend themselves to an RDD identification. Since only firms below an exogenous size cutoff were eligible, we can pin down the causal effects of these policies on the financing decisions of firms and lending preferences of banks, using the bank-firm-level interest rates as signals for bank and firm time-varying unobservables such as risk aversion and default risk in RDD analysis. Furthermore, we also undertake analysis at the loan level using firm×bank×time

[3]See di Giovanni et al. (2021) and Kalemli-Ozcan and Varela (2021) for evidence on the UIP wedge during local and global shocks. See Basu and Gopinath (2024) for a model where the use of different policies during a risk-off shock closes the UIP wedge and Das et al. (2022), for evidence on the impact of these policies on the UIP wedge during Taper Tantrum for a wide range of countries.

fixed effects to account for such time varying firm-bank characteristics.

Our empirical analysis yields two important findings. First, the RDD results show that eligibility for government guarantees causes firms to increase their domestic debt share, even from the same bank. An eligible firm just to the left of the size cutoff has a domestic debt share between 5 to 9 percentage points larger than an ineligible firm just to the right. Although our RDD analysis prevents us from making statements about firms far from the eligibility cut-off, the eligible firms were a significant portion of the corporate sector: their output represents 18 percent of Chile's gross output and their increase in domestic credit at the beginning of the crisis reached about 1 percent of 2020's GDP. The RDD results are robust to a placebo period test, a manipulation test, as well as using alternative specifications of the polynomial regression in the RDD.

The second main finding is that the key underlying mechanism behind the increase in domestic debt by the eligible firms is the pricing of credit risk. Through loan-level regression analysis with a rich set of fixed effects, we find that Chilean firms face a domestic UIP premium on loans in local currency borrowed from domestic lenders during regular times that increased further during the sudden stop, and this result is robust to triple firm-bank-time fixed effects. This means foreign currency loans from domestic lenders are relatively cheaper during sudden stops, which are events characterized by a freeze in lending in both currencies by foreign lenders. Between 2012 and 2019 we estimate a domestic UIP premium of around 4 percent, broadly in line with that found in other emerging markets (di Giovanni et al. 2021; Kalemli-Ozcan and Varela 2021; Gutierrez et al. 2023). This UIP premium can be interpreted as 4 percent more expensive local currency debt or 4 percent cheaper foreign currency debt, both from domestic lenders. When we zoom into the period after the introduction of the policies, we find that the UIP premium disappears for firms that were eligible for the government guarantees program. This is not the case for the ineligible firms. We also document that the reduction in the UIP premium for eligible firms is mainly due to

an average reduction in the domestic interest rate on local currency debt as opposed to an increase in the foreign-lender and/or domestic-lender interest rate on dollar loans and/or a depreciation of the local currency. In other words, we find that the guarantees policy cause the UIP deviation of eligible firms to fall (and disappear), in expectation, prompting them not only to substitute foreign lenders with domestic ones but also foreign currency debt with local currency debt from domestic lenders. We also show that the reduction of the UIP premium cannot be traced back to appreciation of the dollar that will lead to changes in liquidity and/or convenience yields on the dollar, as there is an upward pressure on interest rates of dollar-denominated loans due to domestic lenders having difficulty in obtaining dollar funding abroad. Thus we interpret this result, also from the lens of our model, as a reduction in credit risk for local currency debt, in spite of the increased currency risk of such debt.

We build a two-period small open economy model with heterogeneous firms. The model can explain our results and allows us to perform policy counterfactuals. The model is real and lacks the currency dimension but features firms that can borrow domestically and abroad, and face different collateral constraints in each lending market à la Caballero and Krishnamurthy (2001) that can be interpreted as currency specific, especially because firms are heterogeneous in their international collateral. This limits how much they can borrow abroad and ensures that, consistent with the empirical evidence, firms also finance themselves in the domestic credit market. The supply of domestic credit comes from financial intermediaries who lend to firms what they obtain from households and the Central Bank. A critical element in the domestic supply of credit is financial intermediaries' risk aversion.

The model displays three key properties. First, it delivers an endogenous firms' finance mix between domestic and foreign debt, allowing us to study how this mix responds to shocks and policies. Second, it features that larger firms issue more debt abroad relative to smaller firms, in line with the Chilean microdata. Last, also as in the data, the model features an endogenous interest rate wedge between domestic and foreign debt that stems

from the differential collateral constraints, which effectively segments the market. The model points at the interplay of two forces. On one hand, a sudden stop shock that leads to an increase in the cost of borrowing abroad makes firms move away from foreign debt towards domestic debt, increasing the domestic debt share, as we observed in the data. However, absent domestic credit support policies, the model predicts an increase in domestic interest rates and UIP deviation where local currency debt is more expensive than foreign currency debt after the shock and cannot match the decrease in the UIP premia plotted above. On the other hand, when we introduce credit support policies, the model can endogenously generate the declining UIP deviations as observed in the data. We also show that, via policy counterfactuals, the credit line facility alone cannot fully offset the domestic rate increase. A policy of government guarantees also alone cannot fully offset the shock since this policy relaxes constrained firms' collateral constraints, boosting their credit demand and raising domestic rates. Thus, the credit volume is restored to its pre-shock level, but the domestic interest rate continues to be much higher. Therefore, when both policies are active, the model can account for the observed behavior of the domestic credit market, with debt volumes (borrowing costs) at higher (lower) levels than before the shock.

Literature Review. Our work relates to the recent literature that argues that pricing of credit is the lead conduit for the debt substitution and hence optimal policies should compress the UIP premia (e.g., Kalemli-Ozcan 2019; Basu et al. 2020; Adrian et al. 2021, Itskokhi and Mukhin 2021, Bianchi and Lorenzoni 2022). Our work extends the set of unconventional policies studied in this strand of literature, namely that of credit support policies backed by government guarantees, providing both novel empirical evidence and a theoretical framework to assess their effectiveness. We also relate to the literature that studies a mix of different currency debt from foreign lenders (e.g., Aghion et al. 2001, Caballero and Krishnamurthy 2001, 2003, Schneider and Tornell 2004), but feature representative-firm models.

Two separate works have studied the pandemic shock and policy responses in Chile using

microdata. However, their focus and methods are different from our work. Albagli et al. (2021) study the effects of a short-time work scheme on firm-level outcomes such as productivity, employment, sales, and ability of the workforce. To identify the causal effects of this policy, the authors use a matching procedure that exploits rich administrative microdata to compare the behavior of firms that accessed the policy to otherwise similar firms that did not do so. Huneeus et al. (2022) study how credit guarantees and employment protection programs interact and shape incentives when assisting firms during the pandemic through their effect on domestic credit allocation, indebtedness and risk. They use difference-in-difference methods that exploit exogenous variation in firm-level sales growth from the staggered implementation of mandatory lockdowns across Chilean municipalities to estimate selection into the policies and assess determinants of domestic firm indebtedness through cross-sectional regressions of both the demand and supply of credit. With these estimates they measure the macro impacts of credit guarantees on indebtedness and risk. Our work complements both studies by focusing on the international finance dimension, namely the endogenous choice of finance mix between domestic and foreign debt by exploiting the exogenous variation provided by the FOGAPE thresholds.

The rest of the paper is divided as follows. Section 2 describes in further detail the credit support policies implemented in Chile in the wake of COVID-19. Section 3 provides the empirical results of the paper and further robustness checks. Section 4 lays out the model and the various simulation exercises conducted. Concluding remarks are in Section 5.

2 Credit Support Policies in Chile

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

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

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

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

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

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

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

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

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

2.1 Special Central Bank Credit Lines to Commercial Banks: FCIC

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

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

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

2.2 Sovereign Credit Guarantees on Loans: FOGAPE-COVID

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

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

Resources used as guarantees came 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 2019, firms with yearly sales below 25,000 UF were eligible to access FOGAPE loans. The program was expanded in October 2019 after the drop in economic activity due to the episode of social unrest in Chile. By January 2020, it had been capitalized with USD 100 million, and the sales eligibility threshold increased to 350,000 UF.

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

Table I presents a summary of the main FOGAPE-COVID characteristics and compares them to the standard FOGAPE program that existed before the onset of the pandemic. Some institutional changes are worth highlighting. First, and critically for our empirical work, FOGAPE-COVID increased the cutoff required to access the typical FOGAPE credit from 350,000 UF to 1 million UF. Second, contrary to the previous version of the program, where the interest rate was the market rate, FOGAPE-COVID had an interest rate ceiling of the MPR plus 300 basis points. Finally, the fraction of the loan guaranteed and the maximum FOGAPE loan increased for all firm sizes. An important feature of FOGAPE-COVID, not included in Table I, is that eligibility for the program was based on past sales from 2019.

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

3 Empirical Analysis

3.1 Data

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

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

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

The merged dataset has a monthly frequency between April 2012 and December 2020. For firms that borrow abroad directly, we keep only non-trade credit loans and bond issuance. We keep foreign credits in US Dollars, Euros, Japanese Yen, or Chilean Pesos, which represent more than 98% of total external borrowing. We also keep only credits with positive spreads

to avoid distorting the data with credits that are not likely to represent a real need for credit.[9]

Table II presents the most relevant descriptive statistics of our merged dataset. The top panel shows statistics regarding domestic and foreign credit conditions in our dataset. While the mean domestic peso loan has a size of about USD 135 thousand (using the spot exchange rate), the mean foreign loan is almost USD 40 million. This difference is natural since larger firms have access to foreign markets. The standard deviations show that foreign loans exhibit higher dispersion in size than domestic loans.

The mean interest rate on a domestic loan in pesos is 13.4%, while for foreign loans in dollars it is 3.2%. Correcting the latter by (ex-post) UIP yields a mean of 10.3%. Hence, on average, it is cheaper to borrow abroad once you have access to external financial markets. Furthermore, fewer firms have access to foreign credit as the number of domestic loans is about 200 times larger than the number of foreign loans. The yearly debt stock-to-GDP ratio is 32.7% for both domestic and foreign loans.

The last row of the bottom panel in Table II shows that, out of a total of 295,440 firms, 294,234 borrow domestically, 502 abroad, and 704 in both markets. The first two rows of the bottom panel compare sales among the firms studied as a share of GDP, confirming that large firms borrow domestically and abroad since their sales account for 15% of total sales despite being fewer ones than those that borrow domestically. As the last column shows, the mean yearly sales of all firms is 153.3% of GDP, and they represent on average 72.3% of total sales as recorded in the tax information before applying the filters.

3.2 Debt Composition and Interest Rate Behavior during COVID

Focusing now on the pandemic era, we uncover two facts on the foreign-for-domestic debt substitution and the behavior of interest rates.

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

First, regarding firms' debt composition, the left panel in Figure II plots the domestic and external debt stock shares across firms' size in April 2020, right before implementing the FOGAPE-COVID policy. Clearly, the share of domestic debt in the total stock of debt was decreasing in size: while small and medium firms' domestic debt share was, respectively, 71% and 67%, mega firms' domestic debt share was considerably smaller, 40%. Yet, as the right panel in Figure II depicts, between April and July 2020, when credit support policies were deployed, firms tilted their new debt issuance overwhelmingly towards domestic debt.[10] Importantly, this increased domestic debt issuance was limited to small, medium, and large firms, which were eligible for loans with the sovereign guarantees. Indeed, small-medium and large firms increase their share of domestic debt issuance to 100% and 95%, respectively. The share of domestic debt share for mega firms–those that did not qualify for FOGAPE-COVID loans–remained almost unchanged at 43%.[11] Furthermore, between April and July 2020, about 80% of credit flows were in pesos and 20% in dollars, showing that most of the substitution was from foreign dollar-denominated debt to domestic peso-denominated debt.

Second, regarding the behavior of interest rates, the first two rows of Table III document that the mean domestic interest rate considerably fell to 5.3% between March and May 2020, from 16.3% in the same period of 2019. The mean foreign interest rate for newly-issued debt in dollars also fell, but considerably less in relative terms, from 3.9% to 3.8%. 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 13.2% to 23.7%.

Notice from the last row of Table III that the mean 2019 sales of firms that borrowed abroad was higher in 2020 than in 2019. This means there is likely selection among the firms with access to foreign credits. This is, better-performing firms seem to have had access to

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

[11] Figure A.3 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, and when we measure the change in the stock of debt between February and July 2020.

foreign markets at relatively lower foreign interest rates in dollars. This fact, together with the increase in the ex-post UIP corrected foreign interest rate and the increase in the CEMBI spread from 2.5% to 5.1%, suggests that a larger risk faced by firms that had already issued bonds abroad–accompanied by a sharp currency depreciation during 2020–crowded out other firms from foreign markets.

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

Lastly, as documented in the Introduction, the left panel of Figure I depicts two average UIP deviations across firms each month since January 2019: 1) between domestic debt in pesos and foreign debt in dollars; and 2) between domestic debt in pesos and domestic debt in dollars. The second vertical line represents May 2020, when FOGAPE-COVID was in place. The figure shows how the UIP deviation between (domestic) debt in pesos and debt in dollars (be it domestic or foreign) increases at the onset of COVID in March 2020 (first vertical line) and remains high until May when the credit support policies were implemented, dropping again to pre-COVID levels.[12]

We argue that the facts described by Figure I, Figure II, and Table III 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 firms' finance mix.

[12] Figure A.2 in the appendix shows the right panel of Figure I extended to the whole period in our sample. The same pattern holds in both figures.

3.3 Empirical Design

We use RDD to estimate the causal effect of becoming eligible to receive a FOGAPE-COVID credit on firms' domestic debt share.[13] This approach is natural since we have exogenous changes in the sales thresholds required to be eligible for FOGAPE-COVID credits. Specifically, before May 2020, firms with annual sales between 350,000 UF and 1 million UF were not eligible for this type of credit. However, as described before, the threshold was increased to 1 million UF as part of the credit-supporting policies. Since the annual sales to determine the cutoff are those of 2019, firms are quasi-randomly assigned around the new eligibility threshold in May 2020. In RDD terms, the assignment variable (2019 sales) is observable to the econometrician, and depends on a threshold due in the past, leaving small room for firms to conveniently sort themselves right below that threshold, an issue that we explore further below. Therefore, firms on the left-hand side of the cutoff (1 million UF in sales) that are eligible for the program are treated, and those on the right-hand side are controls. The causal effect of this policy over the domestic debt share is then estimated as the size of the discontinuity at the cutoff. In the absence of the cutoff, there would not be any type of discontinuity in the domestic debt share. Below we investigate this formally using an alternative year as placebo test, among other robustness tests.

We define the treatment as *being eligible to obtain FOGAPE-COVID loans*. This is, having sales in 2019 lower than 1 million UF, implying that all firms to the left of this threshold that did not have access to FOGAPE credits before (i.e., firms with more than 350,000 UF) are treated, and those to the right, are not. Hence, we estimate a sharp RDD.[14]

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

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

The specification is the following:

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

The outcome variable in the left-hand side of Equation 1 is calculated by dividing domestic debt by total debt (i.e., domestic plus foreign debt) of firm i. For this, we transformed the foreign debt to dollars at the spot exchange rate and then calculated the share of domestic debt over the total.[15] Although domestic debt includes US dollar-denominated loans issued in the domestic market, more than 80% of domestic debt is peso-denominated debt. Furthermore, FCIC, capitalized in pesos, was the largest source of funds for banks during April and July 2020, as the right-hand-side panel of Figure A.4 shows. Thus, we often use domestic debt and peso-denominated domestic debt almost interchangeably.

The right-hand side in Equation 1 has the assignment variable, 2019 sales in logs, and the treatment, $Eligible_i$, which takes the value of 1 when firms have sales below the 1 million UF cutoff and 0 otherwise. The outcome variable is the firm-level domestic debt average between May and July 2020. As mentioned before, we choose this period because the cutoff was increased in May and, starting in August 2020, other policies were launched which could distort our estimation.[16] 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.,

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

[16] Two prominent examples of these additional policies implemented since August 2020 were a law that allowed workers to withdraw a fraction of their pension funds and direct cash transfers to households. Because these policies may evidently have brought about general equilibrium effects over domestic interest rates–among other variables–, we believe it is best to carry out our analysis for the period before these additional measures were implemented. The study of long-term effects of these policies (e.g., whether they helped zombie firms survive or whether ineligible firms found alternative funding) is also outside the scope of the paper for the same reason. See Huneeus et al. (2022) for effects of FOGAPE on firms' default rates two years after the program.

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

3.4 RDD Results

Table IV presents the results of the RDD analysis described in Equation 1. There are 532 firms around the cutoff, with 353 to the left and 179 to the right. The first row reports the estimate of δ, and the other rows report the standard errors and the number of observations. The stars denote (robust) standard levels of significance. The first column corresponds to a baseline estimation, with a local regression of a degree-0 polynomial and triangular (tri) kernel. The second column is an estimate implementing a degree-1 polynomial and a Triangular Kernel. The third and fourth columns report the estimates with degree-0 and degree-1 polynomials using an Epanechnikov (epa) Kernel. Figure III shows a graphical representation of the local regression using the baseline specification. The vertical line depicts the cutoff of 1 million UF sales (in logs). At each side of the cutoff, the plot shows the estimated polynomial, where 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 between 4.89 and 8.37 percentage points for firms around the cutoff. We interpret this result as evidence of *debt substitution*: firms that became eligible to receive FOGAPE-COVID, altered their finance mix by taking on more domestic debt relative to foreign debt. That is, treated firms recomposed their liabilities towards less exposure to external foreign-currency debt relative to domestic local-currency debt.[17]

[17]It can still be argued that changes in the dependent variable in Equation 1 are driven by foreign debt falling. To address this, Figure A.4 below shows the decomposition in the change of firms' debt, providing evidence that the change in the finance mix was due to a considerable increase in domestic liabilities with

The debt-substitution behavior identified is not only statistically significant, but it also applies to a sizable portion of the corporate sector. Indeed, the total sales of the firms that became eligible represent 18% of GDP and 8% of the total sales in the tax records (F29) database. Moreover, the increase in domestic credit by these firms at the beginning of the crisis reached about 1% of 2020's GDP.

3.5 Mechanism: The Cost of Capital

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

For this purpose, we rely on the well-established finding in the literature that there is a UIP risk premium in emerging markets (Kalemli-Ozcan and Varela, 2021). First, we investigate the size of this UIP premium in the Chilean data pre-COVID-sudden stop. Second, we document the extent to which the sudden stop altered the UIP premium and, third, what role credit support played. For the first two questions, 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. We control for a vector of firm-level characteristics, $X_{f,m}$, a vector of bank-level characteristics, $Z_{b,m}$, and a

respect to the total.

vector of lagged macro controls, $Macro_{m-1}$. The variables in each of the first two vectors are value-added, market share (within the correspondent 2-digit economic sector), and leverage for both firms and banks. The macro controls are the price of copper (which is Chile's main export by far), the MPR, and a monthly indicator of economic activity in Chile. The last term of the equation is the mean-0 $i.i.d$ disturbance.

The specification in Equation 2 follows di Giovanni et al. (2021), who argue that the estimate of δ is the UIP premium. Thus, we run this estimation for domestic credits since we have information about each lender. The standard errors are clustered at the firm level.[18]

The first two columns of Table V show the results of estimating Equation 2 in two different periods. The first column reports results covering the beginning of our sample, April 2012 until September 2019, immediately before the October 2019 episode of social unrest. During this period, we find a UIP premium of 3.98 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. (2023) find a UIP premium of 2 p.p for Peru in a sample of large firms.

The second column of Table V covers the onset of COVID in Chile from March to July 2020. For this period, the coefficient on FX becomes statistically insignificant, suggesting that the UIP premium disappears and that, on average, borrowing in dollars was not cheaper than borrowing in pesos during the beginning of the COVID-19 crisis.

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

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

[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.

where $E_{f,m}$ is a dummy that takes the value of one if firm f in month m is eligible for a FOGAPE-COVID loan and zero otherwise. The remaining variables are the same as in Equation 2. Notice that $E_{f,m}$ is interacted with $FX_{f,b,d,m}$, meaning that if the coefficient of such interaction, ψ, is positive and significant, the reduction in the UIP premium is linked to this policy.[19]

The third column of Table V shows the results of estimating Equation 3. The main result is that the UIP premium for FOGAPE-COVID eligible firms not only disappears but is overturned, as evidenced by the positive and significant estimate of ψ. For firms that are not eligible, the UIP premium remains, albeit it is an order of magnitude lower than the 2012-2019 period and is not significant. In other words, the apparent disappearance of the UIP premium shown in the second column of Table V is driven by those firms affected by the FOGAPE-COVID policy.

Crucially, we argue that our results are not driven by selection concerns of firms borrowing from certain type of banks or by banks lending to certain type of firms with unobserved characteristics that are not considered in the controls. For this purpose, we estimate Equation 2 and Equation 3 with richer fixed-effects specifications in the spirit of Khwaja and Mian (2008) and Amiti and Weinstein (2018). Thus, aside from bank-firm fixed effects ($\alpha_{f,b}$), we run different specifications including bank-firm and firm-month ($\alpha_{f,b} + \alpha_{f,m}$); firm-bank-month ($\alpha_{f,b,m}$); and firm-month and bank-month ($\alpha_{f,m} + \alpha_{b,m}$).

The top panel of Table VII shows the results of these exercises. Each fixed effects specification listed above has two corresponding columns: one for the normal-times period, and another one 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

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

effects used, the UIP 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.[20]

Among the results in the top panel of Table VII, it is worth highlighting those from columns 5 and 6, which correspond to the firm-bank-time fixed effects estimation. These show that when tracking the same bank-firm pair over time, our result holds, implying that our findings are not driven by firms substituting foreign debt from one bank for domestic debt with a different one. On the contrary, within the same firm-bank relationship, the cost of domestic loans for eligible firms becomes cheaper than that of foreign loans, underscoring a differential positive credit supply effect on domestic-currency loans.

It is also noteworthy 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 III shows how both the mean domestic interest rate in pesos and the foreign interest rate in dollars that firms faced fell between March-July 2019 and same period in 2020.[21]. Furthermore, Table A.1 in the Appendix, documents that interest rates of domestic debt in pesos fell considerably more than those of foreign debt issued in pesos. Therefore, our main takeaway is that changes in domestic interest rates were key in the mechanism behind the observed debt substitution, as they dropped more than rates in dollars, considerably reducing the UIP premium in dollar loans. Specifically, this result can be traced back to the FOGAPE-COVID credits enacted during the crisis.

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

[20]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.

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

3.6 Robustness

3.6.1 RDD Robustness

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

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).[22] Figure IV shows in the confidence bands, at the 95% level, the results of the test. Statistically, the mass of firms just to the left of the cutoff is similar to that just to its right. This is, we do not find evidence of manipulation.[23]

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

[22] 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.

[23] 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).

Finally, we argue in the Appendix that our results are unrelated to a contemporaneous firms' support policy implemented by the government –namely the employment protection law– since we show that being eligible for FOGAPE-COVID does not affect the probability of accessing this other program (Table A.2). Unlike FOGAPE-COVID, access to the employment protection policy was independent of firm-level sales.

In sum, our results of debt substitution towards the relatively cheaper domestic debt caused by credit support policies are robust to a placebo period, to testing for manipulation, and considering a simultaneous firm-level support policy from the government. Also, as shown in Table IV, they are robust to different specifications of the polynomial regression.

3.6.2 Robustness of the Interest Rates Mechanisms

A potential concern about our results on the interest rate mechanism behind the foreign-for-domestic debt substitution is whether they hold in the same period during the previous year. In other words, whether there was a previous trend in the differential UIP premium reduction for eligible firms. Thus, we re estimate our specification in Equation 3, as well as its augmented specifications with the above-mentioned rich battery of fixed effects that deal with selection concerns, for the April 2012-September 2019 period. Panel B in Table VII shows that during this placebo eligibility period the UIP premium remains for every fixed-effects specification. Furthermore, there is no significant effect over the relative cost of foreign currency debt of being an eligible firm.

An additional concern regarding the interest rate mechanism behind our baseline results is that, alternatively, there may have been an external dollar credit dry-out for banks. This could have lowered the domestic supply of dollar-denominated loans, increasing their interest rate, lowering the UIP premium and leading firms to borrow more in domestic currency. However, the evidence on banks' foreign lending and the behavior of foreign interests during May and July 2020 described in the Appendix goes against this alternative explanation.

Instead, the evidence points to foreign-for-domestic debt substitution triggered by unconventional policies. Since the spread between domestic and foreign interest rates falls, firms were likely less willing to take on the exchange rate risk derived from borrowing abroad, a decision fueled by larger relative supply of domestic-currency loans to eligible firms. As shown in Table VII, our results hold even within groups of the same unobserved characteristics, such that the UIP is diferentially lower for eligible firms and there is a UIP deviation for the rest, albeit lower than during normal times. This latter finding is also arguably driven by general equilibrium effects of the battery of other policies enacted simultaneously. These are, the large drop in the MPR and FCIC.

The model we develop in the following section rationalizes our empirical findings by focusing on the role that firm-level heterogeneity and financial frictions play in determining both the equilibrium foreign and domestic credit, as well as the endogenous UIP deviation in the economy.

4 Model

4.1 Overview

This section presents a stylized model of firms' debt financing to rationalize the mechanisms behind the documented debt-substitution effect, including the unconventional credit support policies implemented and their impact on the finance mix of firms as the COVID shock unfolded. Importantly, while the empirical analysis focuses on FOGAPE-COVID, the model allows us to study the effects of the COVID shock, FCIC only, and FCIC and FOGAPE jointly.

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 FCIC and FOGAPE-COVID programs. Second, it features heterogeneity in the firms' finance mix, with larger firms issuing relatively more debt abroad and smaller firms borrowing in domestic markets, consistent with the empirical evidence. Lastly, as observed in the data, the model generates an endogenous interest rate wedge between debt issued in domestic and global markets, incentivizing 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, $r^\star$, to one. The 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 domestic households get endowment $e_{1,H}$. 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.[24]

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 the domestic market and $d^i_{1,f}$ from foreign financiers with interest rates R_2 and $R^\star$, respectively. The foreign interest rate firms face, $R^\star$, equals:

$$R^\star = r^\star + risk\, premium \tag{6}$$

where $r^\star = 1$ and it is pinned down by the savings technology. For simplicity, we assume that in normal times, the risk premium equals 0. Consistent with the empirical evidence in the first three rows of Table III, 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:

$$\lambda^i_{2,f} + A_2(d^i_{1,d} + d^i_{1,f})^\alpha - R_2 d^i_{1,d} - R^\star d^i_{1,f} \tag{7}$$

Borrowing is subject to the following collateral constraints:

$$R^\star d^i_{1,f} \leq \lambda^i_{2,f} \tag{8}$$

$$R_2 d^i_{1,d} \leq \theta_d * A_2 * (d^i_{1,d} + d^i_{1,f})^\alpha + \lambda^i_{2,f} - R^\star d^i_{1,f} \tag{9}$$

[24] 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.

which are similar to the ones in CK. Foreign borrowing must be backed up by international collateral. Only domestic lenders have access to a share $\theta_d < 1$ of firms' output as well as the international collateral not pledged to foreign financiers. The domestic collateral constraint resembles the one in Gennaioli et al. (2014). The foreign collateral constraint ensures that firms borrow both abroad and domestically, since if $R^\star < R_2$ and absent foreign collateral constraints, firms would finance themselves exclusively abroad, which is counterfactual. In other words, the foreign collateral constraint guarantees the existence of the domestic credit market.

First-best level of capital Firms wish to finance

$$(A_2\alpha)^{\frac{1}{1-\alpha}} \equiv k^\star \tag{10}$$

which can be found by maximizing Equation 4 minus the opportunity cost of capital, one.

Firms' decisions Solving the model for the case where $R_2 > R^\star$ implies that firms will always want to tap international debt markets before going to the domestic debt market.[25]

Because $R^\star < R_2$ and Equation 5 holds, all firms borrow up to their foreign collateral constraint, Equation 8, implying that foreign debt for firm i equals:

$$d^i_{1,f} = \frac{\lambda^i_{2,f}}{R^\star} \tag{11}$$

which can be zero for firms with $\lambda^i_{2,f} = 0$. Using Equation 11, the domestic collateral constraint becomes:

$$R_2 d^i_{1,d} \leq \theta_d A_2 (d^i_{1,d} + \frac{\lambda^i_{2,f}}{R^\star})^\alpha \tag{12}$$

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, $k^\star$.

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

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

$$d^i_{1,d} = k^\star - \frac{\lambda^i_{2,f}}{R^\star} \tag{13}$$

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

$$\lambda^i_{2,f} > R^\star \left(k^\star - \frac{\theta_d A_2 (k^\star)^\alpha}{R_2} \right) \equiv \hat{\lambda} \tag{14}$$

obtained operating on Equation 12, making $d^i_{1,d}$ equal to its expression in Equation 13, and making the constraint slack. International collateral also determines which firms are unconstrained domestically, 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 II.

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:

$$d^\star_{1,d}(\lambda^i_{2,f}) = \frac{\theta_d A_2 \left(\theta_d A_2 + \sqrt{(\theta_d A_2)^2 + 4R_2^2 \frac{\lambda^i_{2,f}}{R^\star}} \right)}{2R_2^2}, \tag{15}$$

where we use the formula for the quadratic equation since the domestic collateral constraint with equality is a quadratic equation, and we focus on the positive solution. The Appendix shows the derivations and why Equation 15 is the only positive solution. We call these firms domestically constrained or, simply, constrained.

From Equation 12, it is clear that an increase in θ_d increases firms' access to domestic borrowing. Thus, we capture FOGAPE-COVID, which increased firms' access to domestic

credit by providing sovereign debt guarantees, as an increase in θ_d.

Credit supply The total supply of credit in the domestic market, $e_{1,T}$, comes from households, who supply $e_{1,H}$, and from the Central Bank, which supplies $e_{1,CB}$. We pose the following expression for $e_{1,T}$:

$$e_{1,T} = e_{1,CB}^{\phi} + e_{1,H} \tag{16}$$

where $e_{1,CB} < 1$ and ϕ is a parameter that depends on the global shock and policies. In particular, we assume:

$$\phi = e^{R^\star - 1} - \psi(\Delta\theta_d) \tag{17}$$

where Δ denotes change.

Equations 16 and 17 capture, albeit in reduced form, the behavior of financial intermediaries, which are left unmodeled in the main body of the paper, when a shock like COVID materializes (e.g., increases in $R^\star$ due to an increase in the risk premium) 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. In the baseline equilibrium without a risk-premium shock and no credit support policies, where $R^\star = 1$ and $\Delta\theta_d = 0$, $\phi = 1$, total credit supply, $e_{1,T} = e_{1,CB} + e_1$.

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

Parameter ϕ can be interpreted as capturing financial intermediaries' risk aversion. Around a global shock that increases ϕ, triggered by a rise in the risk premium, which

increases $R^\star$, financial intermediaries lend out less of the Central Bank's funds to firms due to higher risk aversion.

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

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

Equilibrium The only equilibrium price in the model is R_2 and can be found equating firms' demand for domestic credit to the total credit supply, $e_{1,T}$.

$$\underbrace{\int_0^{\hat{\lambda}} d^\star_{1,d}(\lambda^i_{2,f})d\lambda^i_{2,f}}_{\text{Demand from constrained firms}} + \underbrace{\int_{\hat{\lambda}}^{\bar{\lambda}} \left(k^\star - \frac{\lambda^i_{2,f}}{R^\star}\right) d\lambda^i_{2,f}}_{\text{Demand from unconstrained firms}} = e_{1,T} \tag{18}$$

where $\hat{\lambda}$ is the endogenous threshold that separates firms into constrained and unconstrained, given in Equation 14, $d^\star_{1,d}$ is given in Equation 15, and $e_{1,T}$ is governed by Equations 16 and 17. The Appendix solves the integrals in Equation 18.

4.3 Equilibrium: A Graphical Analysis

We now graphically characterize the model's equilibrium by plotting the supply and demand curves in the domestic credit market. We consider a COVID-type shock that increases the interest rate at which firms borrow abroad (R^*) and study three policy scenarios: the deployment of a Central Bank's credit line facility through an increase in $e_{1,CB}$ (akin to FCIC); the issuance of sovereign guarantees as an increase in θ_d (akin to FOGAPE); and the simultaneous deployment of both policies.

Figure V depicts the change in the equilibrium in the domestic credit market following an increase in R^*. Before the increase, the equilibrium is given by point A, where the vertical supply curve intersects the negatively sloped demand curve.[26] The Figure highlights two separate and simultaneous effects following the increase in $R^\star$. First, the demand for domestic credit increases as the share of the unconstrained firms substitute foreign for domestic credit, shifting the demand curve upward, and pushing up the domestic interest rate from point A to B. Second, the supply curve contracts due to the effect a higher $R^\star$ has on ϕ and subsequently on $e^{\phi}_{1,CB}$. The latter captures, albeit in reduced form, commercial banks' heightened aversion to lending in a riskier environment. The overall effect is captured in the new equilibrium point C, at a higher domestic rate and a lower volume of total domestic credit.

Note that the upward shift in demand hides important firm heterogeneity. As it is clear from Equation 13, unconstrained firms increase domestic debt because they substitute foreign for domestic debt and still finance the first-best level of capital.[27] Instead, for constrained firms, borrowing less abroad implies a tightening of their domestic collateral constraint, negatively affecting their access to domestic credit. If θ_d is high enough, unconstrained firms' behavior dominates, increasing the total credit demand as plotted in the Figure.

[26] The supply curve is vertical because credit supply is independent of R_2 (see Equation 16); the shape of the demand curve depends on parameters as it is clear from Equation 21 in the Online Appendix. The next subsection ensures it is indeed downward-sloping.

[27] Of course, the mass of unconstrained firms shrinks when $R^\star$ and R_2 increase (see Equation 14).

Figure VI depicts the three policy experiments deployed to address the new COVID-induced equilibrium. The upper panel characterizes the use of a Central Bank credit line facility akin to FCIC, whereby the supply curve reverts to the right. This reduces the equilibrium domestic interest, though not all the way to its pre-COVID level, and raises domestic credit volumes to point $D^{\star}$. Note that while the plotted FCIC mitigates the shock in terms of volumes, domestic interest rates stay elevated and do not return to pre-crisis levels. Without sovereign guarantees, the policy falls short of fully offsetting the shock's impact on both prices and quantities.

The middle panel plots the effect of sovereign guarantees alone, captured in the model by an increase in θ_d, which relaxes constrained firms' collateral constraint, shifting the credit demand curve up and raising domestic rates even higher. This is only partially offset by the effect that sovereign guarantees have on the supply of credit via ϕ, capturing decreased banks' risk-aversion, which unlocks the Central Bank's supply of funds.[28] This delivers a new equilibrium point $D^{\star\star}$, where the credit volume is restored to its pre-shock level, but the domestic interest rate continues to be much higher. Thus, a policy of sovereign guarantees alone, without FCIC, is also not capable of fully offsetting the shock in terms of prices and quantities.[29]

The lower panel depicts the case where both policies are deployed simultaneously. The key insight is that the complementarities between the two can restore domestic rates to levels equal to (or below) those prevailing before the risk-premium shock despite the large rightward shift in firms' demand for credit. As a result, the volume of credit increases considerably to point $D^{\star\star\star}$ in the plot. This captures, albeit in a qualitative way, what was observed in Chile soon after deploying the policies, when credit grew considerably and domestic rates were lower than before the shock. The following subsection explores these

[28] Note that such a rightward shift also holds in the richer setup of financial intermediaries à la Curdia and Woodford (2011) who optimize over their credit supply decision, as shown in the Appendix.

[29] For ease of comparison, we have placed the new supply curve at the same location as the original one. Further quantitative exercises presented in the next section will precisely pin down the behavior of credit in this policy experiment.

policies quantitatively.

4.4 Quantitative Analysis

The quantitative analysis of the model describes the parametrization, summarized in Table VIII, that reproduces the qualitative patterns outlined in the previous subsection.

First, in the baseline equilibrium, the risk premium equals zero, and the foreign interest rate, $R^\star$, is pinned down by the savings technology and, hence, equal to one. 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.

Turning now to the credit supply and policy parameters in Table VIII, the baseline total credit supply, $e_{1,T}$, is chosen so that the domestic interest rate is 10%, approximately the difference between the average domestic and foreign interest rates in the pre-COVID period (2019) in Table III. The supply of credit coming from the Central Bank, $e_{1,CB}$, satisfies $e_{1,CB} < 1$. We pick a value of ψ equal to 24, an FCIC funding of 0.05, and an increase in θ_d (FOGAPE) of 0.02, from 0.25 to 0.27. We choose the last three parameters to qualitatively match the observed effect of both policies in the domestic credit market: a higher level of domestic credit and a lower interest rate. A sensitivity analysis to the size of the policies is in the Online Appendix.

Figure V and Figure VI present, respectively, the qualitative behavior of credit demand and supply after a global shock and after policies are implemented. Under the parametrization in Table VIII, the model's numerical results are given in Table IX and align well with those in the figures.

As Table IX shows, the domestic economy starts with an interest rate of 10% and an equilibrium level of credit equal to 1.48 (second column in the table). After the risk-premium shock (third column), the foreign interest rate increases to 10%, the domestic interest rate to 20%, and credit contracts to 1.44. We now turn to the policies. FCIC only, in the

fourth column, decreases domestic rates to 15%, still above the pre-crisis level of 10%. Total domestic credit after FCIC equals 1.5 and is only somewhat above the pre-global shock level. An FCIC of the magnitude considered here, a 10% increase in the Central Bank's credit supply, has limited power to expand credit and lower the interest rate. FOGAPE only, in the fifth column, increases domestic credit to 1.63, substantially more than FCIC only, and lowers the interest rate to 12%, which still remains above its pre-crisis level. Lastly, the sixth column shows the equilibrium values after deploying FCIC and FOGAPE jointly. This is the only case where the interest rate drops to its pre-COVID level of 1.1, making the UIP premium disappear, consistent with the empirical evidence from column (2) in Table V. Equilibrium domestic credit expands the most, to 1.67.

These quantitative results are robust to a host of sensitivity tests. The Online Appendix shows that the importance of policy complementarity holds for a wide range of plausible policy sizes. Specifically, the analysis shows that increasing FOGAPE or FCIC alone has a limited effect, except when considering implausibly extreme initial values of the monetary base ($e_{1,CB}$). Indeed, for most realistic parameter combinations, only the joint implementation of both policies restores credit conditions to pre-COVID shock levels. These results confirm that policy complementarity was essential for Chile's effective credit support, and that the main quantitative findings hold across reasonable parameter values.

5 Conclusion

Using comprehensive administrative data on Chilean firms, we examine whether credit lines and government-backed credit guarantees mitigated the impact of the large sudden stop event during Covid-19. Our identification rests on a regression discontinuity design to demonstrate that firms eligible for these programs increased their borrowing from domestic lenders at a relatively lower cost. By reducing the cost of domestic currency debt relative to foreign currency debt, these policies effectively lowered the relative cost of domestic capital

in the short term. This reduction in borrowing costs is conditional on selection effects at both the firm and bank levels, where only policy-eligible firms benefit from the lower credit costs from the same lender that non-eligible firms also borrow from.

Relative to the existing literature, we have three contributions. Our first contribution is to identify the causal effect of government debt guarantees on firm credit expansion from domestic lenders in local currency. The second contribution establishes the mechanism being a decline in the relative cost of local currency borrowing from domestic lenders instead of foreign or local currency borrowing from foreign lenders. The third contribution of our work is to provide a model of heterogeneous firms with different set of financial frictions in foreign and domestic financing that can match our finding of higher domestic debt from domestic lenders at a lower cost, after the introduction of government policies.

Overall our results showed that government policies can incentivize domestic lenders to replace a dry up of financing from the international capital markets during stress events in the short term.

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This study was developed within the scope of the research agenda conducted by the Central Bank of Chile (CBC) in economic and financial affairs of its competence. The CBC has access to anonymized information from various public and private entities, by virtue of collaboration agreements signed with these institutions.

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

To secure the privacy of workers and firms, the CBC mandates that the development, extraction and publication of the results should not allow the identification, directly, indirectly, of natural or legal persons. Officials of the Central Bank of Chile processed the disaggregated data. All the analysis was implemented by the authors and did not involve, nor compromise the Chilean IRS or the Chilean Financial Markets Commission.

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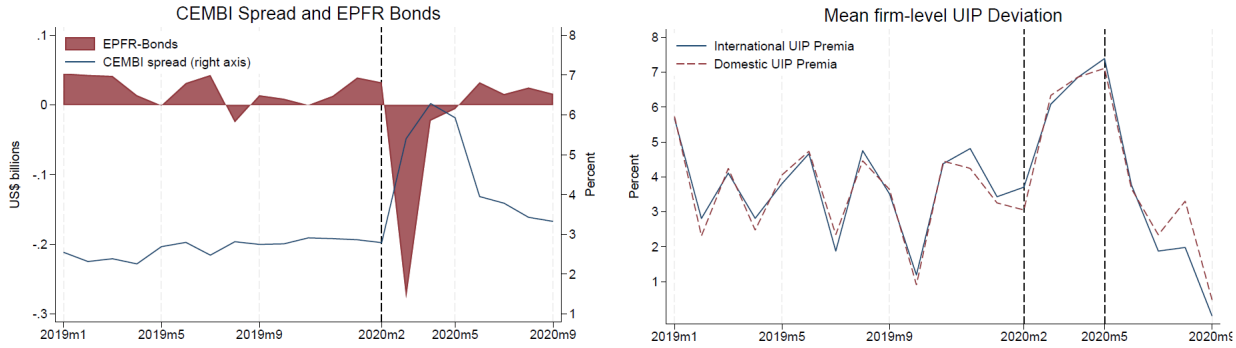
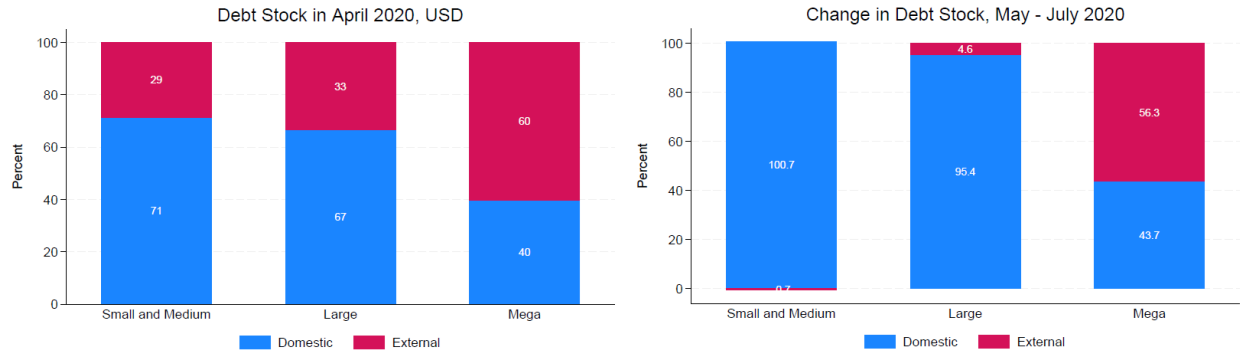
Figure I: The Sudden Stop-COVID Shock in Chile: Capital Flows, Risk and UIP Premia



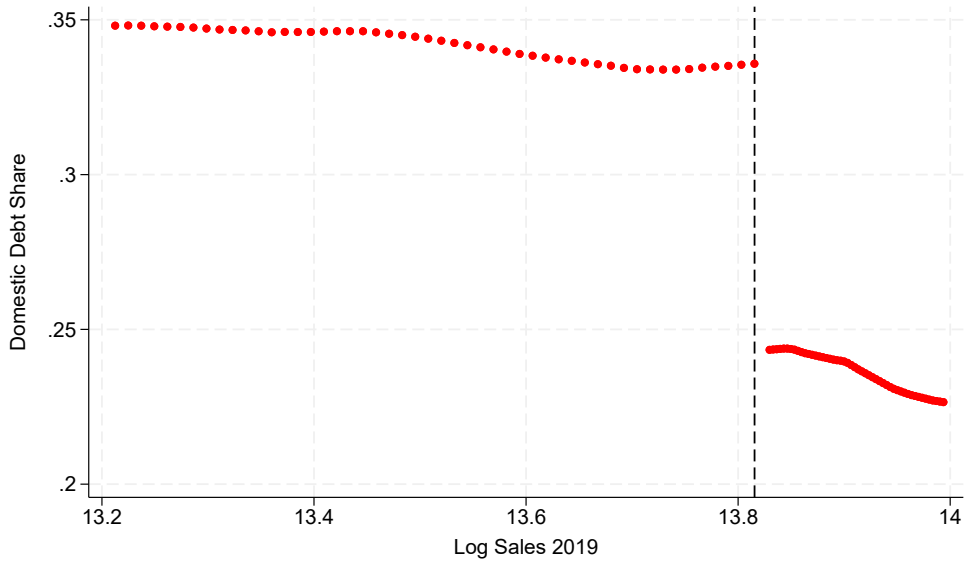
Notes: The left panel depicts the fund flows' EPFR measure and the CEMBI spread for Chile (right axis). The vertical line denotes February 2020, the month before the first COVID case in Chile in March 7, 2020. The data sources are, respectively, Informa PLC and Bloomberg. The right panel depicts the average firm-level International UIP Deviation (blue line) and Domestic UIP Premia (red dashed line). We calculate the UIP Premium of firm f in month m as: $UIPP_{f,m} = i_{f,m} - i^*_{f,m} - \frac{E_m(e_{m+12}-e_m)}{e_m}$, where $i_{f,m}$ and $i^*_{f,m}$ are, respectively, the average interest rate of loans taken by the firm in domestic currency and the average interest rate of loans taken by the firm in dollars. The last term is the expected depreciation calculated with the one-year ahead expected nominal exchange rate ($E_m(e_{m+12})$) from the Central Bank of Chile's survey to financial operators and the average spot nominal exchange rate (e_m). The vertical lines denote, respectively, the sudden stop due to the onset of the pandemic in February 2020 and the month when the sovereign guarantees policy was implemented (May 2020). The rest of sources for the data in the right panel are explained in Section 3.

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



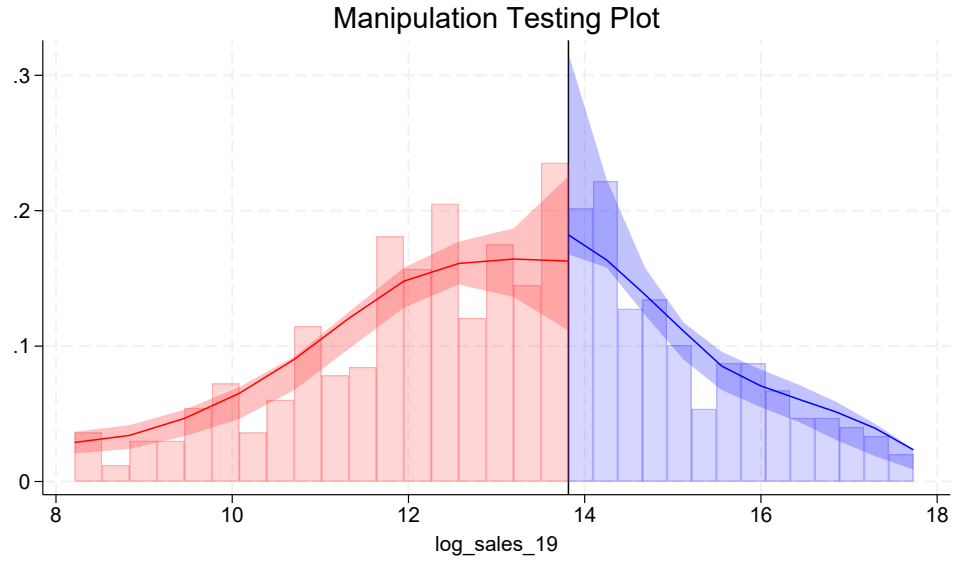
Notes: The left panel depicts the domestic (blue) and external (red) debt share over total debt for three groups of firms in April 2020: 1) Small and medium (yearly sales of less than 100,000 UF). 2) Large (yearly sales greater than 100,000 UF and less than 1,000,000 UF). 3) Mega (yearly sales greater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

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



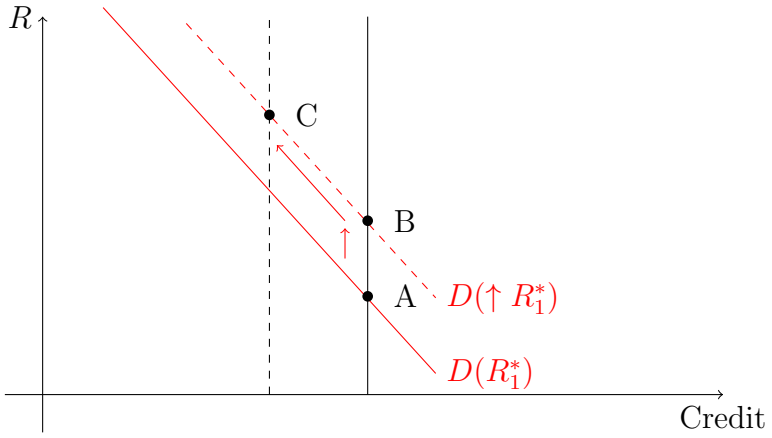
Notes: The red dots depict local polynomial approximations around the cutoff (vertical line). The specification shown in the figure is a degree-0 polynomial with a Triangular Kernel.

Figure IV: 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.

Figure V: Equilibrium After an Increase in R^*



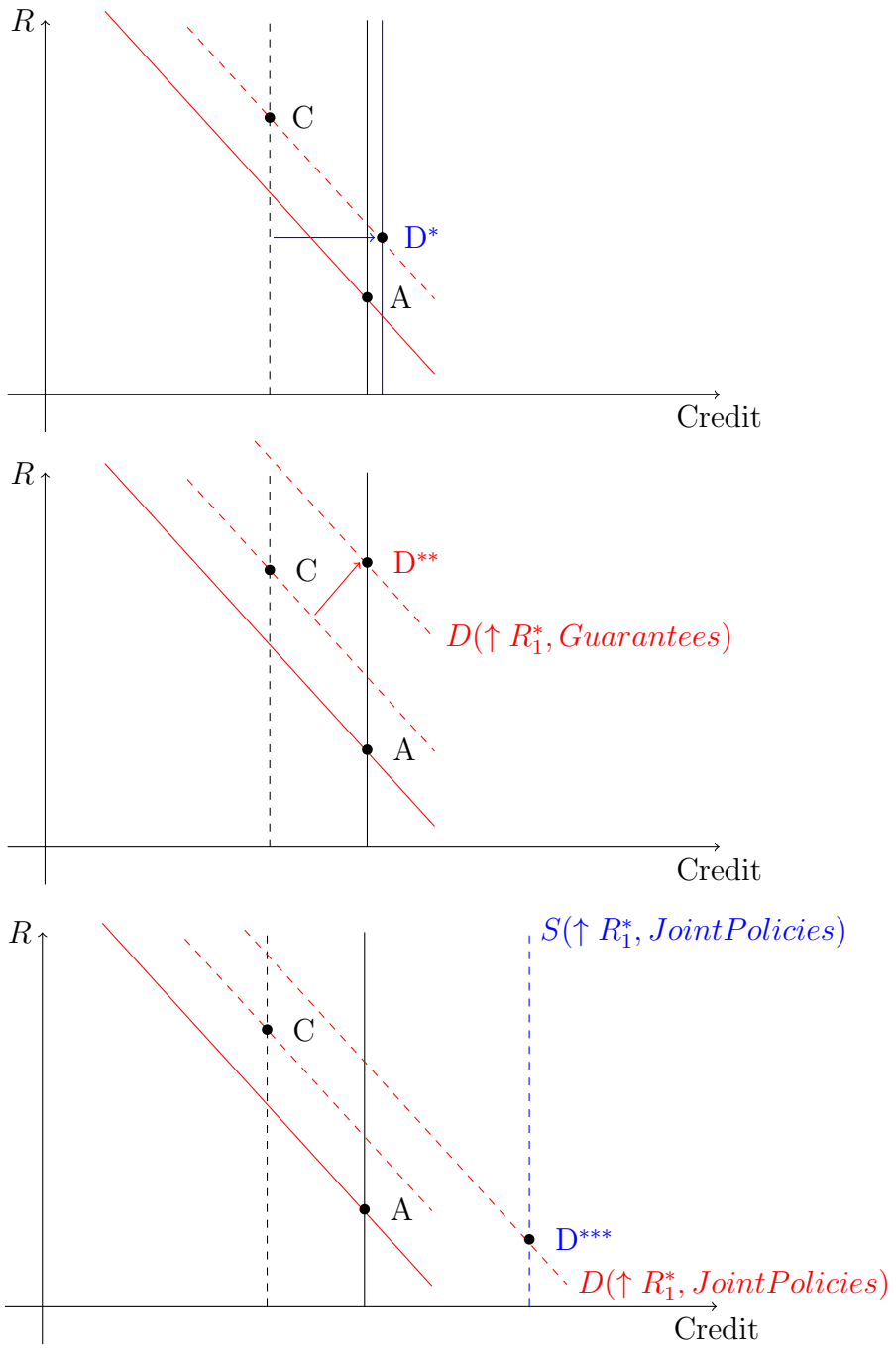
Notes: The figure present the equilibrium following an increase in R^*.

Table I: 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.

Figure VI: Equilibrium After an Increase in R^*



Notes: The panels present the equilibrium following three types of policy experiments aimed at offsetting the impact on R^*: the deployment of a Central Bank´s credit line facility through an increase in $e_{1,CB}$ akin to FCIC (upper panel); the issuance of sovereign guarantees as an increase in θ_d akin to FOGAPE (middle panel); and the simultaneous deployment of both policies (lower panel).

Table II: Descriptive statistics - Merged Dataset

	Domestic loans	Foreign loans	Domestic interest rate (CHP -%)	Foreign interest rate (USD - %)	Foreign interest rate (CHP Ex-Post UIP - %)
Mean	135344 USD	39412800 USD	13.41	3.15	10.29
Standard Deviation	1354379 USD	183083945 USD	9.46	2.43	9.08
Total yearly loans (% of GDP)	32.72	32.71			
Number of loans	2279813	2792			
	Domestic loans only	Foreign loans only	Domestic and Foreign Debt	All firms	
Total yearly sales (% GDP)	119.8	3.2	32.4	153.3	
Total yearly sales (% F29 total sales)	56	1.3	14.9	72.3	
Number of firms	294234	502	704	295440	

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

Table III: Interest rates 2019 vs 2020

	March - July 2019	March - July 2020
Mean i (CHP - %)	16.3	5.3
Mean $i^\star$ (USD - %)	3.9	3.8
Mean $i^\star$ (CHP Ex-Post UIP - %)	13.2	23.7
CEMBI (USD %)	2.5	5.1
Number of firms (i)	77452	228831
Number of firms (i*)	76	65
Mean 2019 sales UF (i)	116319	45144
Mean 2019 sales UF (i*)	8856720	9707512

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

Table IV: Estimate - Regression Discontinuity Design

	Baseline (degree 0, tri)	Alternative 1 (degree 1, tri)	Alternative 2 (degree 0, epa)	Alternative 3 (degree 1, epa)
Treatment estimate	-0.04896**	-0.08371*	-0.03932**	-0.08516*
Standard Error	0.05487	0.07609	0.05465	0.07573
Number of Observations	532	532	532	532

Notes: The table shows the estimates of becoming eligible for FOGAPE-COVID loans, represented by δ in Equation 1 under different specifications. The dependent variable is $\frac{D_i^{domestic}}{D_i^{total}}$, this is the firm-level average domestic debt share 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.

Table V: 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	-0.0398***	-0.00355	-0.00359
	(0.00335)	(0.00135)	(0.00214)
Fx·elegible			0.0107***
			(0.00241)
Firm × Bank FE	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes
Observations	5,485,935	310,799	310,799
R-squared	0.840	0.711	0.711

Notes: The dependent variable in each column is the interest rate of a loan taken by firm f from bank b in currency d at month m, $i_{f,b,d,m}$. 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.

Table VI: 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	0.01267	0.01414	0.00039	0.00483
Standard Error	0.05085	0.08235	0.05092	0.08266
Number of Observations	636	636	636	636

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

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

Variables	(1) Apr 2012 to Sept 2019	(2) March 2020 to July 2020	(3) Apr 2012 to Sept 2019	(4) March 2020 to July 2020	(5) Apr 2012 to Sept 2019	(6) March 2020 to July 2020	(7) Apr 2012 to Sept 2019	(8) March 2020 to July 2020
Panel A - Pre Crisis and Policy Periods								
fx	-0.0398***	-0.00336	-0.0428***	-0.00308	-0.0472***	-0.00389	-0.0439***	-0.00712***
	(0.00335)	(0.00214)	(0.00629)	(0.00264)	(0.00830)	(0.00328)	(0.00534)	(0.00216)
fx_elegible		0.0107***		0.00674**		0.00724**		0.00697***
		(0.00241)		(0.00301)		(0.00362)		(0.00247)
Firm × Bank FE	Yes	Yes	Yes	Yes	No	No	No	No
Firm × Month FE	No	No	Yes	Yes	No	No	Yes	Yes
Bank × Month FE	No	No	No	No	No	No	Yes	Yes
Firm × Bank × Month FE	No	No	No	No	Yes	Yes	No	No
Macro Controls	Yes	Yes	No	No	No	No	No	No
Firm Controls	Yes	Yes	No	No	No	No	No	No
Bank Controls	Yes	Yes	Yes	Yes	No	No	No	No
Observations	5,929,453	348,550	5,140,684	312,865	4,981,579	307,515	5,166,004	329,039
R-squared	0.869	0.646	0.918	0.717	0.924	0.720	0.904	0.699
Panel B - Placebo Eligibility								
fx	-0.0388***		-0.0431***		-0.0481***		-0.0446***	
	(0.00467)		(0.00754)		(0.00981)		(0.00621)	
fx_elegible	-0.00389		0.00192		0.00485		0.00426	
	(0.00472)		(0.00763)		(0.00994)		(0.00613)	
Firm × Bank FE	Yes		Yes		No		No	
Firm × Month FE	No		Yes		No		Yes	
Bank × Month FE	No		No		No		Yes	
Firm × Bank × Month FE	No		No		Yes		No	
Macro Controls	Yes		No		No		No	
Firm Controls	Yes		No		No		No	
Bank Controls	No		No		No		No	
Observations	5,484,102		5,048,261		4,879,708		5,066,906	
R-squared	0.840		0.909		0.916		0.894	

Clustered standard errors in parentheses
*** p\textless{}0.01, ** p\textless{}0.05, * p\textless{}0.1

Notes: The shows the estimates of Equation 2 for the April 2012 - Sept 2019 period and Equation 3 for the March 2020 - July 2020 period under different fixed-effect specifications. The dependent variable in each column is the interest rate of a loan taken by firm f from bank b in currency d at month m, $i_{f,b,d,m}$. 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 V. *,**, *** are significant coefficients at the three standard levels of significance. Standard errors are displayed in parenthesis and clustered at the firm level.

Table VIII: Model Parametrization

Parameter description	Symbol	Value
Gross foreign interest rate	$R^\star$	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	$\bar{\lambda}$	$k^\star - 0.2$
Pledgeable share of output	θ_d	0.25
Initial credit supply	$e_{1,T}$	1.4781
Central Bank supply of credit	$e_{1,CB}$	0.5
Responsiveness of financial intermediaries' risk-aversion to FOGAPE	ψ	24
FCIC size	$\Delta e_{1,CB}$	0.05
FOGAPE size	$\Delta\theta_d$	0.02

Notes: The table lists the parameter and policy values used in the analysis of the model's results. The values listed in the table generate the qualitative results of Figure V, Figure VI, and the numerical results in Table IX.

Table IX: Equilibrium Analysis: Numerical values

Variable	Pre-Shock	Post-Shock			
		No policies	FCIC	FOGAPE	FCIC and FOGAPE
R*	1.00	1.10	1.10	1.10	1.10
R_2	1.10	1.20	1.15	1.12	1.10
Credit	1.48	1.44	1.50	1.63	1.67
Policy Parameters					
θ_d	0.25	0.25	0.25	0.27	0.27
$e_{1,CB}$	0.50	0.50	0.55	0.50	0.55
Equilibrium	A - Fig. VI	C - Fig. VI	D* - Fig. VII.a	D** - Fig. VII.b	D*** - Fig. VII.c

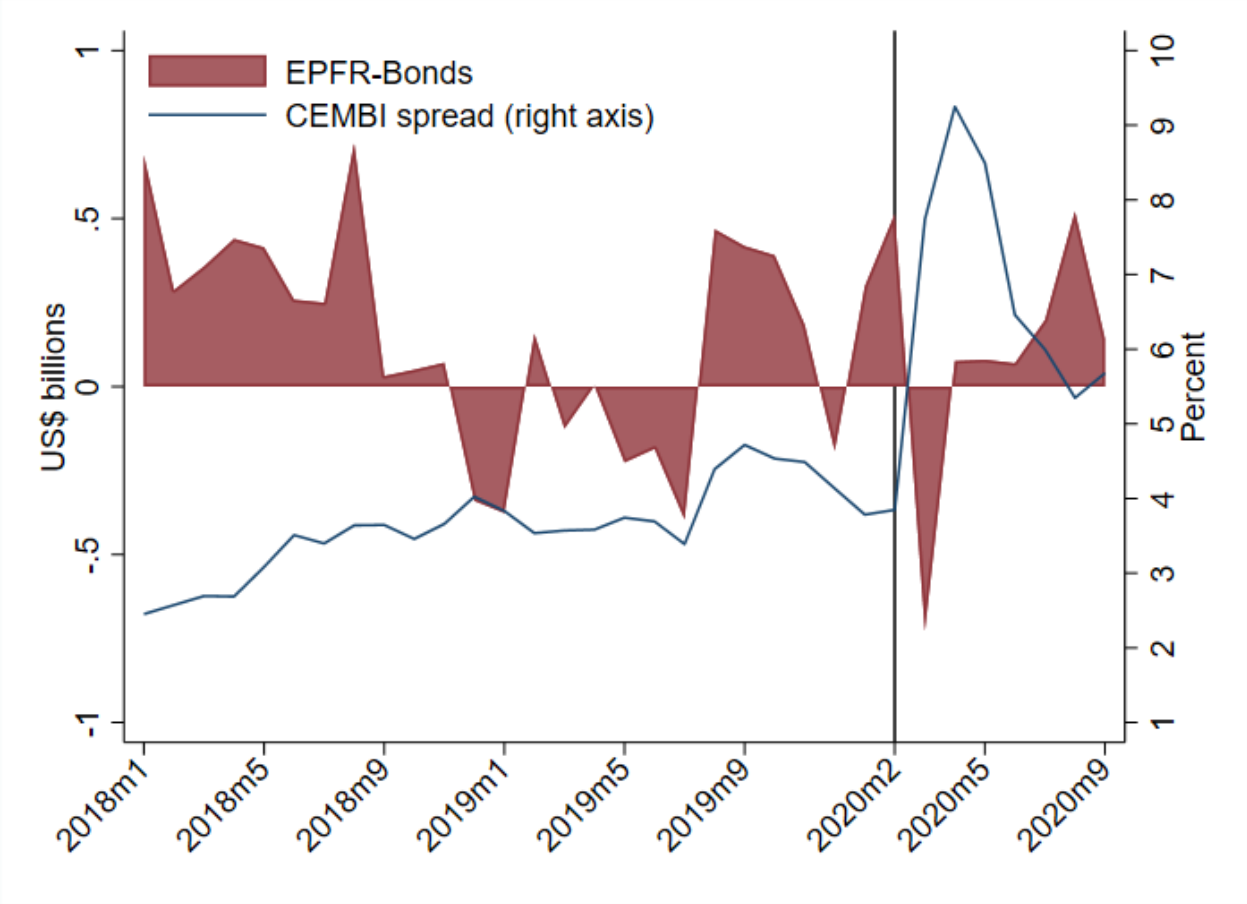
Notes: This table gives the numerical values of the foreign interest rate, $R^\star$, the equilibrium domestic interest rate (R_2), the total credit in equilibrium, and the policy parameters considered in different scenarios (pre-global shock, post-global shock but pre-policies, FCIC, FOGAPE, and, finally, FCIC and FOGAPE jointly). The last row in this table makes the correspondence between the numerical values and the equilibria in Figure V and Figure VI.

Online Appendix

A.1. Empirics' Additional Results

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

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

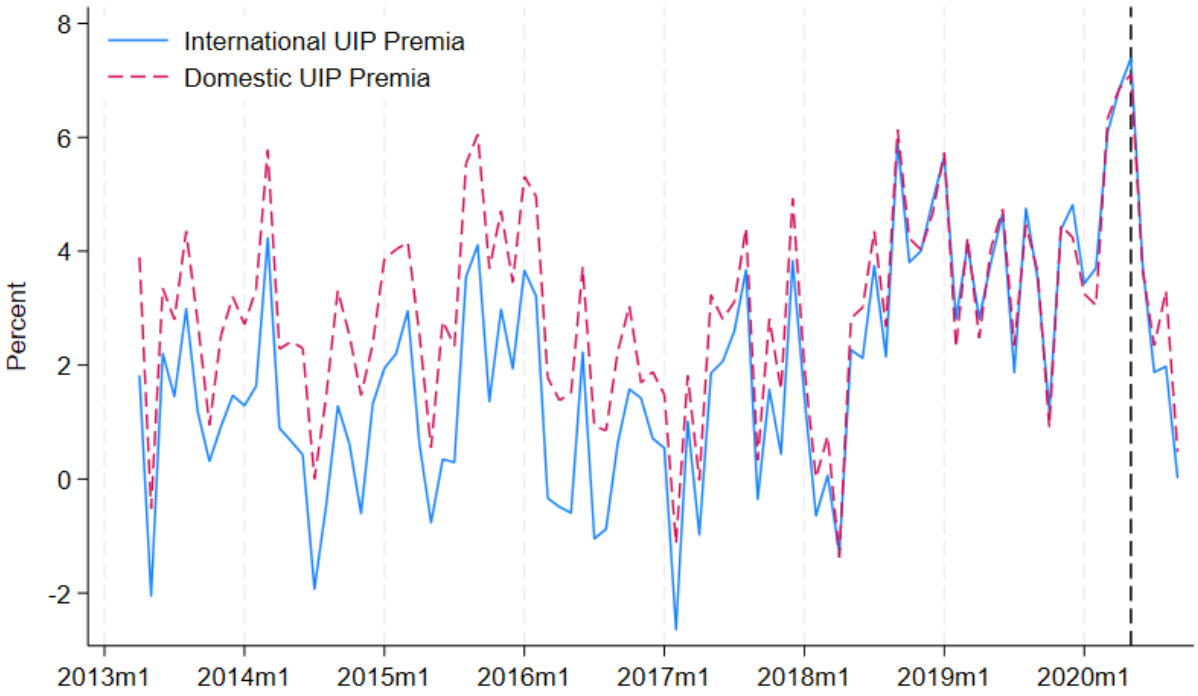


Notes. The figure depicts the fund flows' mean EPFR measure and the mean CEMBI spread (right axis) for: Argentina, Brazil, Chile, Colombia, Mexico, and Peru. Vertical line denotes February/2020, the month prior to the first COVID case in Chile. The data sources are, respectively, Informa PLC and Bloomberg.

Figure A.2 shows the behavior of the firm-level UIP deviation as the right-hand panel of Figure I for the whole period in our sample. The pattern holds, and the peak UIP deviation

is right before the implementation of the FOGAPE-COVID credit.

Figure A.2: Average UIP deviation of firms



Notes: The left panel depicts the fund flows' EPFR measure and the CEMBI spread for Chile (right axis). The vertical line denotes February 2020, the month before the first COVID case in Chile in March 7, 2020. The data sources are, respectively, Informa PLC and Bloomberg. The right panel depicts the average firm-level International UIP Premia (blue line) and Domestic UIP Premia (red dashed line). We calculate the UIP Premium of firm f in month m as: $UIPP_{f,m} = i_{f,m} - i^*_{f,m} - \frac{E_m(e_{m+12}-e_m)}{e_m}$, where $i_{f,m}$ and $i^*_{f,m}$ are, respectively, the average interest rate of loans taken by the firm in domestic currency and the average interest rate of loans taken by the firm in dollars. The last term is the expected depreciation calculated with the one-year ahead expected nominal exchange rate ($E_m(e_{m+12})$) from the Central Bank of Chile's survey to financial operators and the average spot nominal exchange rate (e_m). The vertical lines denote, respectively, the sudden stop due to the onset of the pandemic in February 2020 and the month when the sovereign guarantees policy was implemented (May 2020). The rest of sources for the data in the right panel are explained in Section 3.

Table A.1 shows the comparison between interest rates of debt issued either in Chilean pesos or dollars, both domestically and abroad. It has the mean across firms for the whole sample, and the periods March-July 2019 and March-July 2020.

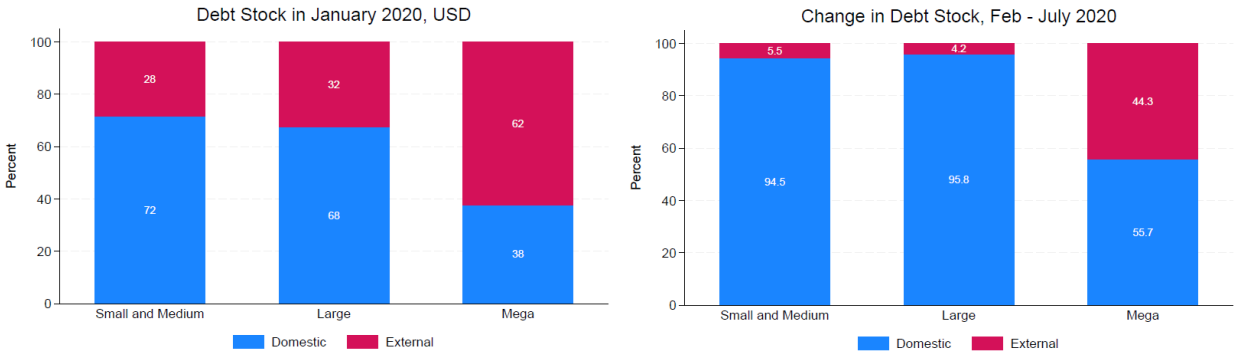
Figure A.3 is akin to Figure II, but considering the period between January and July 2020.

Table A.1: Interest rates of debt issued in CHP and USD

	Whole Sample	March - July 2019	March - July 2020
Mean i (CHP Domestic Debt - %)	13.4	16.3	5.3
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 - %)	3.2	3.9	3.8

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 A.3: Stock and change in firms' finance mix



Notes: The left oanel depicts the domestic (blue) and external (red) debt share over total debt for three groups of firms: 1) Small and medium (yearly sales of less than 100,000 UF. 2) Large (yearly sales greater than 100,000UF and less than 1,000,000 UF.). 3) Mega (yearly sales greater or equal than 1,000,000 UF). The right panel 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.

RDD with Eligibility to an Alternative Policy A natural concern is that a contemporaneous support policy to firms could affect our results. Specifically, if such a policy also applies to firms below the eligibility threshold mentioned in the main next, then the substitution of foreign for domestic debt could be also attributed in part to this policy.

In our period of analysis, there was a contemporaneous policy named "Employment Protection Law" (LPE, its achronym in spanish). This program provided firms with resources to fund furloughs such that workers would still receive their salaries instead of being laid off (see Albagli et al. (2021) for further details on this policy). However, any firm regardless of its previous sales was eligible to this policy. Therefore, to ensure that the effect of our FOGAPE

policy around the eligibility threshold is not confounded by eligibility to the LPE, we test wether being eligible to FOGAPE affects the probability of accessing the LPE program. We merge our data with the LPE dataset, which has data on whether firms access or not this program, and estimate

$$LPE_i = \beta_0 + \beta_1 Log(sales_i^{2019}) + \delta Eligible_i + \epsilon_i \tag{19}$$

Where LPE_i takes the value of 1 if the firm accessed the LPE policy, and zero otherwise. Table A.2 shows the results of this estimation. Clearly, there is no significant effect of the FOGAPE eligibility threshold over LPE access. Thus, we find no evidence that this contemporaneous policy could drive our results.

Table A.2: 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	-0.03451	-0.06197	-0.03195	-0.04583
Standard Error	0.0774	0.1111	0.0777	0.1096
Number of Observations	500	500	500	500

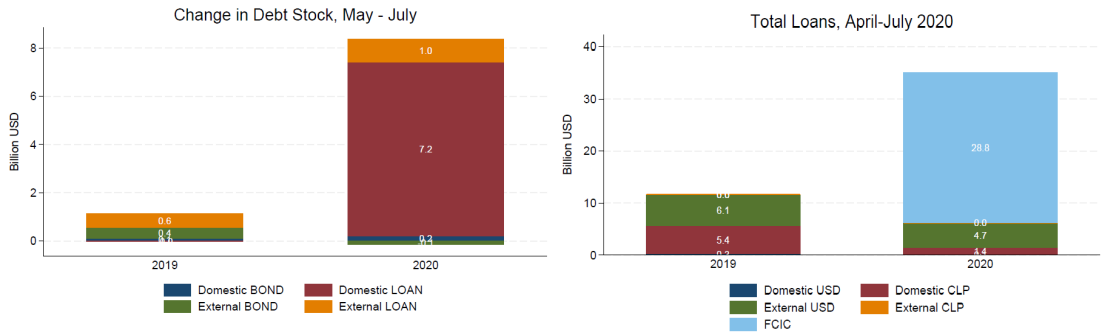
Notes: The table shows the estimates of becoming eligible for FOGAPE-COVID loans, represented by δ in Equation 1 under different specifications. The dependent variable is $\frac{D_i^{domestic}}{D_i^{total}}$, this is the firm-level average domestic debt share between May and July of 2020. *,**, *** are 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.

External dollar dry-out for banks An additional concern regarding the interest rate mechanism behind our baseline results is that, alternatively, there may have been an external dollar credit dry-out for banks. This could have lowered the domestic supply of dollar-denominated loans, increasing their interest rate, lowering the UIP premium and leading firms to borrow more in domestic currency.[30]

[30]Notwithstanding this, less dollars in the system also generate an upward pressure over the UIP premium. First, less dollars in the credit market depreciate the dollar, which increase the expected appreciation. Second, lower total liquidity would increase the domestic interest rate via higher risk, specially for eligible firms which are smaller (hence riskier).

The left panel of Figure A.4 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, which lends no support to the hypothesis that banks faced a credit dry-out abroad. The right panel of Figure A.4 shows the gross increase in domestic and foreign borrowing by currency, all expressed in billions of USD. On the one hand, it shows that new external borrowing in dollars was lower in 2020 than in 2019 (4.7 vs 6.1 billion USD), albeit still a significant amount. On the other hand, it shows how large the FCIC policy was in terms of new lending. Out of a total of USD 42.2 billion, FCIC represents more than two thirds of the new credit banks take. This suggests that, even though banks still had access to considerable foreign borrowing, they also substituted some for domestic loans, mainly due to FCIC. Indeed, that increase in FCIC explains the net increase in domestic loans for banks exhibited in the second bar of the left-hand side panel (red area).

Figure A.4: Total Loan and Change in Debt Stock by banks'



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

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

in the same period of 2020.[31]

A.2. Model Derivations and Additional Results

Domestic debt derivation To find Equation 15, we operate on the domestic collateral constraint with equality as follows:

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

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

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:

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

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

[31] This concern is akin to the possibility of mismatches in the local currency swap markets due to a lack of counterparties. If this were the case, due to regulation requiring zero balance sheet miss matches in swaps for banks, banks would have supplied fewer dollar-denominated loans, and their interest rate would have increased, which did not happen as evidenced in Table A.1 in the Appendix.

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

Credit market equilibrium Equation 18 can be solved using the power rule of integration, yielding:

$$\left[\frac{1}{2}\left(\frac{\theta_d A_2}{R_2}\right)^2 \lambda_{2,f}^i\right]_0^{\hat{\lambda}} + \left[\frac{\theta_d A_2 R^\star}{12R_2^4}\left(\sqrt{(\theta_d A_2)^2 + \frac{4R_2^2}{R^\star}\lambda_{2,f}^i}\right)^3\right]_0^{\hat{\lambda}} + \left[k^\star \lambda_{2,f}^i - \frac{\left(\lambda_{2,f}^i\right)^2}{2R^\star}\right]_{\hat{\lambda}}^{\bar{\lambda}} = e_{1,T} \tag{21}$$

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

After evaluating the integrals at their respective upper and lower limits, Equation 21 becomes:

$$\frac{1}{2}\left(\frac{\theta_d A_2}{R_2}\right)^2 \hat{\lambda} + \frac{\theta_d A_2 R^\star}{12R_2^4}\left(\sqrt{(\theta_d A_2)^2 + \frac{4R_2^2}{R^\star}\hat{\lambda}}\right)^3 - \frac{R^\star}{12}\left(\frac{\theta_d A_2}{R_2}\right)^4 + k^\star\left(\bar{\lambda} - \hat{\lambda}\right) - \frac{1}{2R^\star}\left(\bar{\lambda}^2 - \hat{\lambda}^2\right) = e_{1,T} \tag{22}$$

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

TFP shock Figure A.5 and A.6 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:

$$D_f = \int_0^{\bar{\lambda}} \frac{\lambda^i_{2,f}}{R^\star} d\lambda^i_{2,f} = \frac{1}{R^\star} \int_0^{\bar{\lambda}} \lambda^i_{2,f} d\lambda^i_{2,f} = \frac{1}{R^\star} \frac{(\lambda^i_{2,f})^2}{2} \Big|_0^{\bar{\lambda}} = \frac{(\bar{\lambda})^2}{2R^\star} \tag{23}$$

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.

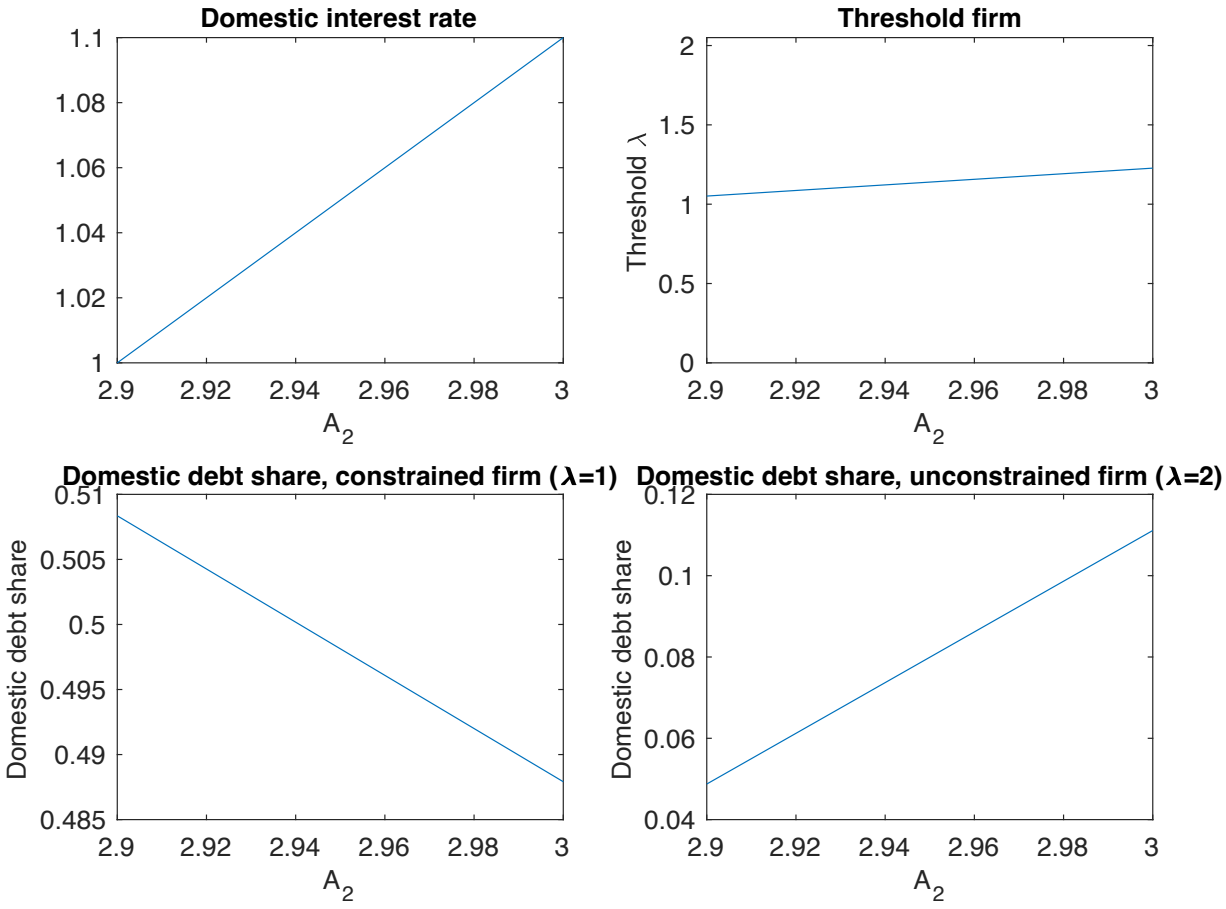
Similarly to CW, financial intermediaries also demand reserves m_1 and get paid an interest rate on reserves R^m_2. Differently from CW, they also demand FCIC, denoted as e^{CB}_1, and pay an interest rate R^{CB}_2 to access the public liquidity. Finally, some of the loans financial intermediaries issue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

$$\Xi(\int L^i_1 di - e^{CB}_1, \theta_d, m_1) \tag{24}$$

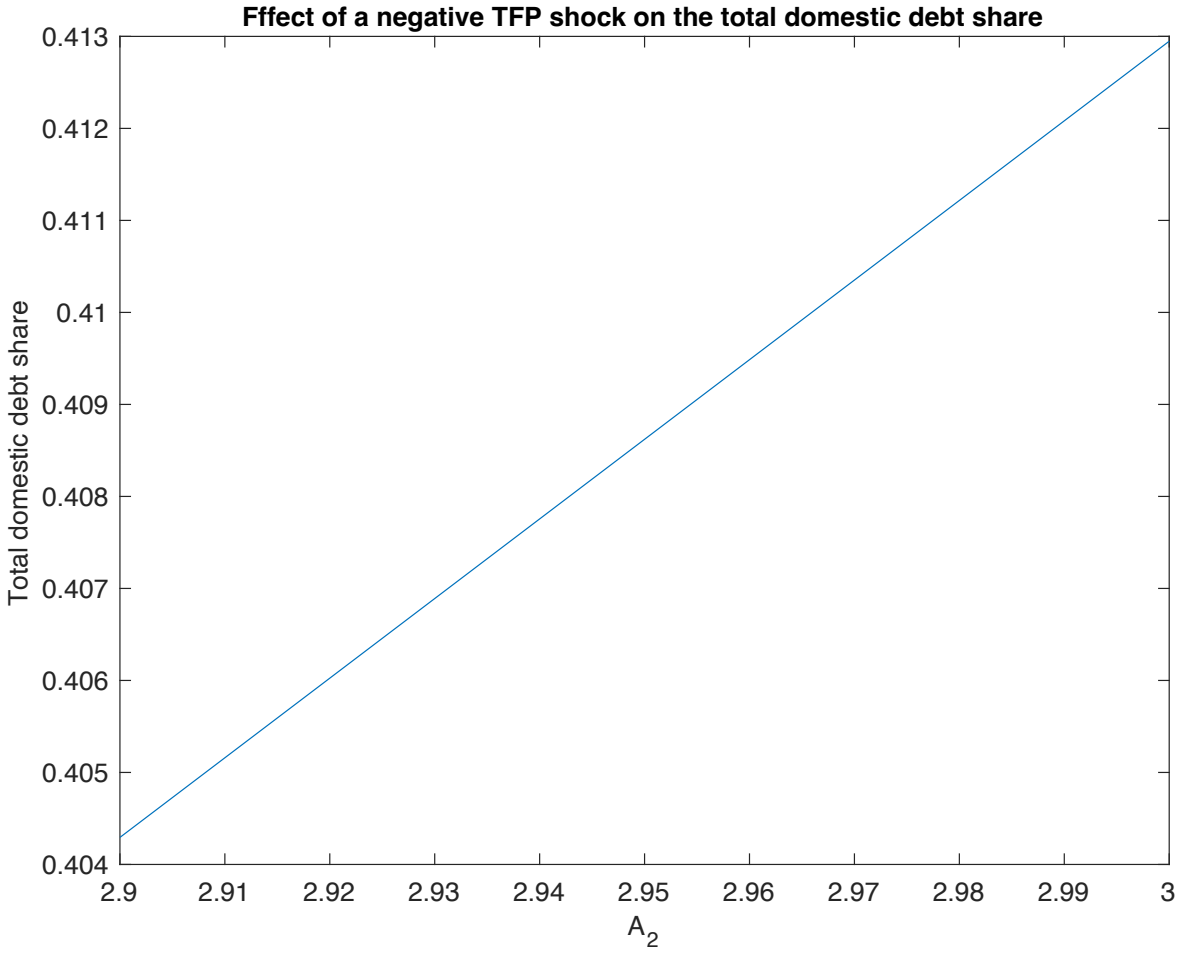
which satisfies $\Xi_L(\int L^i_1 di - e^{CB}_1, \theta_d, m_1) \geq 0$, $\Xi_{\theta_d}(\int L^i_1 di - e^{CB}_1, \theta_d, m_1) \leq 0$, and $\Xi_m(\int L^i_1 di - e^{CB}_1, \theta_d, m_1) \leq 0$. We also assume that financial intermediaries have a satiation point for reserves, $\Xi_m(\int L^i_1 di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

Figure A.5: 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 A.6: 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

Equation 24 modifies CW's loan origination costs in two ways. First, loans with public sector guarantees (FOGAPE) decrease loan origination costs. Intuitively, public sector guarantees require less information acquisition about the quality of collateral. Second, only loans coming from private resources generate loan origination costs. In this way, we capture a benefit of the Central Bank's credit policy (FCIC). In CW, the credit policy given directly to domestic households also does not generate any loan origination costs for the Central Bank.

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

$$\begin{aligned} max_{L_1^i, s_1, m_1, e_1^{CB}} \quad & R_2^b \int L_1^i di + R_2^m m_1 - R_2^d s_1 - R_2^{CB} e_1^{CB} \\ & -\Xi(\int L_1^i di - e_1^{CB}, \theta_d, m_1) \qquad (25) \\ s.t \quad & s_1 = m_1 + \int L_1^i di \qquad (26) \end{aligned}$$

The constraint is financial intermediaries' balance sheet constraint.

Substituting Equation 26 into Equation 25 gives the following expression for financial intermediaries' objective function:

$$R_2^b \int L_1^i di + R_2^m m_1 - R_2^d (m_1 + \int L_1^i di) - R_2^{CB} e_1^{CB} - \Xi(\int L_1^i di - e_1^{CB}, \theta_d, m_1) \qquad (27)$$

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

$$\Xi_L(\int L_1^i di - e_1^{CB}, \theta_d, m_1) = R_2^b - R_2^d \equiv \omega_2 \qquad (28)$$

$$-\Xi_m(\int L_1^i di - e_1^{CB}, \theta_d, m_1) = R_2^d - R_2^m \equiv \delta_2^m \implies m^d(L_1^i) \qquad (29)$$

These are analogous to equations (15) and (16) in CW. Equation 28 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 29 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:

$$\Xi_L(\int L_1^i di - e_1^{CB}, \theta_d, m_1) = R_2^{CB} \tag{30}$$

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 28 and Equation 30 are identical.

Households and firms are identical to the model in the main body of the paper. Market clearing in Equation 18 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 28, 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.

Sensitivity Analysis The qualitative analysis of the model's equilibria and its corresponding numerical analysis shown, respectively, in subsection 4.3 and subsection 4.4 explain how the model is able to qualitatively rationalize the observed patterns of domestic credit and interest rates given the joint implementation of FOGAPE-COVID and FCIC. This is an equilibrium with higher domestic credit and a lower domestic interest rate–in its absolute level and relative to the foreign interest rate–than the initial equilibrium previous to the COVID-type global shock.

Nevertheless, as mentioned before, this result is conditional on the model's parametriza-

tion and on the chosen size of the policies ($\Delta e_{1,CB}$ and $\Delta\theta_d$). In this section, we explore how sensitive the results are to other values of changes in the policies for a plausible space of parameters of both FOGAPE, θ_d, and FCIC, $e_{1,CB}$.

For this purpose, we now define a parameter space for θ_d between 0.25, its initial value in the numerical analysis, and 0.29. For e_{1CB}, the parameter space is between 0 and 0.8. The upper limit of each parameter is defined as the maximum value for which any combination of the parameters θ_d and $e_{1,CB}$ yields an equilibrium defined in the space of real numbers, given the rest of the model's parametrization described in Table VIII. Since the amount of domestic credit is increasing in both θ_d and $e_{1,CB}$, we focus our sensitivity analysis on the equilibrium domestic interest rate.

Figure A.7 shows the equilibrium domestic interest rate, R_2 for each combination of θ_d and $e_{1,CB}$ in two cases, $R^\star = 1$ (before the risk-premium shock) and $R^\star = 1.1$ (after the shock). The bottom surface (in black) shows the former case, and the top surface shows the latter (in blue). The highlighted dots show the same equilibrium points depicted by Table IX in the numerical analysis.

The first feature to notice in Figure A.7 is that, regardless of the value of the policy parameters, the domestic interest rate is increasing in the foreign interest rate. In other words, a risk-premium shock mapped as an increase in $R^\star$ always yields an increase in the domestic interest rate, as explained in the previous two sections.[32]

A second feature is that, regardless of the value of R^*, there is a monotonic relationship between $e_{1,CB}$ and R_2. The higher the size of FCIC, the lower the domestic interest rate. This is a natural consequence of Equation 16 when $\phi > 0$. However, the rate at which a change in FCIC would lower the domestic interest rate is not linear and depends on the value of θ_d.

A third feature is that there is a non-monotonic relationship between θ_d and R_2. Notice

[32] An increase in $R^\star$ is isomorphic to a decrease in ψ, which has the net effect of increasing ϕ.

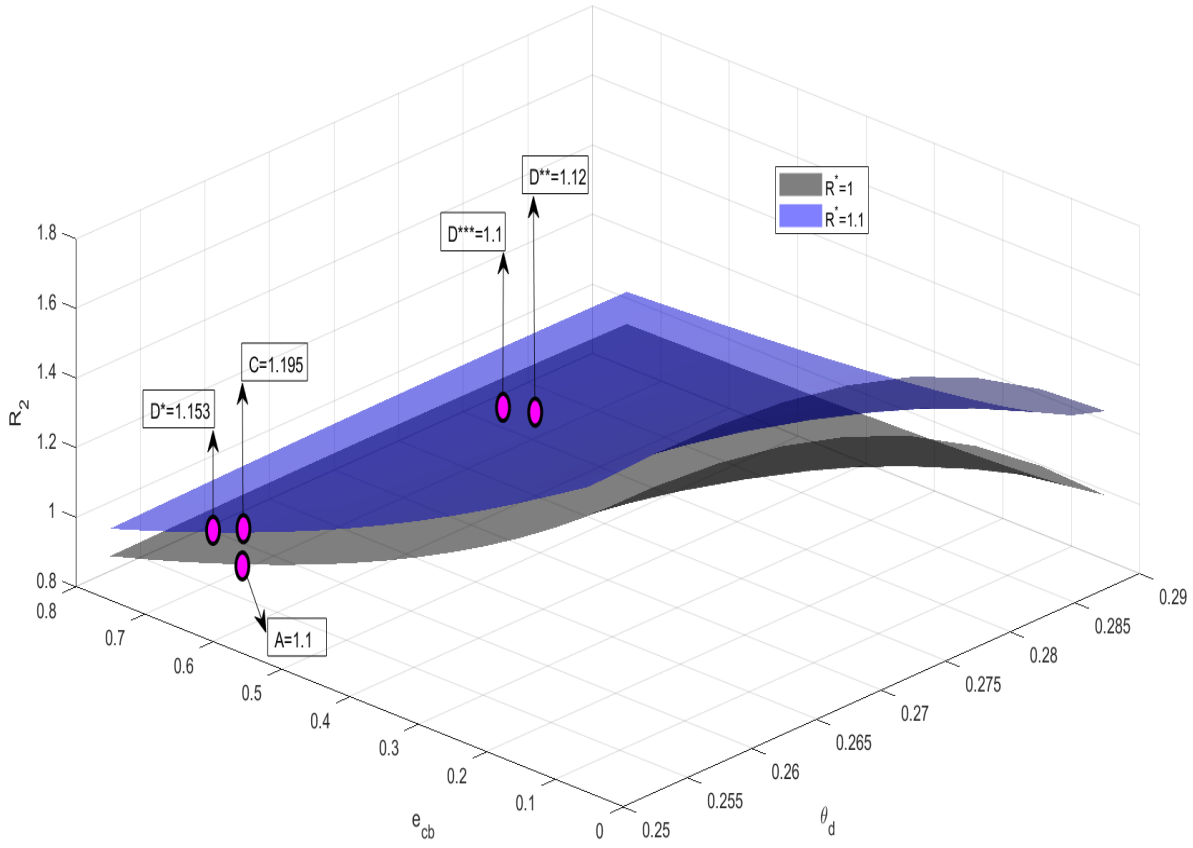
from Figure A.7 that, for very low values of $e_{1,CB}$, an increase in θ_d from 0.25 to higher values initially leads to an increase in the interest rate up to a certain point. This implies that the effect of FOGAPE-COVID on the demand for domestic credit is larger than its effect on supply. However, after a tipping point, the effect on the supply of credit dominates, and the interest rate decreases. The same happens for very high values of $e_{1,CB}$. Therefore, for extreme values of $e_{1,CB}$, given the same size of FCIC, we would require larger increases in θ_d to obtain a lower domestic equilibrium interest rate than the initial one (point A) after the shock. Conversely, the effect of FCIC is larger for very low initial values of e_{CB}, which could be thought of as an economy with very low participation from the Central Bank in lending to financial intermediaries.

However, for intermediate values of the policy parameters, between 0.1 and 0.65–which cover most of the parameter space–, an increase in θ_d always leads to a decrease in R_2. Yet, the rate of this decrease is non-linear with respect to $e_{1,CB}$. For example, as shown in Figure A.7 and in the numerical analysis, an increase in θ_d from 0.25 to 0.27 leads to a fall in the R_2 from point C, 1.195. to point D*, 1.12.

Therefore, we can summarize our results from this exercise as follows: 1) For intermediate values of θ_d and $e_{1,CB}$, which cover most of the parameter space, the joint implementation of FOGAPE-COVID and FCIC generates a fall in the domestic interest rate, and the size of this fall depends on the initial state of the economy. 2) Given the risk-premium shock and the implausibility of having initial extreme values of $e_{1,CB}$ in the economy, the joint implementation of both policies is required to achieve an equilibrium with more domestic credit and a lower or equal domestic interest rate with respect to those before the shock. 3) There could be an initial state of the economy for which a sufficiently large increase in either θ_d or $e_{1,CB}$ is enough to obtain an equilibrium with lower domestic interest rates and higher credit than the initial ones. Yet, considering that such an outcome requires extremely high or extremely low liquidity provided by the Central Bank, this scenario of non-complementarity

between both policies seems unlikely in light of the observed patterns of credit, interest rates, and the policies during the COVID-19 crisis.

Figure A.7: Sensitivity Analysis



Notes: The figure depicts a sensitivity analysis of the numerical results by varying $e_{1,CB}$ and θ_d. All reported values of these parameters are those for which a real solution is defined given the rest of the model's parametrization in Table VIII.