Debt Moratorium: Theory and Evidence[1]

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Abstract

Our study offers a comprehensive analysis of the effects of debt moratorium policies, which is arguably the oldest approach used to address repayment issues. Our theoretical predictions, based on demand and supply elasticities, suggest that non-stressed firms will experience an increase in loan rates, while stressed firms will witness a rise in loan amounts. Using administrative data from Colombia, we empirically test and confirm these predictions by locally comparing loans that narrowly met the treatment criteria with loans that narrowly missed it. We also investigate how macro variables, such as investment and labor, are affected by the policy. Finally, we use a quantitative default model to gain broader insights into short- and long-run gains and losses. Among our findings, we reveal significant welfare gains when the policy is designed to include the forgiveness of interest accrued during debt suspension.

Keywords: Debt management, debt moratorium, regression discontinuity design
JEL Codes: E44, F34, H63

[1]We thank Paulina Restrepo-Echavarría for insightful comments and suggestions at the NBER conference: "Emerging and Frontier Markets: Capital Flows, Resiliency, Risks, and Growth." We also thank the useful comments by Karel Mertens and José-Luis Peydró. Finally, we appreciate all comments received at the Leuven Summer Event, International Francqui Chair Symposium, OECD, ESM, Deakin University, Ghent University, University of Antwerp, University of Melbourne, and Central Bank of Colombia. The views expressed herein are those of the authors and should not be attributed to the Central Bank of Colombia, its Executive Board, nor its management.

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"IF *it is difficult for someone to repay a debt, postpone it until a time of ease. And if you waive it as an act of charity, it will be better for you, if only you knew.*" –Qur'an 2:280

1 Introduction

Deeply rooted in history and even mentioned in ancient texts such as Exodus 22:24, debt moratorium policies have only recently gained significant attention. These policies came to the forefront of the economic debate at the onset of the 2020 pandemic crisis, with over 70 countries enacting them (for a summary, see Appendix F). Paradoxically, despite its historical lineage and sudden surge in implementation, there is still a general lack of focus within the literature; more centered on alternative debt resolution practices, such as bankruptcy laws and debt renegotiation.[1]

To fill this gap, our study takes a comprehensive approach. Through a combination of theoretical, empirical, and quantitative methods, we delve into the intricacies of debt moratorium policies. By examining their potential effects on firms and their ability to alleviate debt burdens, we contribute key insights and enhance the understanding of these policies in the context of contemporary debt management practices.

We first posit a three period closed-economy model. There, we prove that the policy raises interest rates on loans for non-stressed firms, defined as non-defaulting firms, while the effect on the loan amount is indeterminate. Intuition relies on banks' unwillingness to supply loans when resources are scarce while firms demand more loans. On the other hand, for stressed firms, the policy increases the loan amount while the effect on the loan rate is indeterminate and depends on demand and supply elasticities.

On the empirical front, we use administrative data from Colombia during 2018-2022 to separately evaluate the effects on stressed and non-stressed firms, which we define as those with and without days past due on their loans (i.e., days in arrears). For stressed firms, we exploit a discontinuity in the eligibility criterion according to the way the Colombian regulation was enacted: eligible borrowers (firms) could not exceed 60 days past due on their loans as of the 29^{th} of February 2020. In essence, we argue that stressed borrowers just below and above this threshold are ex ante similar (and comparable) on different types of loan conditions, and differ mainly in receiving the treatment. For non-stressed firms, we conduct a Difference-in-Difference (DID) estimation and control for bank and firm-time fixed effects.

[1] Most of these alternative practices have been implemented in response to the Great Recession of 2008-2009 (Ganong and Noel, 2020) and the Great Depression of 1929 (Rose, 2011).

We recognize that a key challenge for causal inference is the fact that the policy directly responds to the episode of economic distress (in our case the 2020 pandemic, which amounted to an unprecedented global shock). In principle, the pandemic acts as a confounding factor that affects loans and corporate variables as well as the enactment of the policy. Fortunately, the rich borrower heterogeneity in the entire Colombian credit registry allows us to compare similar firm-bank-loan relationships with and without treatment. For stressed firms, the closeness to the regulatory threshold guarantees local exogeneity, while for non-stressed firms the firm-time fixed effects strip out demand-driven effects. Further, we rule out the anticipation of the policy since the regulation cutoff (February 29^{th}), which applied to *existing* loans, preceded the arrival of Covid cases in Colombia (March 6^{th}).

Our empirical findings indicate, for stressed firms, that the debt moratorium policy alleviated debtors' *new* loan conditions: loan amounts increased by 15.8% (consistent with our theoretical predictions), and interest rates and the default probability decreased by 0.26 and 1.5 percentage points, respectively. Instead, for non-stressed firms, the policy tightened loan conditions albeit in lesser magnitude: loan amounts decreased by 0.4%, and interest rates and default probability increased by 0.02 and 0.01 percentage points, respectively. When mapping these loan-level results to the real sector (yearly firm balances), we find that stressed firms –with debt moratorium– see an increase in: employment (1.6%), investment (0.08%), operating revenues (7.15%), and assets (0.93%), while we find no significant changes for non-stressed firms.

As a final contribution, we construct a general equilibrium default model to complement our analysis by studying the long-run macroeconomic effects as well as the welfare of the debt moratorium policy. We then use our model as a testing ground to amend and improve the gains of the implemented policy. Specifically, we investigate the concept of an optimal debt relief on existing loans. This line of inquiry gains particular relevance due to the divergent approaches observed in different policy applications, where some borrowers accrue interest on their loans while others do not. For example, in some countries like Belgium, firms did not accrue interest rates, while in other like Colombia, they did.

A brief context of the model is as follows: our framework analyzes an equilibrium default model with a representative firm that receives two types of loans from banks: (i) a non-contingent loan, and (ii) a loan that includes provisions for suspending debt payments in response to liquidity shocks, which arise from increased risk aversion among banks. Importantly, the interest rates associated with both loans are endogenously determined. There are two types of shocks: liquidity shocks, which induce risk-averse behavior in banks that are otherwise risk-neutral, and total factor productivity (TFP) shocks, which impact firms which are modeled as in Mendoza and Yue (2012). These shocks are modeled as correlated, consistent with our empirical observations.

The primary trade-off faced by firms is related to the availability of the moratorium asset. On the one hand, this allows firms to secure low-cost financing, specifically during risk-off periods, thereby avoiding costly defaults. On the other hand, borrowing costs associated with the moratorium asset increase during normal times, as banks are reluctant to have their receivables delayed during adverse shocks. Consequently, firms actively manage their loan portfolios by balancing between non-contingent loans and those with moratorium provisions. To model the portfolio problem, we use ingredients from Hatchondo et al. (2022). Further, we introduce a Nash-bargaining game between lenders and borrowers to restructure delinquent loans when borrowers fail to honor their repayment obligations.

We find that moratorium loans help reduce the number of firm defaults caused by liquidity shocks, leading to increased overall welfare. However, these loans also contribute to a slightly higher frequency of defaults since borrowers opt for higher debt levels when they have access to the moratorium policy. Put differently, by alleviating liquidity concerns, these loans make borrowing more appealing, thereby increasing the risk of default. Moratorium loans also exacerbate the rise in interest rates (spreads) during normal times. This occurs for two main reasons: (i) lenders typically dislike payment suspensions caused by risk-premium shocks, unless these suspensions significantly reduce the likelihood of default, and (ii) payment suspensions resulting from financing shocks lead to increased debt levels, while the firm grapples with these shocks.

Our research also reveals that merely postponing debt payments through moratorium loans provides limited relief as TFP shocks are persistent while the relief policy is short-lived. Yet, borrowers experience significant welfare gains when debt payment restructuring is coupled with debt forgiveness, involving face-value haircuts. Namely, debt forgiveness reduces default risk, not only resulting in a decrease in the average spread but also mitigating the spread increase prompted by liquidity shocks. Intuitively, debt levels rise when moratorium loans defer loan payments, but they actually decrease when coupled with debt relief. These findings provide valuable insights and recommendations for policymakers, contributing to the ongoing discourse on effective debt management and fostering financial stability.

In summary, our paper offers significant theoretical, empirical, and quantitative insights into this long-standing policy. Policy recommendations should be tailored with precision based on whether the borrower is under financial stress or not. The policy proves most effective "IF it is difficult for someone to repay a debt," and providing it to non-stressed borrowers may, in fact, result in losses. Our quantitative model demonstrates that the policy yields the greatest benefit when combined with debt forgiveness. At the very least, the policy could be structured to include the forgiveness of interest accrued during the debt suspension.

2 A three-period model

In our three-period model, we focus on a closed economy where a single good is produced and traded. The economy consists of competitive lenders and firms. Firms and lenders have different initial endowments and preferences, allowing for intertemporal trade.

Specifically, firms have zero endowment in the first period ($y_1 = 0$), indicating that they do not possess any resources initially. Firms discount the future at a constant rate denoted as β, which is less than one. On the other hand, for simplicity, banks are assumed to have a discount rate of unity. The key requirement for intertemporal trade is that banks' discount rate is higher than that of firms.

In periods 2 and 3, the firm is endowed with one unit of the produced good. To incorporate a loan moratorium policy into this simple three-period framework, we introduce a liquidity shock in the second period. This shock occurs with a probability denoted as π and implies that firms cannot access a portion (ℓ) of their resources in the second period. However, this amount can be accessed and utilized in the third period. Consequently, with the implementation of the moratorium policy, firms will postpone the payment of their liabilities if they are affected by the shock and will repay all their obligations in the final period. In our initial formulation of the simple three-period model, we intentionally exclude the possibility of default on loans. This allows us to examine the dynamics of the model without default and establish a baseline understanding of the economic interactions.

However, we recognize the importance of incorporating default into our analysis to capture more realistic scenarios. By relaxing the initial assumption of no default, we can investigate how default affects the dynamics of the model. Indeed, the incorporation of default into the model will highlight the necessity of solving an infinite horizon model.

The utility function for both the bank and the firm is assumed to take the quasi-linear form, that $u(c) = Ac$ for the initial period and $v(c) = Ac - \frac{\phi}{2}c^2$ with $A > \phi > 0$.

In the initial period, the household's sole choice to fund its consumption is by borrowing. This borrowing takes the form of a long-term loan denoted as b, which is acquired at a price q. This loan is initiated in the first period and involves an agreement to deliver δ units of a good in the subsequent (second) period, while the remaining portion of the loan, equivalent to $(1-\delta)$ units of the good, is settled in the third period. In the following analysis we let $\delta = 1/2$ for simplicity.

The maximization problem of the firm without the loan moratorium policy can then be written as

$$\begin{aligned}
&\max_{b>0}\ u\left(qb\right) + \beta\left[(1-\pi)v\left(1-\frac{b}{2}\right) + \pi v\left(1-\frac{b}{2}-\ell\right)\right] \\
&+\beta\left[(1-\pi)v\left(1-\frac{b}{2}\right) + \pi v\left(1-\frac{b}{2}+\ell\right)\right] \\
&\text{subject to } 1-\frac{b}{2}-\ell \geq 0.
\end{aligned} \tag{1}$$

The FOC with respect to b yields the demand curve for loans:

$$b(q):\ \ 2\frac{A(q-\beta)+\beta\phi}{\beta\phi}. \tag{2}$$

And in an economy with the loan moratorium policy, the firm's repayments are deferred to the next period, Thus, instead of paying $\frac{b}{2}$ this period, the firm is going to pay all of its loan b in the next period.[2] The maximization problem of the firm becomes

$$\begin{aligned}
&\max_{b^p}\ u(qb^p) + \beta\Big[(1-\pi)v\left(1-\frac{b^p}{2}\right) + \pi v\left(1-\ell\right)\Big] + \\
&\beta\Big[(1-\pi)v\left(1-\frac{b^p}{2}\right) + \pi v\left(1+\ell-b^p\right)\Big] \\
&\text{subject to } c \geq 0.
\end{aligned} \tag{3}$$

The solution to this problem is

$$b^p(q):\ \ 2\frac{A(q-\beta)+\beta\phi}{\beta\phi} + \beta\frac{\pi(A-\phi)+\pi\phi\ell}{\beta\phi}. \tag{4}$$

The last term (in blue) in equation (4) is the additional term compared to equation (2). This term turns out to be always positive so that the firm always prefers higher loan with the policy.

[2]For simplicity, we assume that the deferred payments do not accrue interest rate.

We can now write the lenders' maximization problem with and without the moratorium policy as follows. First without the policy:

$$\begin{aligned} &\max_{b>0}\ u\left(1-qb\right)+v\left(1+\frac{b}{2}\right)+v\left(1+\frac{b}{2}\right) \\ &\text{subject to } 1-qb\geq 0. \end{aligned} \tag{5}$$

With the policy it reads

$$\begin{aligned} &\max_{b^p}\ u(1-qb^p)+\left[(1-\pi)v\left(1+\frac{b^p}{2}\right)+\pi v(1)\right]+ \\ &\left[(1-\pi)v\left(1+\frac{b^p}{2}\right)+\pi v\left(1+b^p\right)\right] \\ &\text{subject to } c\geq 0. \end{aligned} \tag{6}$$

The solution to these problems yield the supply curves as

$$b(q):\ \ 2\frac{A(1-q)-\phi}{\phi}, \tag{7}$$

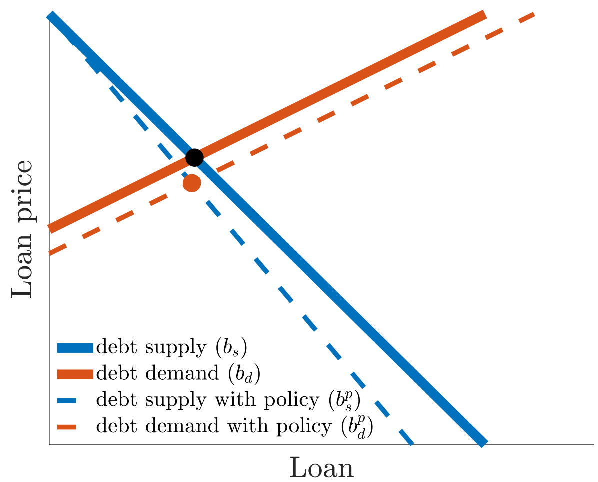
$$b^p(q):\ \ 2\frac{A(1-q)-\phi}{\phi(1+\pi)}. \tag{8}$$

Theorem 1 *Let $b_s^p(q)$ and $b_s(q)$ represent the loans supplied by lenders with and without the policy, respectively. Similarly, $b_d^p(q)$ and $b_d(q)$ denote the loans demanded by borrowers, with and without the policy. Assume that both borrowers and lenders have quasi-linear utility functions, defined as $u(c)=Ac$ and $v(c)=Ac+\frac{\phi}{2}c^2$ with $A>\phi>0$. It follows that, for a positive loan amount, $b_s>0$, lenders are inclined to offer a smaller amount of loan to firms under the loan moratorium policy, denoted as b_s^p, as compared to the situation without the policy (b_s), that is, $b_s^p<b_s$. Additionally, firms exhibit an increased demand for loan from lenders under the policy (b_d^p), compared to the scenario without the policy (b_d), for the same given price "q", that is $b_d^p>b_d$.*

Intuitively, risk-averse lenders are not willing to lend to firms when they need the resources the most.[3] Figure 1 visualizes this intuition. For each level of price (which is inversely related with the interest rate) lenders are willing to save more and require a higher interest rate to meet the exact demand of the firms without the policy. Firms, on the other hand, are willing to borrow more for each level of interest rate.

[3]Proof: Equation (4) is always greater than equation (2). Thus, it follows that $b_d^p>b_d$. Similarly, the equation (8), which denotes the supply curve, is always lower than the supply curve without the policy given in the equation (8). Thus, $b_s^p<b_s$. ∎

Figure 1: Demand and supply of loans with and without the policy.



In our basic three-period model, we initially disregarded the possibility of borrowers defaulting. This means that the loan price, denoted as q was assumed to be independent of the loan amount "b." Now, we can introduce the idea that the loan price can also be influenced by the loan amount b.

Furthermore, we are expanding the model to accommodate uncertainty regarding incomes in the second and third periods. These income values are considered as random variables and are drawn from a distribution represented by a probability density function (pdf) denoted as $f(y)$ and a cumulative distribution function (cdf) denoted as $F(y)$. In cases of default, borrowers incur a cost associated with defaulting, denoted as $C(y)$. Without this default cost, borrowers would always choose to default in the terminal period.

Within this revised framework, the borrower has the potential to default based on the realized income outcomes in the second and third periods. To capture this, we define an income threshold denoted as $y^\star(b, y)$. When the realized income falls below this threshold, borrowers might find it optimal to choose for defaulting on their obligations.

Incorporating the possibility of default, we can reformulate the borrower's problem by partitioning the integral as follows:

$$\max_{b>0}\ u\left(qb\right)+\beta(1-\pi)\left(\underbrace{\int_{y^\star} v\left(y-\frac{b}{2}\right)}_{repayment}+\underbrace{\int^{y^\star} v\left(y-C\left(y\right)\right)}_{default}\right)dF(y) \tag{9}$$

$$+\beta\pi\left(\underbrace{\int_{y^\star} v\left(y-\frac{b}{2}-\ell\right)}_{repayment}+\underbrace{\int^{y^\star} v\left(y-C\left(y\right)\right)}_{default}\right)dF(y)$$

$$+\beta(1-\pi)\left(\underbrace{\int_{y^\star} v\left(y-\frac{b}{2}\right)}_{repayment}+\underbrace{\int^{y^\star} v\left(y-C\left(y\right)\right)}_{default}\right)dF(y)$$

$$+\beta\pi\left(\underbrace{\int_{y^\star} v\left(y-\frac{b}{2}+\ell\right)}_{repayment}+\underbrace{\int^{y^\star} v\left(y-C\left(y\right)\right)}_{default}\right)dF(y)$$

$$\text{subject to } y-\frac{b}{2}-\ell\geq 0,\ y-C\left(y\right)>0.$$

and the lender's problem who takes the default threshold y^* given as

$$\max_{b>0}\ u\left(1-qb\right)+(1-\pi)\left(\underbrace{\int_{y^\star} v\left(y+\frac{b}{2}\right)}_{repaid}+\underbrace{\int^{y^\star} v\left(y\right)}_{defaulted}\right)dF(y) \tag{10}$$

$$+\pi\left(\underbrace{\int_{y^\star} v\left(y+\frac{b}{2}\right)}_{repaid}+\underbrace{\int^{y^\star} v\left(y\right)}_{defaulted}\right)dF(y)$$

$$+(1-\pi)\left(\underbrace{\int_{y^\star} v\left(y+\frac{b}{2}\right)}_{repaid}+\underbrace{\int^{y^\star} v\left(y\right)}_{defaulted}\right)dF(y)$$

$$+\pi\left(\underbrace{\int_{y^\star} v\left(y+\frac{b}{2}\right)}_{repaid}+\underbrace{\int^{y^\star} v\left(y\right)}_{defaulted}\right)dF(y)$$

$$\text{subject to } 1-qb\geq 0.$$

Notice that the integrals in the equations may not be canceled, as the default threshold y^* in each line may vary which we will elaborate below.

Moving forward, the solution to the firm's problem without the policy becomes

$$b(q): \;\; 2\frac{A(q-\beta)+\beta\phi}{\beta\phi-2A\frac{\partial q}{\partial b}}. \tag{11}$$

Similarly, when we make the same adjustments in equation (3) to the equation (9) to solve the impact of the policy, details of which are relegated to Appendix D, the solution to the firm's problem becomes

$$b^p(q^p): \;\; 2\frac{A(q^p-\beta)+\beta\phi}{\beta\phi-2A\frac{\partial q^p}{\partial b}}+\beta\frac{\pi(A-\phi)+\pi\phi\ell}{\beta\phi}-2A\frac{\partial q^p}{\partial b}. \tag{12}$$

The next follows the solution to the lender's problem which yields

$$b(q): \;\; 2\frac{A(1-q)-\phi}{\phi+2A\frac{\partial q}{\partial b}}, \tag{13}$$

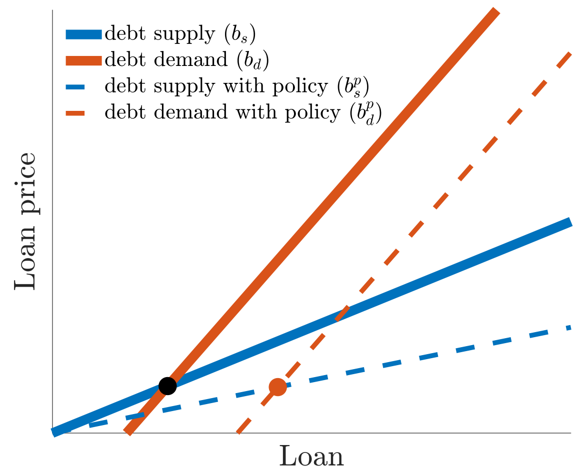
$$b^p(q^p): \;\; 2\frac{A(1-q^p)-\phi}{\phi(1+\pi)+2A\frac{\partial q^p}{\partial b}}. \tag{14}$$

It's important to emphasize that the optimal default thresholds in the maximization problem could vary for both firms and lenders, with and without the policy. This introduces an additional layer of complexity to the analysis. In order to obtain a clearer understanding of the potential effects of the policy alteration, we resort to a straightforward numerical example, akin to the one depicted in Figure 2.

The direct comparison between equations (12) and (14) is not straightforward. The derivative term $\frac{\partial q}{\partial b}$ might not be identical since default thresholds could differ across economies. However, there are quantitative observations: $\frac{\partial q}{\partial b} \leq 0$ and $\frac{\partial q^p}{\partial b} \leq 0$, aligning with the typical finding that the likelihood of default increases with larger loans. Furthermore, it's again quantitatively noted that $\frac{\partial q^p}{\partial b} > \frac{\partial q}{\partial b}$ due to the policy reducing default risk for a given loan size. Consequently, the additional blue term to the solution of the firm's optimization problem turns out to be always positive when we account for the risk of default. In other words, firms request more loans from lenders at the same price, factoring in default risk.

On the lender's side, the situation may change based on the price's sensitivity to loans, $\frac{\partial q}{\partial b}$. During non-crisis periods, where the likelihood of default is low, price responsiveness is generally negligible, thus Theorem 1 remains valid. During a crisis, however, prices become highly responsive, leading lenders to be more willing to offer loans to firms for the

Figure 2: Demand and supply of loans with and without the policy when default risk is accounted.



same price $q(b)$ under the loan moratorium policy. This distinction is illustrated in Figure 2.

The intuition is that for such high premiums levied on the firm, lenders are willing to supply more credit while firms are less likely to default compared to the same level of loans held in an economy without the policy.

In the subsequent sections of our study, we validate our theoretical findings through empirical analysis. Additionally, we extend our three-period analysis to an infinite horizon model, allowing us to explore the dynamic implications of the loan moratorium policy in a more comprehensive framework. This allows us to examine the long-term effects of the policy on key variables such as indebtedness and default rates as well as real variables such as employment and income.

3 The Colombian Case

3.1 Matching Firm- and Bank-level data

We use administrative data, comprising the entire Colombian credit registry (at the loan level) from Q1-2018 to Q4-2022. These data, from the Financial Superintendency (*Superintendencia Financiera de Colombia, Formato 341*), contain over 4.4 million observations with information on all loans extended to corporates, such as interest rates, loan amount, maturity, collateral requirements, delinquency rate (i.e. days past due), ex-ante probability of default and ex-ante credit rating. Also from this source we are able to identify loans that received grace periods under the debt moratorium government program.[4]

We merge these data with yearly firm-level balance sheet information from the EMIS (*Emerging Markets Information System*) database in order to include firm-specific variables such as asset size, liabilities, profits, operating revenue, investment, and equity. We obtain data on employment from CONFECAMARAS (*Colombian Confederation of Chambers of Commerce*) although only for a reduced subset of firms as per data availability. After merging these sources, and focusing mainly on stressed firms (with days past due) we match 50,152 loans, a total of 37 financial entities (mostly private banks) and 23,932 firms. Given that our unit of measurement consists of new loans disbursed from bank j to firm i in quarter t, we observe close to 100,000 new loans.

3.2 Financial Alleviation Measures in Colombia

In March 2020, the Financial Superintendency enacted a set of emergency measures to mitigate the effects of the COVID-19 Pandemic. Among them was the payment relief measure (*grace periods*) to performing debtors with less than or equal to 60 days past due on their credit as of February 29^{th}. The program, while set to end on June 30^{th} of 2020, was extended until August 31^{st} of 2021.[5]

During grace periods, banks could not increase interest on loans nor charge interests-on-interests. Also, loan ratings had to be temporarily frozen. The duration of the grace period was negotiated between entities and debtors on a case-by-case basis.

We note that, similar to Colombia, many other countries implemented debt moratorium policies in response to the pandemic. In Appendix F we provide a detailed list of how this policy was enacted for over 70 countries.

3.3 Identification

3.3.1 Stressed Firms

For stressed firms (defaulting firms), we exploit the discontinuity in the eligibility criterion according to how the Colombian regulation was enacted: eligible borrowers could not exceed 60 past due days on their credit as of the 29^{th} of February 2020. In essence,

[4]While loan data is reported quarterly, it traces the daily origination of new loans as well as non-performing days.

[5]See regulation CE007 and CE014 (March 17^{th} and 31^{st}) of the Financial Superintendency. While regulation CE007 initially installed a criteria of 30 days past due, regulation CE014 extended the criteria to 60 days.

we argue that borrowers just below and above this threshold are similar (and comparable) ex-ante across various types of financial variables, and mainly differ in receiving treatment.

The distribution of eligible and non-eligible loans are plotted in Figure 3. Panel (a) shows the frequency (histogram) of eligible versus non-eligible corporate loans along the running variable, centered at zero henceforth, and panel (b) statistically evaluates if there are bunching of observations around the cutoff value, which would indicate evidence of potential control or "manipulation" (McCrary, 2008). Intuitively, the test separately estimates the density of the running variable (i.e. loan's days past-due) on either side of the cutoff point and provides a Wald estimate in which the null corresponds to the non-existence of a discontinuity at the threshold. The resulting p-value of 0.475 indicates a lack of manipulation of the running variable.

We proceed to evaluate the impact of treatment on lending. Note that within eligible borrowers there was imperfect compliance, meaning that for reasons such as lack of information or costs associated with a time consuming process, some eligible firms decided not to take part in the government policy. For this reason, we correct treatment compliance with a fuzzy instrumental variables RDD specification. In Appendix A we further characterize the behavior of eligible treated and non-treated firms.

The fuzziness in our design essentially means that we observe a discontinuous jump in the probability of treatment, but it does not jump from zero to unity, as in the case of a sharp design. Formally, let $D_{ij,t}$ be the actual assignment of treatment i.e., whether the loan (firm-bank "ij") received the policy at time "t". Also, let X_{ij} be the assignment variable i.e., number of past-due days around the centered cutoff. For simplification we omit the sub-index "t" in the assignment variable noting that the loan eligibility criterion was met only if the number of past due days was less than or equal to 60, as of February 29th, 2020.

Notice that in a *sharp* setting of full compliance, treatment would be deterministically determined by the running variable, as follows:

$$\tilde{D}_{ij,t} = \mathbf{1}\left\{X_{ij} \geq 0\right\} \tag{15}$$

where $\mathbf{1}$ denotes an indicator function. But, since the rule does not perfectly predict treatment ($D_{ij,t} \neq \tilde{D}_{ij,t}$), we proceed with the following two-stage approach based on local non-parametric linear regressions:

$$1^{st} \text{ stage:} \qquad \arg\min_{\boldsymbol{\theta}} \sum_{ij=1}^{I\times J}\sum_{t=0}^{T}\left[D_{ij,t+1} - \theta_0 + \theta_1\tilde{D}_{ij,t} + \theta_2 X_{ij} + \theta_3 X_{ij}\tilde{D}_{ij,t}\right]^2 K\left(\frac{X_{ij}}{h}\right) \tag{16}$$

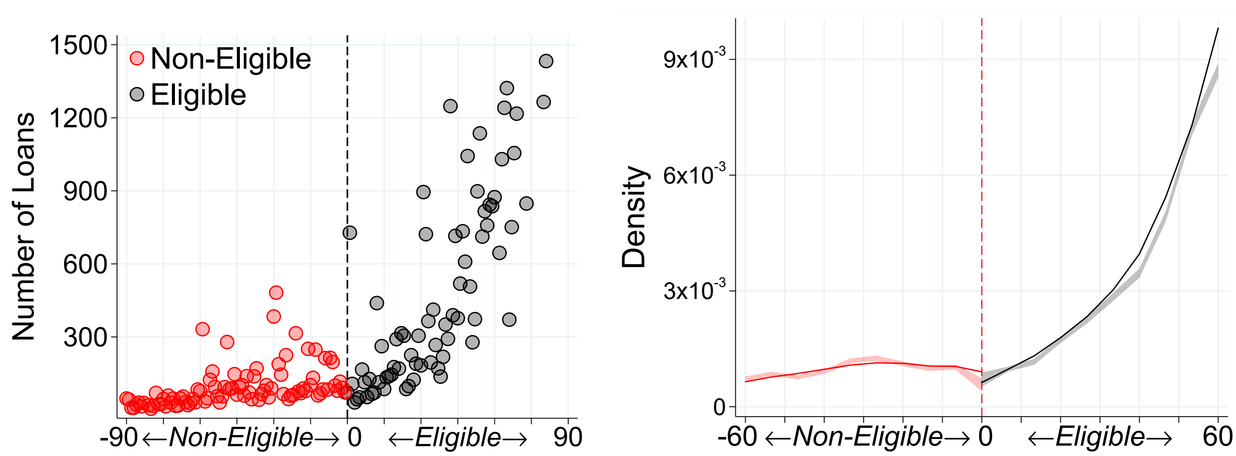
$$2^{nd} \text{ stage:} \qquad \arg\min_{\boldsymbol{\delta}} \sum_{ij=1}^{I\times J}\sum_{t=0}^{T}\left(Loan_{ij,t+1} - \delta_0 + \delta_1\hat{D}_{ij,t} + \delta_2 X_{ij} + \delta_3 X_{ij}\hat{D}_{ij,t}\right)^2 K\left(\frac{X_{ij}}{h}\right) \tag{17}$$

where the $Loan_{ij}$ variable denotes various loan conditions (amount, credit rating, days past due, interest rate, maturity, and collateral requirement) and $K(\cdot)$ is a triangular kernel with optimal bandwidth "h" as described in Calonico et al. (2014). We include the term $\hat{D}_{ij,t} \times X_{ij}$ to allow for different specifications of how the running variable affects the outcome, at either side of the cutoff. Intuitively, in the first stage (equation 16) we estimate the predicted probability of treatment, –intent-to-treat– ($\hat{D}_{ij,t}$), and use it to instrument compliant observations in the second stage (equation 17). Consequently, the fuzzy RDD estimand can be formulated as:

$$\delta_1 = \frac{\lim_{x \downarrow 0} E[Loan_{ij,t+1}|X_{ij} = x] - \lim_{x \uparrow 0} E[Loan_{ij,t+1}|X_{ij} = x]}{\lim_{x \downarrow 0} E[D_{ij,t}|X_{ij} = x] - \lim_{x \uparrow 0} E[D_{ij,t}|X_{ij} = x]} \tag{18}$$

which represents the ratio between the jump in the outcome variable and the share of compliant observations (those that are triggered by the rule and receive treatment).

Figure 3: Eligible and Non-Eligible Loans



(a) Treatment Distribution

(b) McCrary's Test

Panel (a) shows the histogram of eligible versus non-eligible commercial loans along the running variable. All ineligible loans (red) are to the right of the cutoff. Panel (b) statistically evaluates if there are bunching of observations around the cutoff value (McCrary, 2008). The p-value (0.475) does not reject the null, indicating a lack of manipulation of the running variable.

3.3.2 Non-stressed Firms

For non-stressed firms (non-defaulting firms) we compare only across eligible borrowers; with and without treatment. We choose a Difference-in-Difference (DID) regression model, exemplified as:

$$Loan_{ij,t+1} = \alpha_{j,it} + \gamma D_{ij} + \sum_{\tau=0}^{m} \beta_{\tau} D_{ij} T_{t-\tau} + \sum_{\tau=1}^{q} \beta_{-\tau} D_{ij} T_{t+\tau} + \epsilon_{ij,t+1} \tag{19}$$

where $\alpha_{i,jt}$ includes bank and firm-time fixed effects (which especially controls for demand-driven factors), and where $T_t = \mathbf{1}\{2018 \leq t \leq 2022\}$ denotes quarterly time dummies before and after the policy took place. A key assumption is that in the absence of treatment, the difference between treatment and control groups remains constant over time i.e., parallel trends assumption. We test for this under the null $H_0 : \beta_{-\tau} = 0$, for $\tau = 1, 2, ..., 6$, that is, up to six quarters before treatment.

4 Results

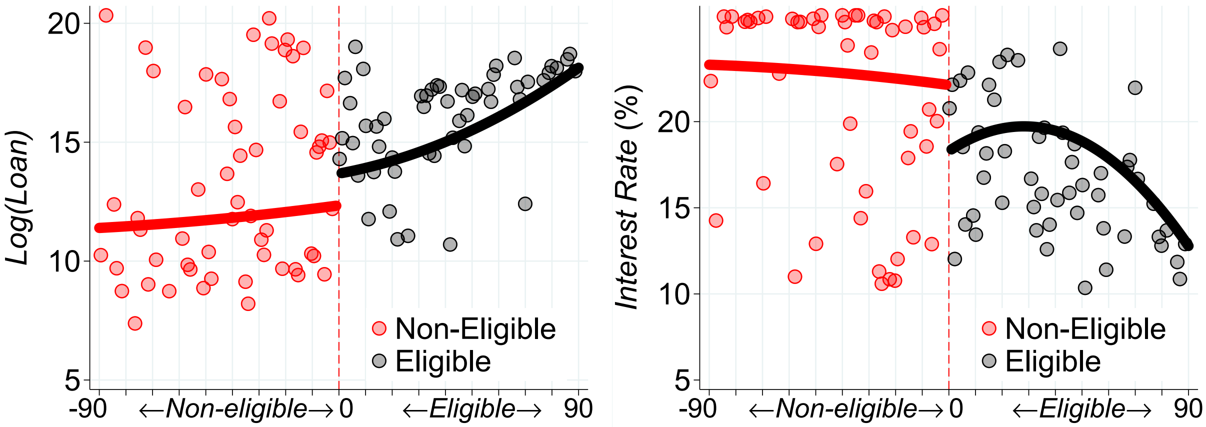
4.1 Loan Conditions

4.1.1 Stressed Firms

This section presents our results on new loan conditions i.e., for a given firm, loans that originated after the policy. For stressed firms, we present fuzzy RDD estimates as specified by equation (18). Our main findings indicate that treated loans i.e., loans with debt moratorium, exhibit an increase in their loan amounts and a decrease in the cost of credit (loan rates). Graphically, these effects are shown in Figure 4, resulting from a discontinuous jump at the cutoff point: positive for loan amounts in panel (a) and negative for loan rates in panel (b).

More formally, Table 1 reports our benchmark fuzzy RDD results. In general, we find that the debt moratorium policy alleviated the debtors' new loan conditions. Specifically, the policy increased the loan amount by 15.8%, which is in line with our theoretical predictions. As a reminder, our model accounts for the fact that firms demand larger loans when moratoria are in effect, and lenders supply them at a premium.

Figure 4: Loan amount and interest rates for eligible and non-eligible observations



(a) New loans amount

(b) Interest rate on new loans

Panel (a) shows new loans. Panel (b) interest rate

The table also shows that the policy lowered interest rates by 0.26 percentage points (pp). One factor contributing to this decline is banks' expectation of a reduced likelihood of default. This is in line with Ganong and Noel (2020), who show that maturity extensions for household debt obligations, which reduces payments in the short term, significantly reduces default rates. In our data, the ex ante probability of default is assessed by each bank at the origination of the loan (in column 6 we observe a 1.51pp decrease). When we examine the ex post outcomes, we find that stressed firms that received the policy actually defaulted 1.45pp less frequent compared to their counterparts who barely missed qualifying for the policy. This confirms that banks' ex-ante assessments were indeed accurate. Our quantitative model also provides the following intuition for this outcome: moratorium policy provides a relief for firms and mitigate concerns of default triggered by adverse shocks. By mitigating concerns about liquidity, moratoria make indebtedness more attractive.

Finally, the policy also increased loan maturity by 8.8 years and improved the rating of the loan by approximately 3 categories. However, it also increased the amount of loan collateral required, by 1.3pp.[6]

[6]For comparability purposes, in Appendix B we show summary loan statistics for stressed firms (Table B1) and non-stressed firms (Table B2).

Table 1: RD Benchmark results: new loans

	Log(Loan)	Interest	Maturity	Collateral	Rating	Default Prob. Ex-ante	Default Prob. Ex-post
Fuzzy-RD	15.76**	-0.255*	8.78**	1.30**	3.43***	-1.51***	-1.45***
	(6.8)	(15.3)	(3.8)	(0.6)	(1.3)	(0.4)	(0.5)
Observations	29,947	29,947	29,947	29,947	29,152	57,461	57,461
BW loc. poly.	16.3	18.9	19.9	29.0	25.3	27.7	18.3

Robust Bias-corrected standard errors in parentheses, *, **, ***, indicate significance at the 10% 5% and 1% respectively

4.1.2 Non-stressed Firms

We next evaluate the effects of debt moratorium policies for non-stressed firms, i.e. firms with no days past-due on their loans. Since our RDD identification no longer applies (all firms are eligible for treatment), we carry out a difference-in-difference loan-level estimation, es exemplified by equation (19).

Our results, reported in Table 2, for non-stressed point towards tighter loan conditions (albeit much lesser in magnitude). Namely, the policy decreased the loan amount by 0.27%, increased the interest rate by 0.020pp, increased the loan maturity by 0.58 years, raised the ex-ante and ex-post probability of default by 0.003pp, and reduced the loan rating by approximately three tenths of a category (effect on collateral is not statistically significant). These results are also consistent with our model's predictions and highlights banks' unwillingness to supply loans when resources are scarce.

We argue that the smaller magnitudes (arguably economically insignificant) stem from the fact that non-stressed firms are, for the most part, larger and less vulnerable to shocks, and can thus symmetrically react less to a given subsidy.

Table 2: DID Benchmark results: new loans

	Log(Loan)	Interest	Maturity	Collateral	Rating	Default Prob. Ex-ante	Default Prob. Ex-post
DID	-0.272**	0.020***	0.585**	-0.057	-0.031***	0.003**	0.003*
	(0.139)	(0.002)	(0.269)	(0.053)	(0.007)	(0.001)	(0.002)
Observations	32,560	82,138	85,657	153,664	153,664	153,661	149,634
$\bar{R}^2$	0.488	0.617	0.453	0.209	0.487	0.568	0.146

Standard errors in parentheses, *, **, ***, indicate significance at the 10% 5% and 1% respectively

4.2 Real Sector (Firm-Balances)

We next evaluate whether these effects translate into end-of-year firm-balances. To do so, we control for firm-sector and firm-size fixed effects. Our firm-level dependent variables consist of: employment, investment, operational revenue, liabilities, assets, profits, and equity. All variables are in log changes with respect to their 2019 value.

4.2.1 Stressed Firms

For stressed firms, we see an increase in: employment (1.6%), investment (0.08%), operating revenues (7.15%), liabilities (0.19%), assets (0.93%), profits (0.8%), and equity (0.7%). These results are presented in Table 3 (to illustrate, some of these are also presented in Figure 5).

Table 3: RD benchmark results: Firm level outcomes

	ΔEmp.	Inv. rate	ΔOp. Rev.	ΔLiab.	Δ Assets	ΔProfits	ΔEquity
Fuzzy-RD	1.59**	0.08***	7.15***	0.19**	0.93***	0.83*	0.68*
	(0.7)	(0.0)	(2.2)	(0.1)	(0.3)	(0.4)	(0.4)
Observations	15,379	11,386	31,799	30,864	30,626	28,490	30,900
BW loc. poly.	28.9	10.7	11.5	12.8	6.6	16.5	16.7

Robust Bias-corrected standard errors in parentheses, *, **, ***, indicate significance at the 10% 5% and 1% respectively

4.2.2 Non-stressed Firms

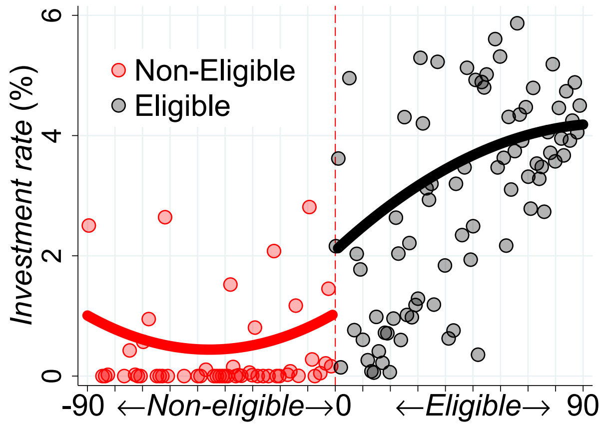
For non-stressed firms, as shown in Table 4, we do not find significant results except for a small decrease in assets (0.03%) and liabilities (0.02%), which confirms that non defaulting firms are much less vulnerable. That is, even if we find small effects on their loan conditions, these are not translated into significant changes in their end-of-year balances.

Table 4: DID benchmark results: firm level outcomes

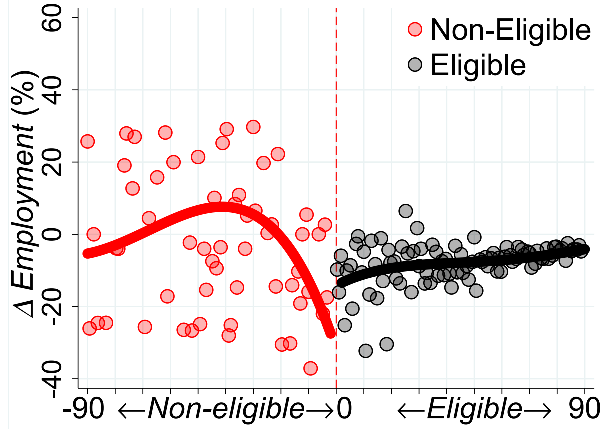
	ΔEmp.	Inv. rate	ΔOp. Rev.	ΔLiab.	Δ Assets	ΔProfit	ΔEquity
DID	0.001	0.01	0.02	-0.015***	-0.025***	-0.007	0.71
	(0.01)	(0.03)	(0.01)	(0.004)	(0.008)	(0.01)	(1.2)
Observations	120,759	35,193	200,720	145,852	138,597	210,535	146,807
$\bar{R}^2$	0.15	0.01	0.01	0.03	0.01	0.007	0.01

Standard errors in parentheses, *, **, ***, indicate significance at the 10% 5% and 1% respectively

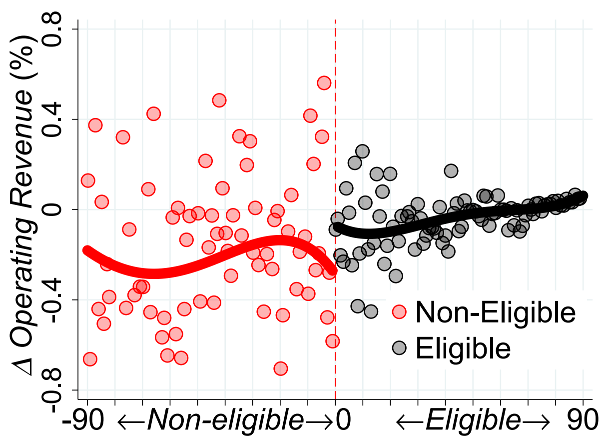
Figure 5: Firm-level outcomes for eligible and non-eligible firms



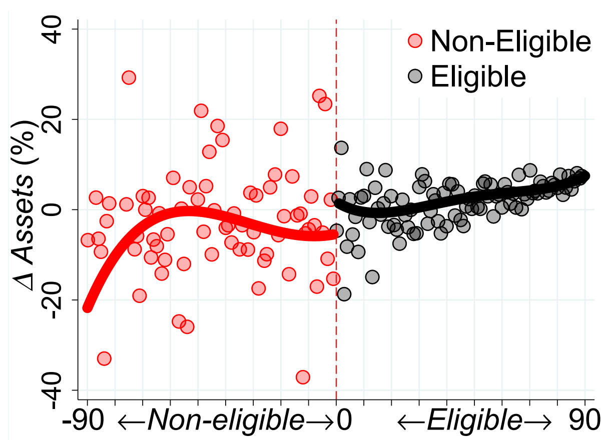
(a) Investment



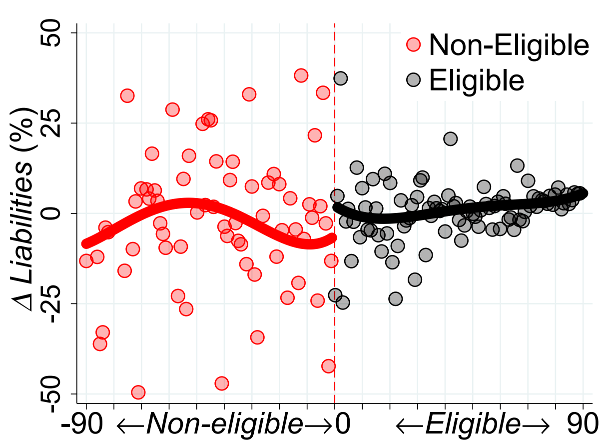
(b) Employment



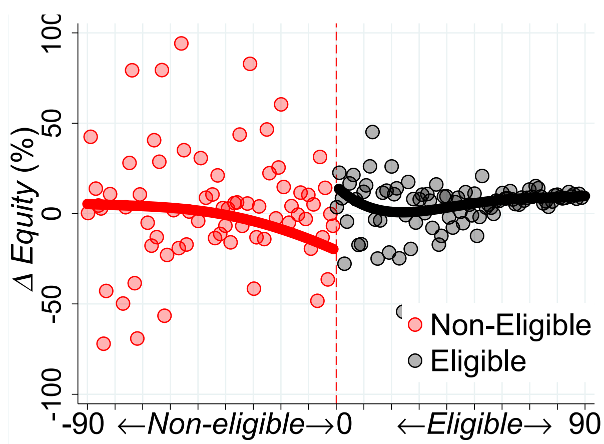
(c) Operational Income



(d) Assets



(e) Liability



(f) Equity

4.3 Robustness checks

For expositional purposes, we present robustness checks focusing on our two main variables of interest: loan amounts and interest rates. Robustness for all other variables, yielding similar results, can be made available upon request. For stressed firms, we conduct exercises with placebo cutoffs and falsification tests (Section 4.3.1), and we test for balanced covariates (Section 4.3.2). In turn, for non-stressed firms, we present evidence of the (DID) parallel trends assumption (Section: 4.3.3).

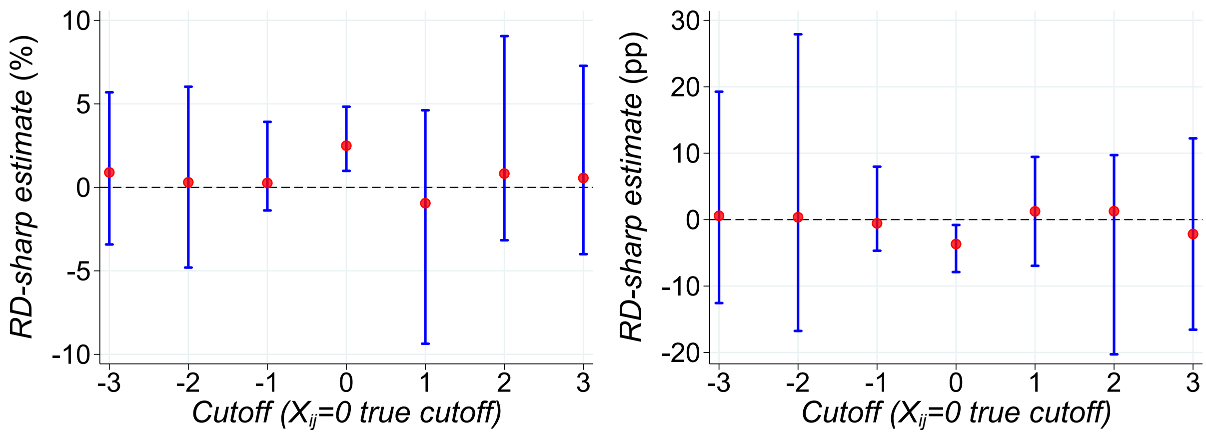
4.3.1 Placebo Cutoffs and Falsification Tests

We begin our robustness checks by evaluating arbitrary cutoff points different to the one that triggered treatment. In principle, a significant placebo cutoff could indicate either: (i) a concurrent policy, potentially contaminating our results, or (ii) systematic differences among eligible and non-eligible borrowers –far from the discontinuity point–. In Figure 6 we evaluate placebo cutoffs for up to 3 days before and after the actual cutoff $X_{ij} = 0$. As expected, none of these different cutoffs are statistically significant for both loan amounts (panel a) and interest rates (panel b).[7]

Further, in Table 5 we present a falsification test in which we regress the treatment status (D_{ij}) on banks' and firms' balance sheet information. As observed, for the entire sample (column 1), treatment is partially explained by bank variables such as provisions, assets and equity (firm level variables are not statistically significant). However, when restricting the sample to a smaller bandwidth (within the vicinity of the triggering threshold), treatment becomes uncoupled from these factors. As shown, with a 70-day bandwidth (column 4), the assignment of treatment is no further explained by either bank or firm variables. This exogenous variation around the cutoff is precisely what our empirical strategy exploits for the case of stressed firms.

[7] In addition to placebo cutoffs, in Appendix C we present a "donut-hole" test, which re-estimates our benchmark results but excluding observations in the immediate neighborhood of the cutoff (1, 2, or 3 days before/after the actual cutoff).

Figure 6: Placebo cutoffs



(a) Log(Loan) (b) Interest Rate

The figure shows the RD estimates for the alternative placebo cutoffs. Each placebo cutoff denotes the closest possible value for the running variable with enough variation to compute the local polynomial RD estimate.

Table 5: Falsification test

	Entire sample	BW = 80	BW = 75	BW = 70
Bank variables				
All loans	-8.93e-05	0.000215	-0.000805*	-0.00126
	(0.000289)	(0.000705)	(0.000474)	(0.000825)
Provisions	0.00795*	0.0179	0.0175	0.0372
	(0.00476)	(0.0146)	(0.0157)	(0.0310)
Assets	-0.0749*	-0.222*	0.0825	0.127
	(0.0454)	(0.134)	(0.0903)	(0.112)
Equity	0.113*	0.336*	-0.171	-0.246
	(0.0676)	(0.182)	(0.133)	(0.166)
Firm variables				
Assets	0.00577	0.00291	-0.0294	-0.0287
	(0.00670)	(0.0111)	(0.0187)	(0.0233)
Equity	-0.0516	-0.0838	-0.0556	-0.00117
	(0.0375)	(0.0643)	(0.0782)	(0.0979)
Profits	0.0126	0.0331	0.0821	0.0548
	(0.0217)	(0.0401)	(0.0574)	(0.0646)
PPE	0.542	0.754	1.138	0.949
	(0.359)	(0.646)	(0.784)	(0.944)
Constant	-0.221	-0.0711	0.788	0.552
	(0.361)	(0.641)	(0.851)	(1.066)
Bank FE	x	x	x	x
Time FE	x	x	x	x
Observations	2,032	676	383	265
R-squared	0.760	0.832	0.820	0.804
F-test all	89.05	312.3	167.1	169.6
pvalue all	0	0	0	0

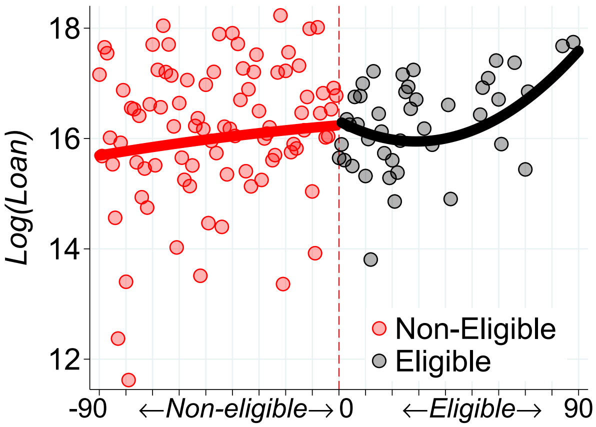
Each column reports a linear regression with the treatment dummy $D_{ij,t}$ as dependent variable and with different bandwidth choices (entire sample, 80, 75, and 70 days). Heteroskedasticity-robust standard errors in parentheses, *, **, ***, indicate significance at the 10% 5% and 1% respectively.

4.3.2 Checking for Balanced Covariates

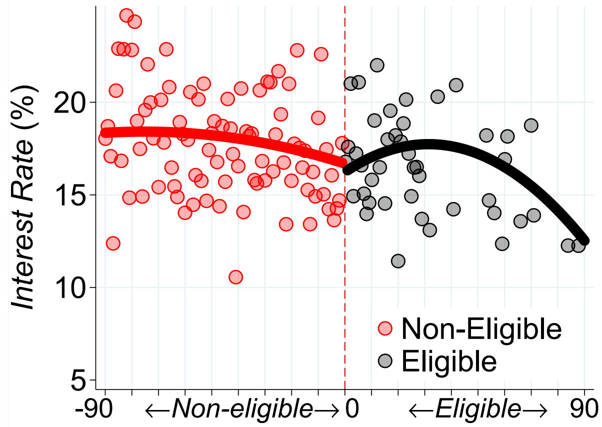
One crucial element in our RDD identification strategy, is for treated and control loans to be almost identical –in everything except in receiving treatment–. A leading marker, one that rules out precise sorting (i.e., manipulation or self-selection around the cutoff), commonly known as the McCrary Test, was previously presented in Figure 3 (panel b).

To complement this analysis, we present a visual inspection of whether loan amount, interest rates, and firm-level variables such as investment, employment, operation income, and total assets carried systematic differences *before* the debt moratorium policy took place. If this were the case, then our results would be reflecting pre-existing differences rather than a causal relationship due to the policy. As shown in in Figure 7, these variables are equally balanced across the running variable for the quarter before the policy (2019Q4). We formally show this for the rest of our loan- and firm-level variables in Table C3 of Appendix C.

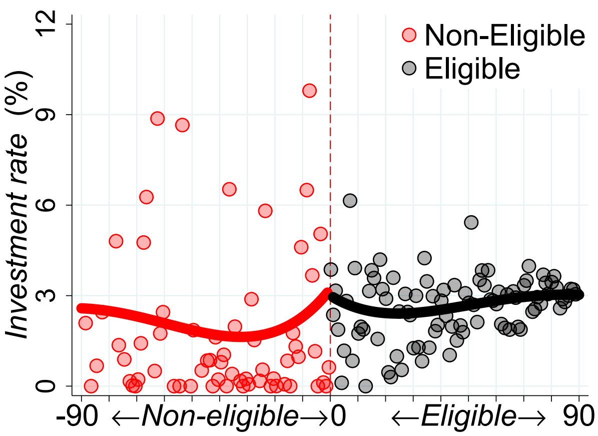
Figure 7: Testing for Pre-existing differences with respect to the year before the policy (2019)



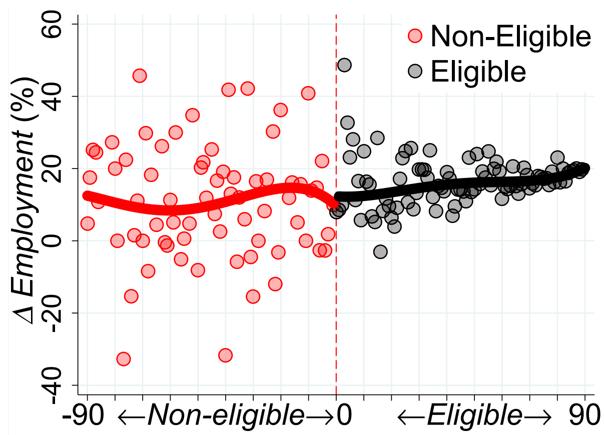
(a) Log(Loan)



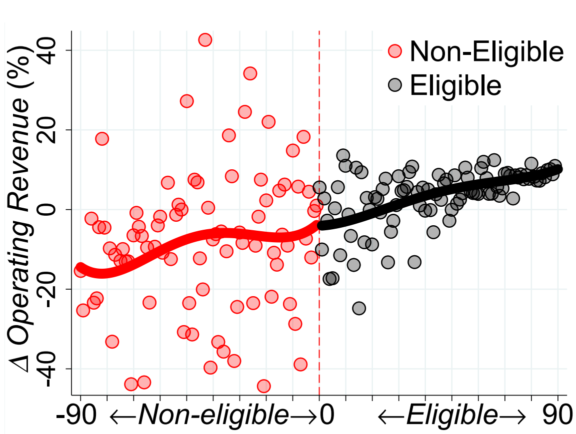
(b) Interest Rate



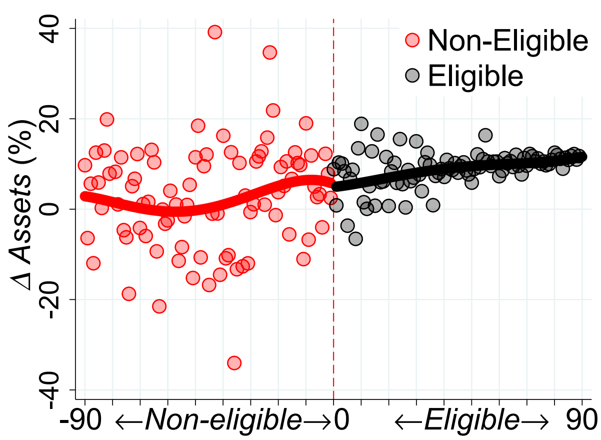
(c) Investment



(d) Employment



(e) Operational Income

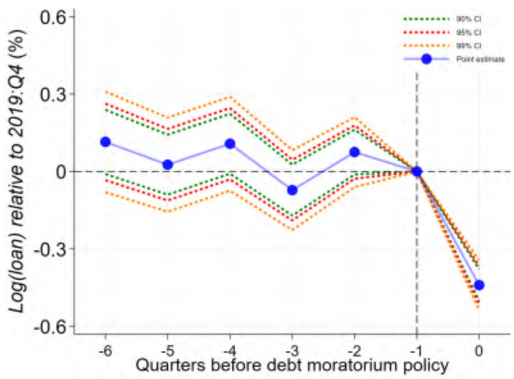


(f) Assets

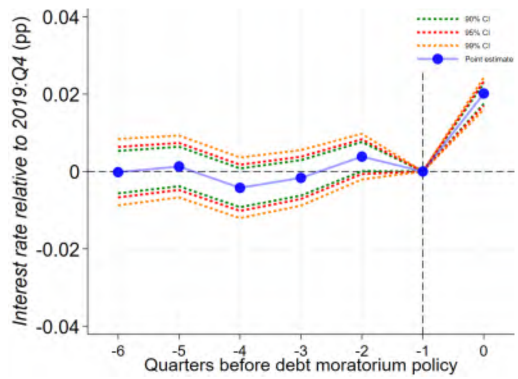
4.3.3 Parallel Trends Assumption

In Figure 8 we present our results that test for the parallel trends assumption (for the case of non-stressed firms), as described in equation (19). As shown, the effect on loan amount (panel a) and interest rates (panel b) prior to the policy are not statistically significant.

Figure 8: Parallel trends assumption for non-stressed firms



(a) Log(Loan)



(b) Interest Rate

5 A Quantitative Exploration

In this section, we briefly describe a quantitative default model that illustrates the potential macroeconomic impact of the introduction of the debt moratorium policy. We make two important modeling choices that are important in generating our findings. Our analysis hinges on two critical modeling decisions that underpin our findings.

Firstly, we incorporate an additional defaultable asset class, which incorporates grace periods during adverse shocks on payments. This inclusion allows us to propose potential amendments to the policy for future reference. If one were to consider this shock as a one-time event, or if such a moratorium policy were never to be introduced again, our analysis would have focused solely on counterfactual policies, without the need for a portfolio problem. However, given our anticipation that this longstanding policy might resurface in response to future shocks, it is both plausible and prudent to engage in a portfolio problem to explore alternative, welfare-enhancing moratorium policies.

To solve the portfolio problem, we rely on ingredients from Hatchondo et al. (2022). Furthermore, we adopt the production economy model originally proposed by Mendoza and Yue (2012). A salient ingredient of the framework of Mendoza and Yue (2012) is that firms require working capital financing to pay for a subset of imported inputs which are imperfect substitutes of domestic or other inputs. As a result, default generates an efficiency loss in production and results in endogenous decline in output. We extend the framework of Mendoza and Yue (2012) by allowing the rate on working capital loans to be a function of default risk as this is more plausible. Third, we introduce a Nash-bargaining game between the borrower and the lender in the event of a default.[8]

In particular, we study an equilibrium default model in which a representative firm obtains loans from banks in two different categories: (i) non-contingent (standard) loans: These loans are conventional and do not contain any special conditions. They follow the typical repayment structure. (ii) Moratorium loans: These loans have a unique feature - the possibility of suspending debt payments when the economy experiences liquidity shocks, especially when there is an increase in bank risk aversion. Other than this suspension feature, these loans are identical to standard loans. The interest rates for both standard and moratorium loans are determined in the model as endogenous variables. Two types of shocks affect the economy. Liquidity shocks: These shocks make otherwise risk-neutral banks risk-averse. These shocks are associated with changes in banks' risk aversion. Total factor productivity (TFP) shocks: These shocks affect the level of productivity of firms. Importantly, these two types of shocks are modeled to be correlated, reflecting the empirical observation of a relationship between them. During liquidity shocks, although payments on moratorium loans are suspended, they continue to accrue interest during the suspension period.

The main trade-off that firms face with the availability of moratorium assets is that they provide the right covariance: The firm can borrow cheaply with a moratorium asset precisely during risk-off episodes and avoid costly defaults. However, the cost of borrowing with a moratorium asset increases in normal times because banks do not like their claims to be delayed during adverse shocks. Thus, firms actively manage their portfolio between standard (non-contingent) loans and moratorium loans.

After tightening the link between our empirical results and the quantitative model, we investigate the effects of an unanticipated announcement that permits firms to borrow new loans with payment suspensions. This analysis allows us to explore the implications of

[8]The rationale is that the introduction of a new asset with grace period features may alter the renegotiation dynamics particularly when default likelihoods are high as these are the periods in which grace periods are triggered. By setting out, ex ante, a pre-defined path for a restructuring, such contracts would dramatically change the renegotiation and restructuring process. The outside options for all parties will be very different. Because of this, it is unclear that haircut numbers calculated based on non-moratoria restructurings and used in the calibration would apply to world where most debt was in moratoria loans. To address this concern, we incorporate a Nash-bargaining game between lenders and borrowers into the analysis. Intriguingly, it turns out that our outcomes remain equivalent even when we remove the Nash-bargaining game structure, assuming either zero recovery or a constant recovery upon the borrower's re-entry into the credit markets. This insight underlines the robustness of our results under different assumptions.

such a policy on various economic variables. In particular, we examine the effects on new loan amounts and interest rates, providing insights into the borrowing behavior of firms in response to the announcement. Additionally, we assess the impact on real variables such as employment, income, and overall welfare, enabling us to gauge the broader economic consequences of the policy. Furthermore, we complement our analysis by considering an amendment to the policy. Specifically, we explore the scenario where payments during suspensions do not accrue interest rates, or a portion of the loan is forgiven, or firms still pay a fraction of their loans during suspensions. By investigating this alternative approach, we aim to quantify the potential gains from such a modified moratorium policy.

Our research indicates that the benefits of the moratorium policy are significantly higher when payments do not accrue interest during suspensions. Similarly, the highest welfare gains are obtained when firms do not pay any fraction of their loans during suspensions. The intuition is as follows. TFP shocks are persistent, while the duration of the moratorium policy, which is triggered by a liquidity shock, is typically short-lived. Thus, debt suspension provides limited relief. With debt forgiveness, it provides the right covariance: both the probability of default and spreads are reduced in both the short and long run. This finding underscores the importance of carefully designing and implementing policies to maximize their positive impact on the welfare of firms and the economy as a whole.

In what follows, we provide a succinct description of the key elements of the model and relegate the rest of the exposition and details of the quantitative application to Appendix E. **Households.** Households choose consumption and labor supply so as to maximize a standard time-separable utility function. Households make the borrowing decision on behalf of the firms. In the event of a loan default, households engage in a Nash-bargaining game with banks. This negotiation process is aimed at determining the recovery rate for the amount that has become delinquent. This step reflects the households' interaction with banks in order to reach an agreement on how much of the delinquent sum needs to be repaid.

Final Goods Producers. Firms in this sector produce using labor and intermediate goods, as well as a time-invariant capital stock. They combine domestically produced inputs and imported inputs into a single final good.

Intermediate Goods Producers. Intermediate good producing firms rent labor services from households to produce domestic inputs to be used in the final goods production.

Lenders. Banks are risk neutral during normal times and become risk-averse during risk-off episodes. This transition follows an estimated Markov process. If a firm chooses to declare bankruptcy, banks go into a bargaining process with firms over the recovery rate on the loan.

6 Quantitative Results

This section presents our baseline results. Table 6 compares the data moments from Colombian data with the one obtained from the model. The model features plausible moments and matches both the debt statistics as well as the business cycle moments reasonably well. Briefly, the model generates a loan-to-income ratio of 15.5 percent, which corresponds to the median loan-to-income ratio of all Colombian firms in our administrative data. The model can also match the median credit spreads. It is not immediately possible to compute the bankruptcy rate in our data. Therefore, we instead aim to match the non-performing loans (NFL) ratio, which is around 3.5 in the data. We leave the details of the calibration targets and sources to Section Appendix E.7 and proceed to analyze the impact of moratorium loans.

6.1 The effects of moratorium debt

To assess the impact of moratorium debt, we begin by conducting a comparative analysis using both long-run statistical moments and impulse response function (IRF) evaluations. In particular, we compare simulation results in the benchmark economy without the presence of moratorium loans with the ones obtained when we introduce the policy for households to borrow both standard loans and moratorium loans. We assume suspended payments earn the risk-free rate ($r_m = r$) and thus the nominal haircut from triggering the contingency clause in moratorium loans is equal to zero. We assume moratoria payments decay at the same rate as the payments of standard non-contingent loans ($\delta_m = \delta$).[9] By comparing the results between these two scenarios, we can assess the impact of introducing moratorium debt on the long-run dynamics and responses of the economy to various shocks and conditions.

[9]When we assume that moratorium loan payments decline at the same rate as standard loan payments, it implies that moratorium loans have a longer duration than non-contingent loans, as we anticipate postponing the payments for moratorium loans. This phenomenon is illustrated in Figure E8. This extended loan duration could exacerbate the inefficiencies arising from the firm's lack of commitment to future borrowing (Hatchondo and Martinez, 2009). To ensure that our findings are not significantly influenced by the assumed duration of moratorium loans, we conduct experiments with varying durations and ascertain that equivalent outcomes are observed. For instance, altering δ_m in a way that aligns the durations of moratorium loans and standard loans does not notably impact our results. This indicates that the higher default probability associated with moratorium loans (as shown in Table 6) is not merely a consequence of assuming longer debt durations. Further details on this matter are available in footnote 11.

Table 6: Long-run effects of introducing moratorium loans.

	Data	Benchmark	Moratoria
Mean standard loan/income (%)	15.7	15.5	4.0
Mean moratorium loan/income (%)	*n.a.*	*n.a.*	14.2
Mean r_s (%)	5.7	5.7	6.5
Mean moratorium r_s (%)	*n.a.*	*n.a.*	7.6
Share of NPL	3.5	3.7	3.9
Recovery rate (%)	33	31.2	29.2
Duration	5.0	5.0	4.8
Duration moratorium	*n.a.*	*n.a.*	5.2
σ_{r_s}	2.2	2.4	2.82
σ_{r_s} moratorium	*n.a.*	*n.a.*	2.9
Labor decline during defaults (%)		14.4	14.3
Labor decline during high-risk-premium		2.8	3.2
Probability high-risk-premium starts (%)	15.0	15.0	15.0
Lower income during high-risk-premium (%)	4.0	4	4.5
$\Delta\ r_s$ with high-risk-premium shock	3	3	3.8
Fraction of defaults triggered by liquidity (%)		10.1	0.8
$\sigma(c)/\sigma(y)$		0.95	0.93
$\rho(c,y)$		0.99	0.99

The standard deviation of x is denoted by $\sigma(x)$. Moments are computed using detrended series. Trends are computed using the Hodrick-Prescott filter with a smoothing parameter of 100. Moments for the simulations correspond to the mean value of each moment in 500 simulation samples, with each sample including 30 years without a default episode. Simulation samples start at least five years after a default. Default episodes are excluded to improve comparability with the data. Consumption and income are expressed in logs. Default frequencies and the probability that a high-risk-premium episode starts are computed using all simulation periods. For moratorium debt, the yield (and spread), the debt duration, and the debt stock are computed using expected payments and thus incorporate uncertainty about the time of payment.

Table 6 presents the results of the baseline model in the second column and the long-run moments of the model with moratorium loans are presented in the third column.

In addition to examining long-run statistics, we also conduct an Impulse Response Function (IRF) analysis. This analysis allows us to compare the dynamic responses of the economy between the baseline scenario (without moratorium loans) and an alternative scenario where moratorium loans are introduced. By observing how key economic variables react over time to various shocks or policy changes, we can gain insights into how the presence of moratorium loans influences the short- to medium-term dynamics of the economy.[10] Figure 9 provides a visual comparison of the two simulations, starting from the transition point between the baseline economy and the economy with moratorium loans. The plots depict the relative deviation of variables from their simulated counterparts in the baseline economy, except for the "Moratoria/y" chart.

Both Figure 9 and Table 6 illustrates a result that aligns with the concerns expressed by critics of moratorium loans: the frequency of defaults increases, leading to higher spreads. This effect stems from the fact that moratorium loans contribute to an elevation in the overall debt level. Notably, households are inclined to borrow more with moratorium loans due to the absence of concerns related to rollover risks, as presented by risk-premium shocks.[11]

Examining Figure 9, one observes that the standard loan to income ratio experiences a decline of approximately 75 percent within 5 years, while moratorium loans to income reach their long-run averages within the same timeframe. This adjustment occurs gradually due to the long-term nature of debt.

The level of consumption (excluding defaults) initially increases by around 0.06 percent in response to the change to the economy with moratorium loans. However, consumption follows an inverted U-shaped pattern. After 20 years, consumption reaches a new level slightly below 0.1 percent lower than its baseline level.

The inverted U-shape in consumption is primarily influenced by the sovereign's consumption frontloading profile. As moratorium loans gradually increases towards its new steady-state level, debt dilution begins to take its toll. This leads to slightly lower prices for standard loan and an increase in default realizations within the economy with moratorium loans. The impact is also reflected in the average spread of standard loan, which rises,

[10] To compare the two scenarios, we conduct simulations using simulated economies. The simulations commence with a pool of 100,000 observations. All these observations commence with a debt level of zero and are characterized by an ergodic income distribution. To initiate the analysis, I simulate the trajectories of two separate economies. For each of these economies, I apply the decision rules established for the baseline economy until they reach a steady state. This steady state point is marked by consistent average debt levels, default rates, and bond spreads. This approach allows me to establish a stable basis for comparison between the two scenarios. Next, in one of the simulated economies, I continue using the decision rules of the baseline economy. In the other simulated economy, I switch to using the decision rules of the economy with moratorium loans. I continue the simulation until the averages of the variables reach their steady-state levels in the economy with moratorium loans.

[11] We have conducted simulations where the household is not permitted to buy back debt in the moratorium economy. Remarkably, the results remain almost identical, signifying that buybacks (potentially prompted by shifts in lenders' valuation of sovereign debt) do not significantly impact the simulations. Furthermore, when we simulate an economy solely reliant on moratorium debt (as opposed to a combination of moratorium and non-contingent debt), similar outcomes are observed, albeit with slightly higher debt levels (18.2), spreads (8.45), and the same default probabilities. This modest discrepancy could potentially be attributed to the extended duration of moratorium loans, exacerbating the inherent time inconsistency problem with long-term debt (Hatchondo et al. (2016)). For further discussion on the effects of the duration of moratorium loans, see footnote 9.

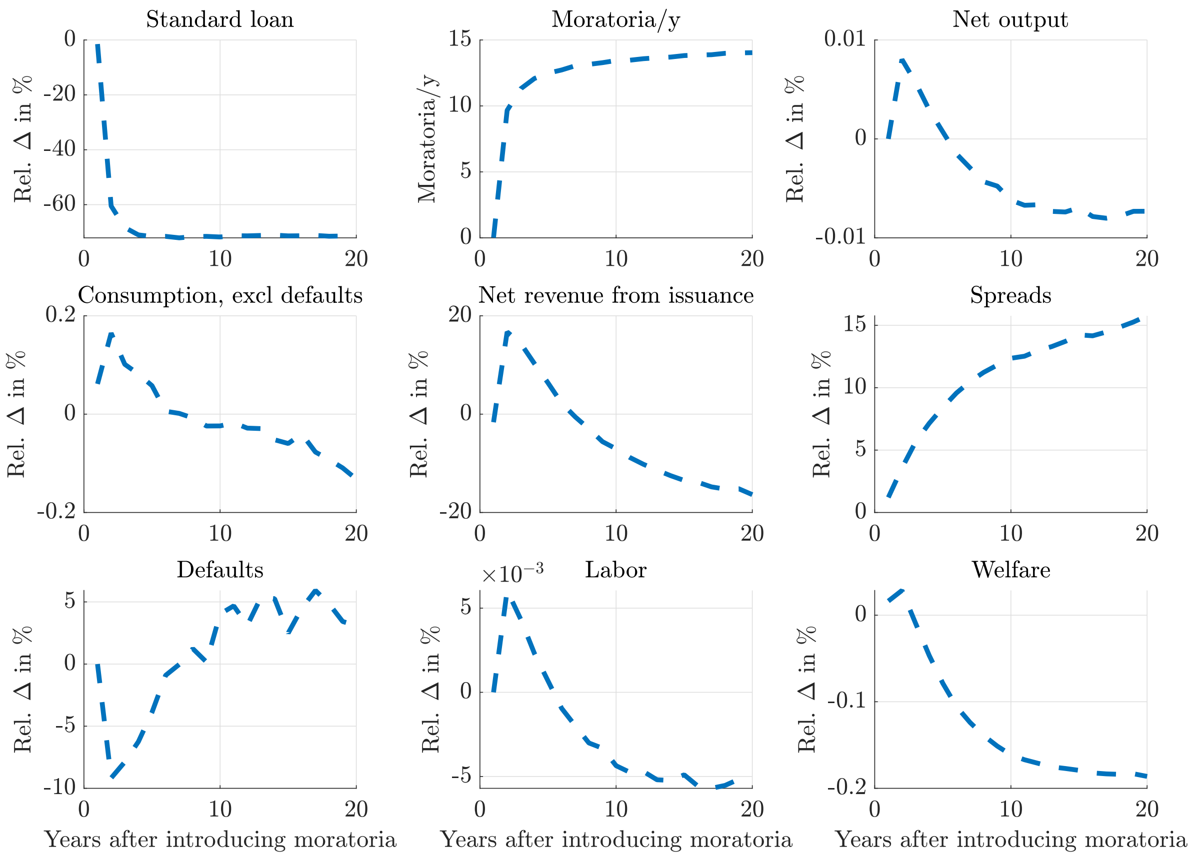
raising the cost of rolling over moratorium loans and subsequently resulting in decreased consumption levels.

The economy with moratorium loans attains lower consumption volatility profile during the transition (Table 6). Net revenue from issuance chart measures how much revenue does the sovereign generate from total debt issuance (both standard loan and moratorium loans) and is $-(q(b', b'_m, y, p)\,[b' - b(1-\delta)] + q_m(b', b'_m, y, p)\,[b'_m - b_m(1-\delta_m)] - \kappa b - \kappa b_m)$. This also explains the inverted U-shape in consumption. It is important to note that net revenue issuance is always negative for both economies. To ensure accurate interpretation, I multiply it by negative one. Otherwise, it appears in the graph as if the long-run net revenue issuance is greater in the economy with moratorium loans, while it is actually lower.

The macroeconomic variables of labor and output exhibit a consistent pattern, closely mirroring the trends observed in the default chart. Specifically, both output and labor experience an initial surge. This initial uptick is primarily attributed to the fact that in an economy with moratorium loans, defaults are initially circumvented. Consequently, this economy avoids the sharp declines in both output and labor that typically accompany defaults. The underlying intuition behind this decline in output and labor can be traced back to insights articulated by Mendoza and Yue (2012). Their work sheds light on the mechanisms driving this phenomenon. In this model, final goods producers make decisions regarding their input choices. These inputs consist of a combination of imported and domestic components, and they are not perfect substitutes; they are aggregated using an Armington aggregator. Additionally, there are different varieties of imported inputs, which are also not perfect substitutes, and these are aggregated using a Dixit-Stiglitz aggregator. Importantly, some of these imported input varieties necessitate foreign working capital financing, while the production of domestic inputs relies on domestic labor. In this framework, the concept of "strategic default" leads to an efficiency loss. This is because final goods producers are unable to continue using the imported input varieties that require credit. Instead, they must find alternative imported inputs and domestic inputs to replace them. Additionally, there is a labor reallocation from the final goods sector to the sector responsible for producing domestic inputs. The consequences of this strategic default include disruptions in the production process due to the unavailability of certain imported inputs that require credit. Furthermore, the shift of labor away from the final goods sector can affect overall productivity and efficiency in the economy. These effects contribute to the efficiency loss observed in this model.

The welfare implications of the analysis are noteworthy. Initially, welfare in the economy with moratorium loans experiences a slight increase, and then slides into the negative territory which becomes more pronounced over the course of a few years during the transition period. In the long run, the welfare losses amount to approximately 0.12 percent. In the subsequent subsection, I delve further into the factors contributing to these losses, providing a more comprehensive understanding of their implications.

Figure 9: Impulse response functions of introducing moratoria loans.



Effects of introducing moratoria loans along with standard loans on debt, default, consumption (excluding default episodes), spread, labor, output and welfare changes. Net revenue from issuance is defined as $-(q \times (b' - (1-\delta)b) - \delta b - q_a \times a' + a)$ whereas revenue from total debt issuance is defined as $q \times (b' - (1-\delta)b) + q_a \times a'$.

6.2 Event Analysis

The assessment of whether our quantitative model aligns with empirical estimates is a complex endeavor, and we must exercise caution when drawing comparisons. There are inherent challenges in bridging microestimates with a general equilibrium macro model (see Önder et al. (2023). Several nuances need consideration. Here are three key points to keep in mind. (i) *Empirical Strategy vs. Model Assumptions:* In our empirical approach, we aim to discern the impact of the moratoria policy on corporate lending. We employ localized methods, control variables, and fixed effects (e.g., firm-time fixed effects) to account for credit demand. In contrast, the quantitative model doesn't control for demand; it seeks to model it. Some effects are a result of firm credit demand. (*ii*) *Partial Equilibrium vs. General Equilibrium:* Empirical estimates are interpreted as partial equilibrium effects on loans, assuming fixed equilibrium prices and rates of return. The quantitative model operates in a general equilibrium framework where changes in the endogenous components (e.g., rates of return) and loans can affect aggregate outcomes. (*iii*) *Comparing Access to Policy*: Empirical analysis measures the incremental effect of having access to the policy relative to firms that could not access it. The model incorporates these dynamics but abstracts from some of the aggregate effects by using firms that barely missed the policy as controls.

Given these disparities, the objective now is to explore how our model's implications align with empirical observations. This will be done through an event study analysis conducted during the Covid-19 crisis in Colombia. The timeline is as follows:

The economy operates according to the dynamics of the baseline model up to 2020 and starting in 2020, the economy transitions to the moratoria economy. Throughout this transition, both the baseline and liquidity line economies in the model will face identical TFP (Total Factor Productivity) and liquidity shocks as their empirical counterparts.[12]

This event study analysis aims to bridge the gap between the theoretical model and the empirical findings outlined in Section 4. By comparing how the model predicts outcomes during the Covid-19 crisis, we seek to establish a tighter link between the model's assumptions and the real-world estimates we have derived.

Results from this analysis are provided in Figure 10. The upper left chart shows the feeded TFP shocks and the initial state corresponds to a liquidity shock (in our case the Covid-19 shock) with which moratoria is triggered. The plots depict the relative deviation of variables from their simulated counterparts in the baseline economy, except for the "Moratoria/income" chart.

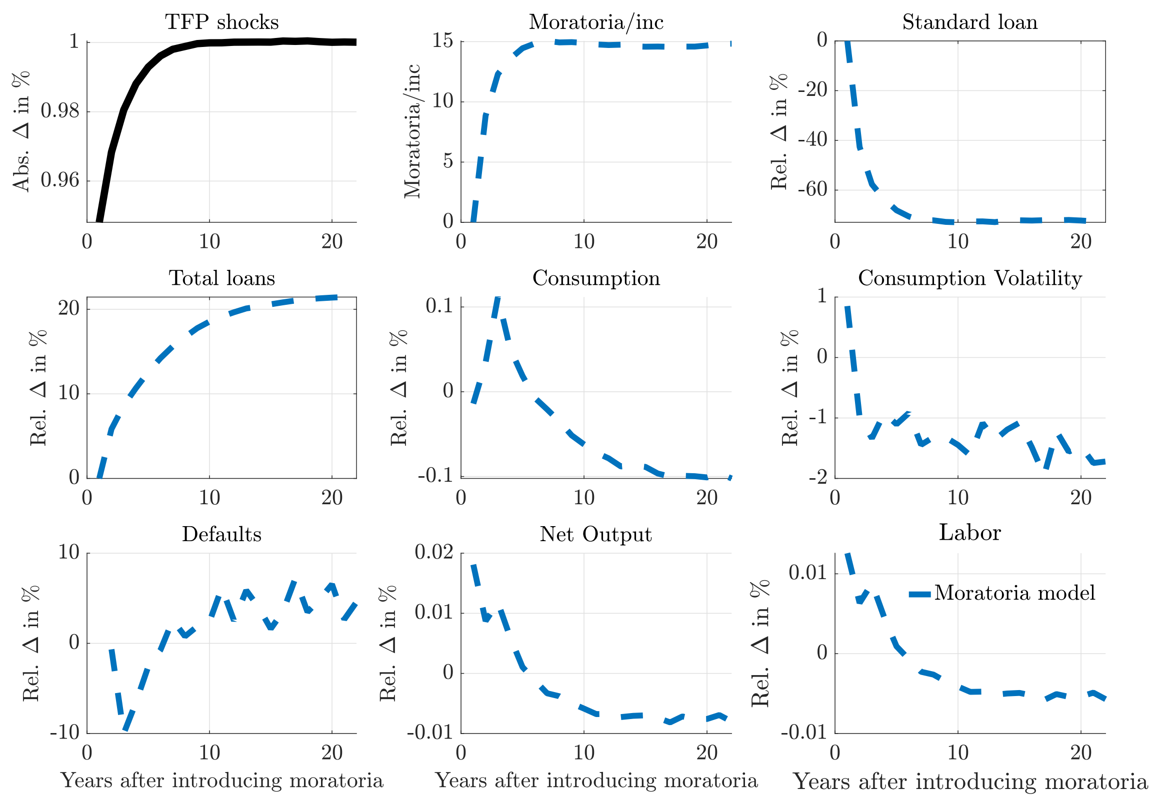
The model generates some stark similarities to the one we observed in our empirical analysis. To start with, our empirical estimates in Section 4.1.1 point to an average of 15.8% increase in loan amounts extended to the firms who barely have accessed the policy while we obtain a 10% increase in the short-term and 20% increase in the long-run for Total Loans chart. Similarly, we have documented that firms who have barely accessed the moratoria loans defaulted 1.5% less often than their counterparts. Our default model also resonates

[12] We follow the methodology provided in Önder and Sunel (2021) for this event analysis. Please refer to it for the technical details.

with this finding quite well for the short-run. As an outcome of fewer defaults, interest rate spreads are also lower in the short-term for firms in an economy with moratoria loans. Turning to macroeconomic variables, our model does a good job picking up the directions of the macroeconomic variables. In particular, our model predicts an immediate increase in the output, which is driven by increase in profits and a jump in labor which are also consistent with our estimates provided in Section 4.2.1.

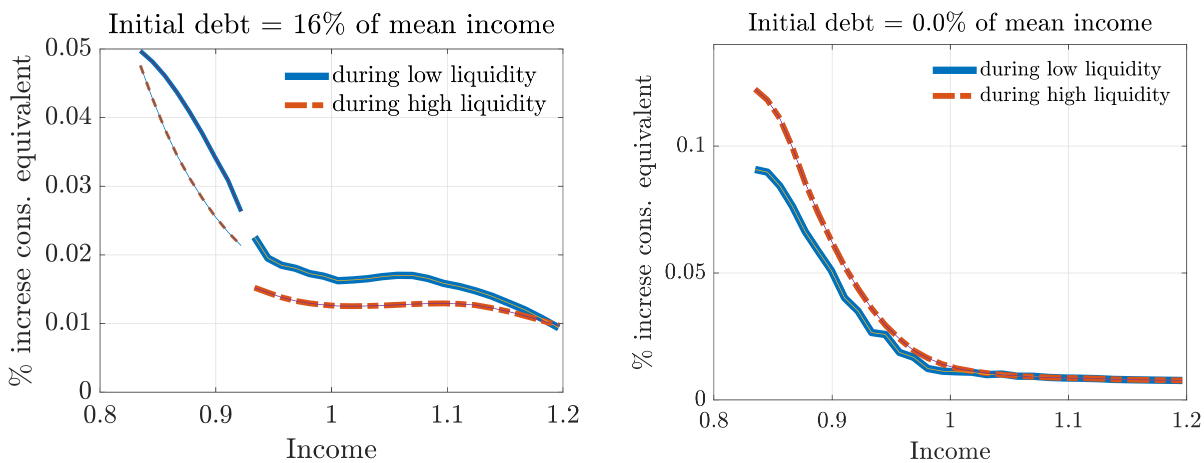
Based on our analysis, we can reasonably conclude that our quantitative model offers a reasonably accurate description of the primary empirical estimates. This alignment between the model and empirical findings suggests that the model's assumptions and mechanisms capture essential aspects of the real-world dynamics we have studied. Moreover, in the upcoming subsection, we delve into a welfare analysis. This aspect of our investigation cannot be directly assessed through our empirical strategy.

Figure 10: Impulse response functions of introducing moratoria loans during a liquidity shock



Effects of introducing moratoria loans along with standard loans on debt, default, consumption (including default episodes), labor and output changes.

Figure 11: Welfare gains from introducing loan moratorium.



The panel plots welfare gains measured in consumption-equivalent terms from the introduction of debt moratorium. The initial debt portfolio at the time of inception entails no moratorium ($b_m = 0$) and a stock of defaultable debt that equals the long-run average debt-to-mean-annual-income ratio of the baseline economy. The right panel plots welfare gains when the stock of defaultable debt equals to zero.

6.3 Welfare Implications

In this section, I compute state-dependent welfare gains in terms of percentage changes in compensating consumption variations that would leave a household indifferent between staying in the baseline economy or switching to the economy with moratorium loans. I measure consumption-equivalent welfare gains denoted by η as,

$$\mathbb{E}_t \sum_{\tau=t}^{\infty} \beta^{\tau-t} u \left(c_\tau^{baseline}[1+\eta] | b_{m,t}, b_t, s_t \right) = \mathbb{E}_t \sum_{\tau=t}^{\infty} \beta^{\tau-t} u \left(c_\tau^{moratoria} | b_{m,t}, b_t, s_t \right), \tag{20}$$

in which the consumption streams $\{c_\tau^{baseline}\}_{\tau=t}^{\infty}$ and $\{c_\tau^{moratoria}\}_{\tau=t}^{\infty}$ are attained in the baseline economy and in the economy with moratorium loans respectively. The welfare gain measure denoted as η is computed under the condition of initial non-contingent loan b_t, moratorium loans $b_{m,t}$, and the exogenous state of the world $s_t = \epsilon_t, p_t$, where ϵ_t represents the output and p_t signifies the exogenous risk premium shock. This welfare gain measure is derived from equilibrium value functions, encompassing the CRRA (Constant Relative Risk Aversion) form for household preferences:

$$\eta(b_{m,t}, b_t, s_t) = \left(\frac{V^{baseline}(b_{m,t}, b_t, s_t)}{V^{moratoria}(b_{m,t}, b_t, s_t)} \right)^{\frac{1}{1-\sigma}} - 1, \tag{21}$$

In this equation, $V^{baseline}(b_t, s_t)$ and $V^{moratoria}(b_{m,t}, b_t, s_t)$ refer to value functions evaluated for the given combinations of moratorium loans $b_{m,t}$, non-contingent debt b_t, and state variables $s_t = \epsilon_t, p_t$. The positive values of η indicate that transitioning to an economy with moratorium loans is preferable. This measure serves as an indicator of the extent to which the introduction of moratorium loans leads to improvements in welfare.

Figure 11 shows that introducing moratorium increases welfare. The initial consumption increase triggered by the household's willingness to sustain higher levels of indebtedness with moratorium loans as well the decline in initial default incidences account for the bulk of these welfare gains. In addition, as expected by proponents of moratorium and illustrated in Table 6, debt moratorium improve consumption smoothing. But in the standard default model the effect of lowering consumption volatility on welfare are small.

Despite small and negative welfare changes observed during the transition from the baseline economy to the economy with moratorium loans, as shown in the bottom panel of Figure 9, the magnitude of welfare losses becomes more pronounced after a few years, eventually reaching -0.2 percent after 20 years.

Figure 12 provides a deeper understanding of the heterogeneity in welfare changes present within the ergodic distribution of the economy featuring moratorium loans. The left chart depicts the distribution of welfare changes during the initial implementation of moratorium loans. The average of this distribution corresponds to the initial data point in the welfare plot shown in the lower panel of Figure 9. Conversely, the right chart illustrates the welfare distribution in the steady state. The average of this distribution corresponds to the final data point in the welfare plot depicted in the lower panel of Figure 9. Both charts in the figure reveal considerable heterogeneity in the welfare changes and following important observations stand out. An important observation to highlight is that when the policy was initially introduced, all observations in the distribution experienced positive welfare gains. However, as time progressed, a notable shift occurred in the distribution of welfare changes, with the majority of observations moving into the negative range. This shift signifies that, over time, the overall welfare impact of the policy has become less favorable.

In the next section, we will propose an amendment of the policy with which welfare gains remain in the positive territory in the long-run as well.

7 Improving the policy

Our baseline analysis assumes that debt moratorium policy suspends all debt payments and do not imply a debt relief on the level of debt ($r_m = r$). In this section we investigate

Figure 12: Distribution of welfare changes at the moment of the introduction of moratorium loans and in the long run with long-term debt.

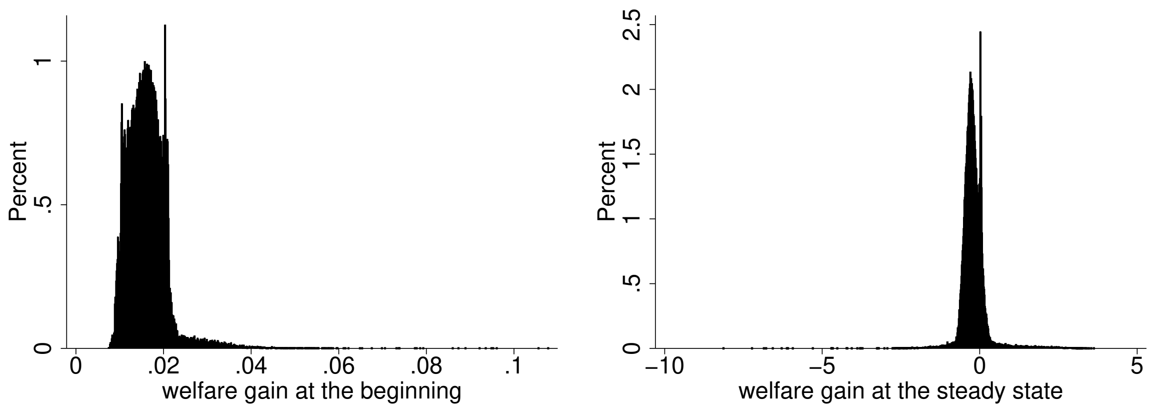
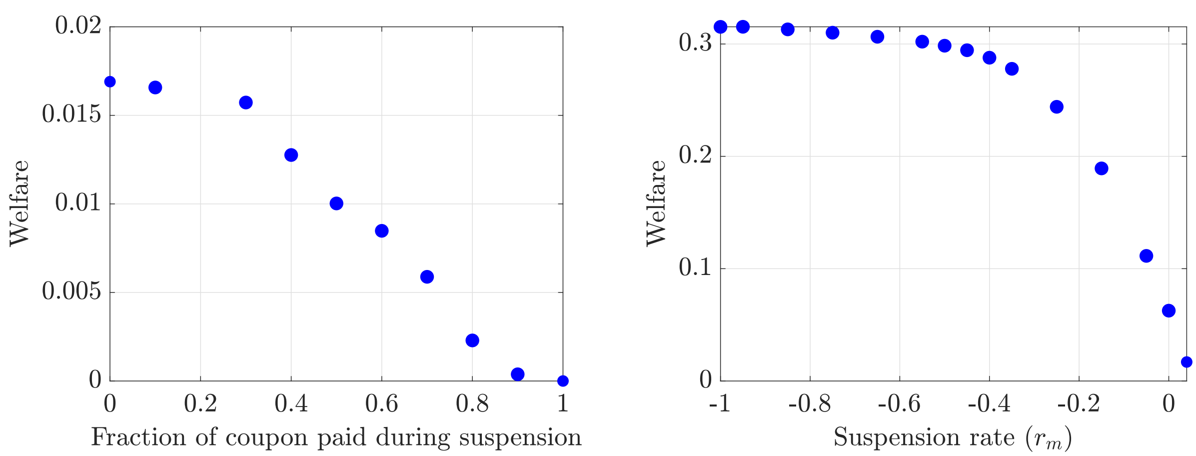


Figure 13: Optimal moratorium debt relief.



the optimal debt relief that can be offered. We show in the left panel of Figure 13 that households do not prefer less debt relief as welfare gains are lower if the policy suspends only a fraction of debt payments.[13]

The right panel of Figure 13 shows that households would benefit from a policy that provide additional debt relief: The optimal rate of growth of suspended moratorium payments (r_m) is negative, implying that it is optimal for the policy to entail haircuts following adverse global shocks. Without haircuts, recall that the moratorium loans

[13]Let θ denote the fraction of coupons paid during the moratorium payment suspension. The next-period stock of moratorium loans is given by

$$b'_m = [1 - \mathcal{I}(p)]\, b_m(1-\delta_m) + \mathcal{I}(p) b_m[\theta(1-\delta) + (1-\theta)e^{r_m}] + i_m.$$

Note that $\theta = 1$ makes the debt non-contingent and $\theta = 0$ corresponds to the case in which all moratorium payments are suspended.

Table 7: Debt-forgiveness Moratoria loans.

	Bmark	$r_m = r$	$r_m = 0.0$	$r_C = -0.35$	$r_C = -1$
Mean standard loan/income (%)	15.5	4.4	3.9	3.1	5.1
Mean morator. loan/income (%)	*n.a.*	14.2	15.7	20.7	19.8
Mean r_s (%)	5.7	6.5	6.4	4.9	3.9
Mean moratorium r_s (%)	*n.a.*	7.6	8.3	12.9	19.0
Share of NPL	3.7	3.9	3.9	3.3	2.9
Recovery rate (%)	31.2	29.2	29.5	34.1	36.9
$\sigma(c)/\sigma(y)$	0.99	0.97	0.92	0.93	0.93
$\sigma(r_s)$	1.43	1.62	1.22	1.16	1.13
Δ r_s with shock	3.1	3.8	3.6	1.9	1.0
Δ r_s moratorium with shock	*n.a.*	3.7	3.6	2.7	2.0

feature higher default probability, picked up by higher spreads. With haircuts, however, moratorium loans feature significantly lower default probability, thus lower spreads, and a lower spread increase triggered by risk-premium shocks as well as improved consumption smoothing picked up by a lower consumption volatility.

The outcomes observed for debt-forgiveness are in line with findings from other state-contingent debt instruments. These instruments similarly enable the reduction of default probabilities and facilitate higher levels of indebtedness, achieved by diminishing debt levels following adverse shocks. This consistency in results across various state-contingent debt approaches highlights the effectiveness of such instruments in mitigating default risks and promoting increased indebtedness in the aftermath of unfavorable economic shocks (Önder (2023b)).

Our intuition is similar to Hatchondo et al. (2022). Moratorium loans that solely trigger a suspension of payments indeed lead to an escalation in the overall debt level. This occurs due to the automatic rollover of suspended payments, which effectively increases the total debt burden. Consequently, this heightened level of debt results in a higher default probability and elevated spreads. These effects can be detrimental to the household's capacity to borrow for the purpose of consumption smoothing.

Conversely, when moratorium loans are designed with debt relief, they have the opposite effect. These assets work to reduce the level of debt, subsequently lowering the default probability and decreasing spreads. This, in turn, enhances the household's ability to borrow for the purpose of consumption smoothing. In essence, the presence of debt relief on moratorium loans serves as a mechanism to alleviate the adverse consequences associated with high debt levels and increased default risks.

The right panel of Figure 13 shows that welfare gains from increasing haircuts level off after sufficient debt relief is provided. This occurs because, as illustrated in Table 7, if moratorium loans provide too much debt relief (haircuts are too high), the household can always compensate by borrowing fewer moratorium loans and more non-contingent bonds.[14]

8 Conclusion

Our study presents a thorough examination of the implications of implementing a debt moratorium policy, which has been historically utilized as a means to address repayment challenges during periods of economic distress. By combining theoretical predictions with empirical analysis, we aim to shed light on the effects of this policy across various dimensions.

Theoretical predictions, grounded in the concepts of demand and supply elasticities, suggest that firms that do not experience financial stress will face higher loan interest rates, while stressed firms will observe an increase in their loan amounts. To empirically test these predictions, we leverage administrative data from Colombia and employ, for stressed firms, a regression discontinuity design. We argue that by comparing loans that barely qualified for the policy with those that barely missed it, we can accurately evaluate the causal effects of the policy. For non-stressed firms, we conduct a Difference-in-Difference estimation and control for bank and firm-time fixed effects.

Beyond examining the impact on loan rates and amounts, our analysis also investigates how real variables such as investment and labor are influenced by the debt moratorium policy. This provides a comprehensive understanding of the broader implications of the policy on the overall economy.

Furthermore, we construct a quantitative default model to gain insights into both short- and long-term gains and losses associated with debt moratorium policies. Notably, our findings indicate substantial welfare gains when the policy incorporates the forgiveness of interest accumulation during suspension episodes.

Through our comprehensive approach combining theoretical, empirical, and quantitative analysis, we aim to provide a comprehensive assessment of the effects of a debt moratorium policy, offering valuable insights for policymakers and stakeholders involved in designing and implementing such measures.

[14]Note however that in the model, the household's ability to compensate for excessive debt relief in moratorium loans is not perfect. Moratorium loans and non-contingent bonds have different durations and committing to higher haircuts implies commitment to a shorter expected duration. Longer durations imply stronger ex-post incentives to dilute the value of bonds held by lenders.

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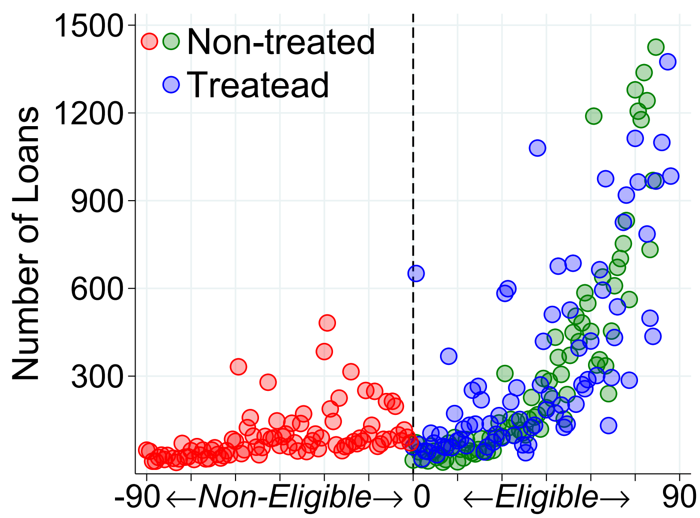
Supplementary

Online Appendix

Appendix A Fuzzy RDD characterization

In this section we further characterize the *fuzzyness* in our RDD design. As explained in Section 3.3, for reasons such as lack of information or costs associated with a time consuming process, some eligible firms decided not to take part in the government policy. Figure A1 clearly depicts this, by showing eligible borrowers (positive support of the running variable) that either received (blue dots) or did not receive the policy (green dots).

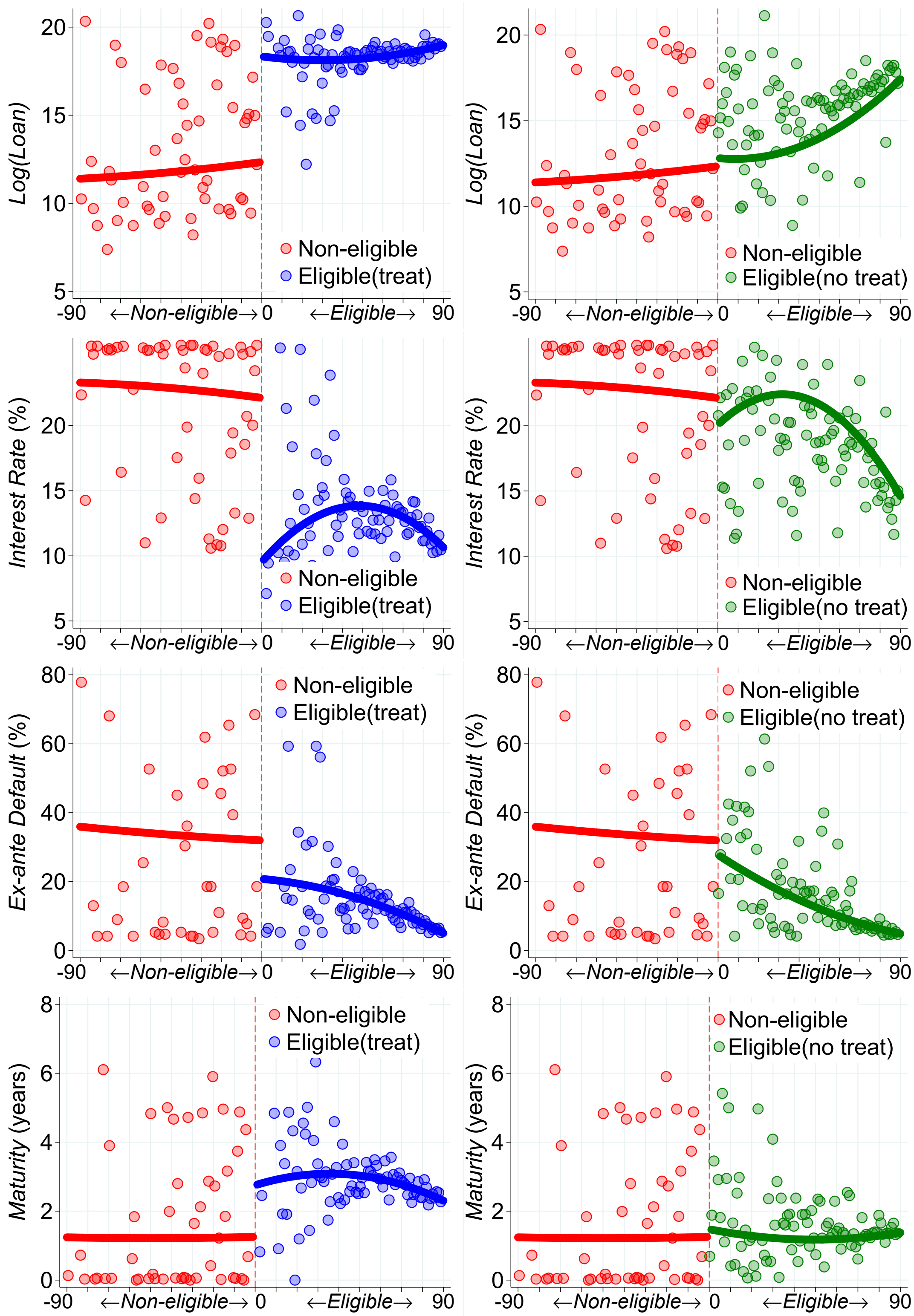
Figure A1: Treated and non-Treated Loans



The figure displays the number of commercial loans along the running variable. All ineligible loans (red) are to the right of the cutoff. All eligible loans on the left of the cutoff are either treated (blue) or non-treated (green) by the debt moratorium policy in Colombia.

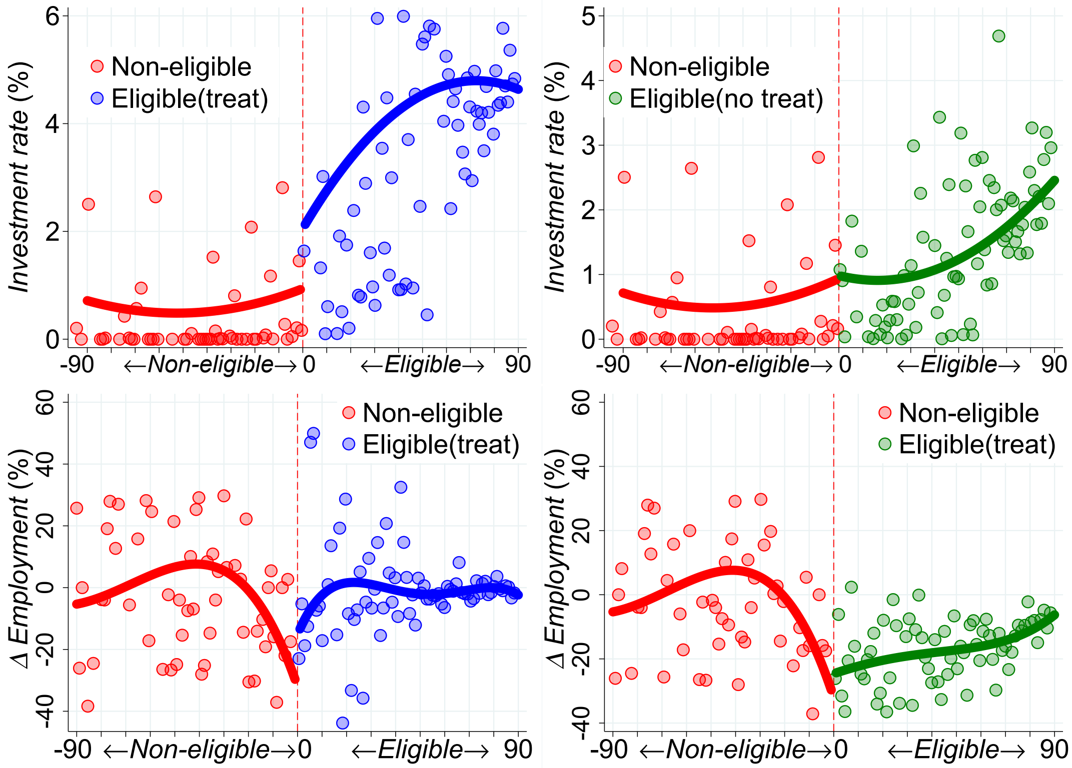
If for some reason these "untreated but eligible" loans showed a significant effect after the policy, then the validity of the design would be compromised, since the effects would not be attributable to receiving treatment, but rather, on being eligible. In Figure A2 we split the eligible sample into eligible treated (left panels) and eligible non-treated (right panels). As shown, the discontinuous jump at the cutoff is only significant for those eligible loans that in fact received treatment. This result applies to all variables considered: loan amount (row 1), interest rates (row 2), probability of default (row 3), and maturity (row 4). Results for other variables, yielding similar results, are available upon request.

Figure A2: New Loans Conditions: Eligible Treated and Non-Treated vs Non-Eligible.



New loan amount(first row), interest rate(second row), Ex-ante default prob.(third row), and maturity(fourth row)

Figure A3: Firm Level Outcomes: Eligible Treated and Non-Treated vs Non-Eligible.



Investment rate(first row) and employment growth(second row)

Appendix B Summary Statistics

Table B1: Loan and firm level outcomes: Stressed Firms

	Mean	S.D	P^{25}	P^{50}	P^{75}	N_{obs}
Eligible-Treated						
Log(Loan)	308.58	1062.98	0.11	13.23	132.65	9,119
Interest	0.19	0.09	0.11	0.25	0.27	9,082
Maturity	19.19	8.94	10.51	25.07	27.17	9,082
Collateral	0.16	0.34	0.00	0.00	0.00	8,964
Rating	4.65	0.76	5.00	5.00	5.00	4,200
Ex-ante default	0.07	0.15	0.04	0.04	0.04	12,088
Ex-post default	0.09	0.29	0.00	0.00	0.00	12,088
Delinq days	7.44	24.27	0.00	0.00	2.00	6,292
ΔEmp.	-0.01	0.58	-0.23	-0.07	0.10	3,988
Inv. rate	0.02	0.05	0.00	0.00	0.02	3,479
ΔOp. Rev.	-0.20	0.65	-0.48	-0.17	0.08	9,794
ΔLiab.	0.03	0.29	-0.07	0.01	0.14	9,913
ΔAssets	0.01	0.50	-0.14	0.02	0.20	9,818
ΔProfits	-0.03	0.30	-0.13	-0.03	0.02	9,264
ΔEquity	0.02	0.18	-0.02	0.01	0.06	9,913
Eligible-Non Treated						
Log(Loan)	487.07	1076.45	30.63	144.21	422.02	6,070
Interest	0.13	0.07	0.08	0.11	0.16	6,056
Maturity	13.02	7.42	8.15	11.05	16.46	6,056
Collateral	0.28	0.39	0.00	0.21	0.44	5,957
Rating	4.71	0.67	5.00	5.00	5.00	5,687
Ex-ante default	0.06	0.14	0.02	0.04	0.04	9,207
Ex-post default	0.04	0.19	0.00	0.00	0.00	9,207
Delinq days	5.05	20.25	0.00	0.00	0.00	8,639
ΔEmp.	0.05	0.76	-0.27	-0.07	0.21	3,291
Inv. rate	0.02	0.05	0.00	0.00	0.02	1,764
ΔOp. Rev.	-0.18	0.75	-0.51	-0.11	0.14	5,455
ΔLiab.	0.03	0.34	-0.08	0.02	0.15	5,577
ΔAssets	-0.01	0.58	-0.21	0.00	0.22	5,530
ΔProfits	-0.00	0.36	-0.12	-0.00	0.04	5,041
ΔEquity	0.04	0.22	-0.03	0.02	0.08	5,577
Non-Eligible						
Log(Loan)	262.00	1039.64	0.01	0.16	70.22	430
Interest	0.19	0.10	0.11	0.26	0.27	423
Maturity	19.06	10.08	11.09	26.17	27.17	423
Collateral	0.09	0.30	0.00	0.00	0.00	405
Rating	3.09	1.50	2.00	3.00	5.00	426
Ex-ante default	0.59	0.45	0.05	1.00	1.00	562
Ex-post default	0.32	0.47	0.00	0.00	1.00	562
Delinq days	50.72	148.88	0.00	8.00	50.00	558
ΔEmp.	0.08	1.00	-0.60	-0.08	0.39	293
Inv. rate	0.00	0.03	0.00	0.00	0.00	556
ΔOp. Rev.	-0.38	0.93	-0.98	-0.31	0.10	945
ΔLiab.	-0.05	0.39	-0.14	0.00	0.04	207
ΔAssets	-0.02	0.59	-0.15	0.00	0.15	206
ΔProfits	-0.09	0.38	-0.24	-0.06	0.00	206
ΔEquity	-0.02	0.25	-0.08	0.00	0.04	227

Table B2: Loan and firm level outcomes: Non-Stressed Firms

	Mean	S.D	P^{25}	P^{50}	P^{75}	N_{obs}
Eligible-Treated						
Log(Loan)	1037.15	2289.61	57.27	250.00	854.83	6,492
Interest	0.12	0.07	0.08	0.11	0.15	12,223
Maturity	2.38	2.11	1.00	2.00	3.00	12,613
Collateral	0.36	0.67	0.00	0.21	0.50	23,346
Rating	4.93	0.34	5.00	5.00	5.00	23,346
Ex-ante default	0.04	0.07	0.02	0.04	0.04	23,346
Ex-post default	0.01	0.11	0.00	0.00	0.00	21,280
Delinq days	1.85	9.94	0.00	0.00	0.00	21,280
ΔEmp	-0.07	0.39	-0.20	-0.07	0.07	5,955
Inv rate	0.02	0.05	0.00	0.00	0.02	3,478
ΔOp. Rev	-0.19	0.54	-0.45	-0.16	0.07	8,667
ΔLiab.	0.02	0.28	-0.07	0.02	0.14	9,158
ΔAssets	0.02	0.49	-0.14	0.02	0.20	9,288
ΔProfits	-0.07	2.19	-0.13	-0.03	0.02	9,264
ΔEquity	-0.08	9.49	-0.05	0.04	0.17	9,101
Eligible-Non Treated						
Log(Loan)	1746.71	3393.90	76.61	375.93	1500.00	9,632
Interest	0.13	0.08	0.07	0.11	0.18	17,992
Maturity	1.71	1.85	0.25	1.00	3.00	18,773
Collateral	0.32	0.74	0.00	0.00	0.50	39,823
Rating	4.94	0.31	5.00	5.00	5.00	39,823
Ex-ante default	0.04	0.06	0.02	0.04	0.04	39,821
Ex-post default	0.01	0.08	0.00	0.00	0.00	37,859
Delinq days	1.06	6.71	0.00	0.00	0.00	37,859
ΔEmp	-0.08	0.46	-0.21	-0.06	0.11	10,391
Inv rate	0.02	0.05	0.00	0.00	0.01	2,318
ΔOp. Rev	-0.19	0.65	-0.50	-0.13	0.12	5,460
ΔLiab.	0.01	0.34	-0.08	0.01	0.13	6,151
ΔAssets	-0.02	0.58	-0.19	0.00	0.21	6,263
ΔProfits	-0.06	2.60	-0.13	-0.01	0.04	5,932
ΔEquity	0.25	10.08	-0.06	0.04	0.18	6,123

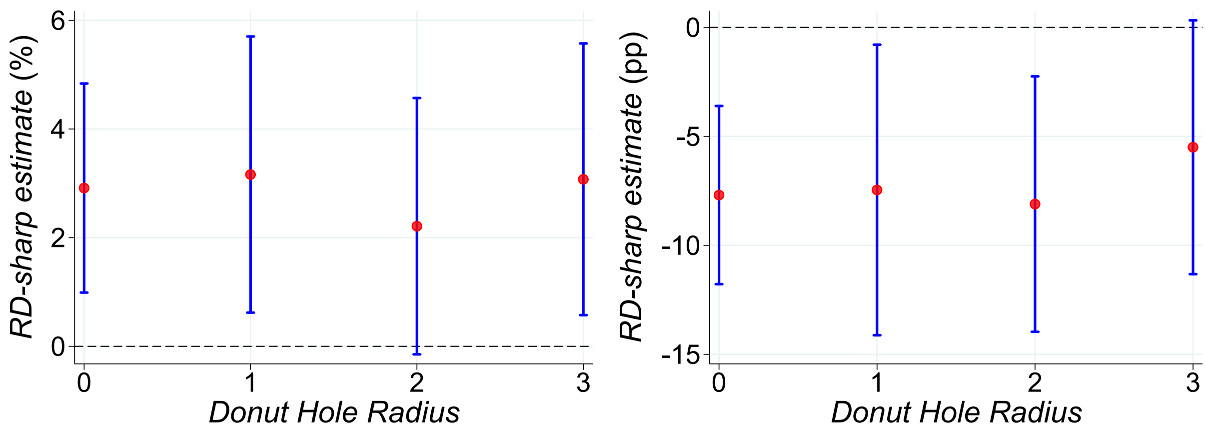
Appendix C Additional Robustness Checks

Appendix C.1 Donut-Hole Test

In this exercise we evaluate the sensitivity of our benchmark results, when excluding observations in the close vicinity of the cutoff-point (1, 2, or 3 days before/after the actual cutoff, $X_{ij} = 0$). These observations are, in principle very informative, with similar values of the running variable. The test, however, checks for additional "bunching" of observations around the cutoff that the McCrary test (see Figure 3) might have potentially missed.

Figure C4 shows similar results when excluding 1, 2, or 3 days before/after the actual cutoff suggesting a lack of "bunching" of observations –at and close to– the cutoff-point.

Figure C4: Donut-Hole Sensitivity Test



(a) Log(Loan)　　(b) Interest Rate

Appendix C.2 Pre-existing differences with respect to 2019: Stressed-Firms

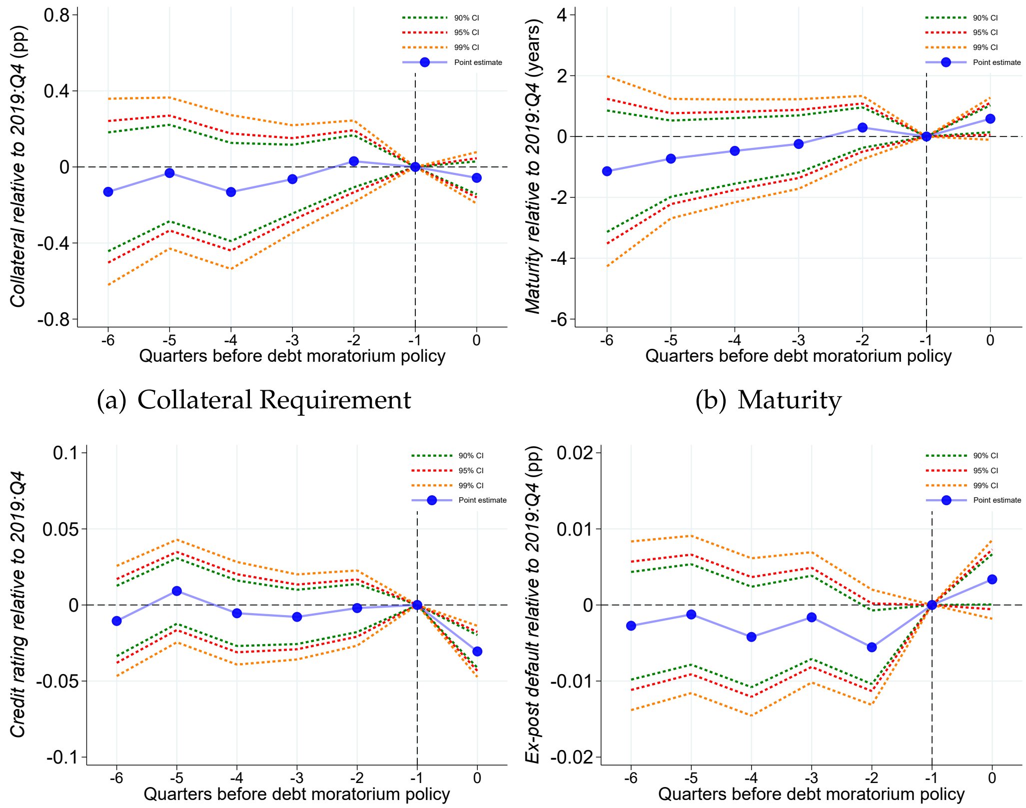
Table C3: Testing for pre-existing differences prior to the policy (stressed firms)

Variable	RD Estimator	Robust Inference		MSE-Optimal Bandwidth	Observations
		p-value	95% Conf. Int.		
Log(Loan)	0.14	0.43	[-0.16, 0.36]	29.82	45,899
Interest	-0.00	0.46	[-0.01, 0.01]	37.83	45,235
Collateral	-0.01	0.82	[-0.76, 0.97]	29.33	37,920
Maturity	0.02	0.93	[-0.22, 0.24]	30.66	45,934
Rating	-0.10	0.60	[-0.33, 0.19]	15.32	45,495
Ex-ante default	0.03	0.59	[-0.10, 0.17]	16.67	45,495
Ex-post default	0.03	0.41	[-0.03, 0.08]	25.16	45,495
Delinquency days	-2.21	0.57	[-19.46, 10.72]	21.29	46,260
Inv. rate	0.01	0.50	[-0.03, 0.07]	29.19	4,951
Δ Emp.	-0.19	0.32	[-0.58, 0.19]	42.62	16,745
Δ Op. Rev.	-0.07	0.36	[-0.26, 0.10]	48.89	17,001
ΔAssets	-0.03	0.66	[-0.31, 0.19]	39.12	16,875
ΔLiab.	-0.02	0.81	[-0.19, 0.15]	56.85	15,215
ΔProfits	-0.09	0.10	[-0.22, 0.02]	55.96	17,001

Authors' calculations. Estimates correspond to Sharp RD estimate. Standard errors are reported in parenthesis. Loan amount, credit exposure and net loss due default are in logs, collateral is expressed in percentages relative to the outstanding loan, credit rating is a categorical variable from 1-5 where 5 is the better rating, days past due are in number of days, interest rates are in % and loan maturity is denoted in number of years.

Appendix C.3 Checking for Parallel Trends: Non-Stressed Firms

Figure C5: Event Study Analysis: Other Loan level outcomes



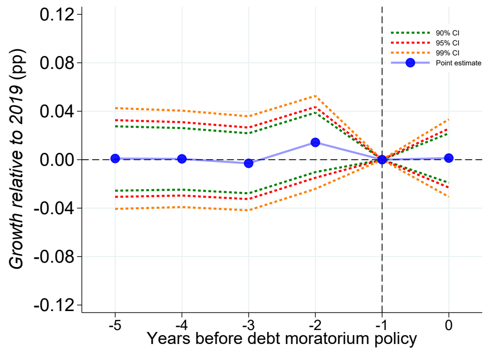
(a) Collateral Requirement

(b) Maturity

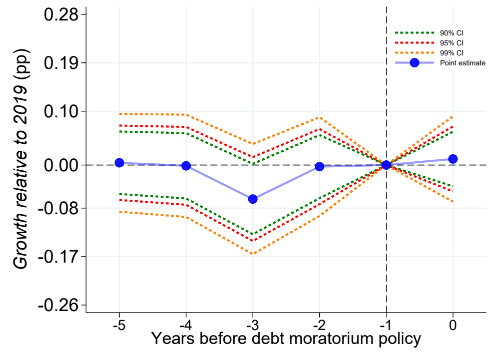
(c) Credit Rating

(d) Default Probability

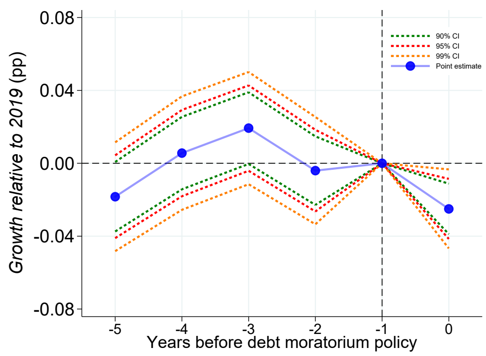
Figure C6: Event Study Analysis: Firm level outcomes



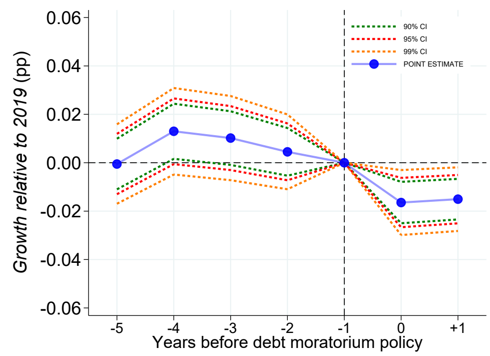
(a) Investment



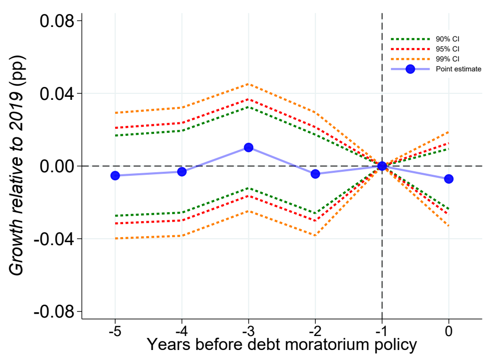
(b) Employment



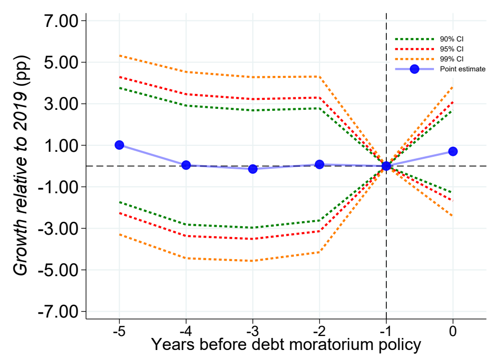
(c) Liabilities



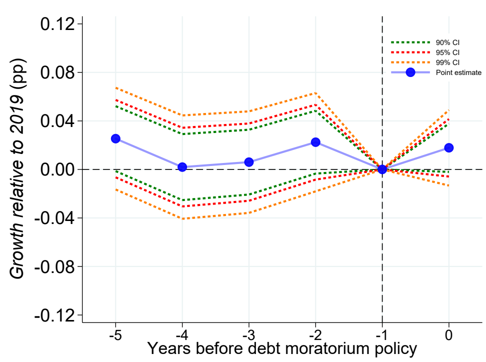
(d) Assets



(e) Profits



(f) Equity



(g) Operating Revenue

Appendix D Continuation of three-period model

In this section, we provide only the maximization problem of the borrower and the lender with the policy in place where default is an option. The maximization problem with default but without the policy is provided in the text.

$$
\begin{aligned}
&\max_{b>0}\ u\left(qb\right)+\beta(1-\pi)\left(\underbrace{\int_{y^\star} v\left(y-\frac{b}{2}\right)}_{repayment}+\underbrace{\int^{y^\star} v\left(y-C\left(y\right)\right)}_{default}\right)dF(y) \qquad \text{(D1)}\\
&+\beta\pi\left(\underbrace{\int_{y^\star} v\left(y-\ell\right)}_{repayment}+\underbrace{\int^{y^\star} v\left(y-C\left(y\right)\right)}_{default}\right)dF(y)\\
&+\beta(1-\pi)\left(\underbrace{\int_{y^\star} v\left(y-\frac{b}{2}\right)}_{repayment}+\underbrace{\int^{y^\star} v\left(y-C\left(y\right)\right)}_{default}\right)dF(y)\\
&+\beta\pi\left(\underbrace{\int_{y^\star} v\left(y-b+\ell\right)}_{repayment}+\underbrace{\int^{y^\star} v\left(y-C\left(y\right)\right)}_{default}\right)dF(y)\\
&\text{subject to}\\
&y-b-\ell\geq 0,\ y-b>0,\ y-C\left(y\right)>0.
\end{aligned}
$$

and the lender's problem who takes the default threshold y^* given as

$$
\begin{aligned}
&\max_{b>0}\ u\left(1-qb\right)+(1-\pi)\left(\int_{y^\star} v\left(y+\frac{b}{2}\right)+\int^{y^\star} v\left(y\right)\right)dF(y) \qquad \text{(D2)}\\
&+\pi\left(\int_{y^\star} v\left(y\right)+\int^{y^\star} v\left(y\right)\right)dF(y)\\
&+(1-\pi)\left(\int_{y^\star} v\left(y+\frac{b}{2}\right)+\int^{y^\star} v\left(y\right)\right)dF(y)\\
&+\pi\left(\int_{y^\star} v\left(y+b\right)+\int^{y^\star} v\left(y\right)\right)dF(y)\\
&\text{subject to } 1-qb\geq 0.
\end{aligned}
$$

Appendix E Quantitative Model

There are three main agents in the economy: households, firms and banks. The production chain is now standard and in particular closely follows Mendoza and Yue (2012). To summarize the production chain, there are two production sectors taking part, all of which are owned by households. Intermediate good producing firms rent labor services from households and produce domestic inputs to be sold to final goods producers whose job is to combine domestic inputs, and differentiated imported inputs into a single final good.

Appendix E.1 Final Goods Producers

The firms in the sector f of final goods producers engage in production using labor input denoted as $L^f(t)$, intermediate goods represented as M_t, and a constant level of capital stock denoted as k.[15] These firms also encounter Markovian Total Factor Productivity (TFP) shocks, denoted as ϵ_t, which follow a transition probability distribution function characterized by $z(\epsilon_t|\epsilon_{t-1})$. In particular, productivity shocks in final goods production follow an AR(1) process:

$$log\epsilon_t = (1-\rho_\epsilon)\mu_\epsilon + \rho_\epsilon + \varepsilon_t, \tag{E3}$$

with $\varepsilon_t \overset{iid}{\sim} N(\mu_\epsilon, \sigma^2_\varepsilon)$. The production function in this sector is assumed to be Cobb-Douglas in nature with the following form:

$$y_t = \epsilon_t \left(M\left(m^d_t, m^i\right)\right)^{\alpha_M} \left(L^f_t\right)^{\alpha_L} k^{\alpha^k}$$

with $\alpha_L + \alpha_M + \alpha^k = 1$ and $0 < \alpha_L, \alpha_M, \alpha^k < 1$.

The mix of intermediate goods M is determined via a CES aggregate of domestic and imported goods, m^d_t and m^i_t, respectively. This aggregation satisfies:

$$M_t = \left[\lambda(m^d_t)^\mu + (1-\lambda)(m^i_t)^\mu\right]^{\frac{1}{\mu}}, \tag{E4}$$

where $\lambda \in [0,1)$ is the weight of m^d_t, and $\mu < 1$ governs the (inverse) elasticity of substitution. Moreover, m^i_t is composed of imperfectly substitutable varieties, for reasons that we discuss below. In particular, m^i_t is a CES aggregate of imported goods varieties:

$$m^i_t = \left(\int_{j\in[0,1]} (m^i_{j,t})^\nu dj\right)^{\frac{1}{\nu}}, \tag{E5}$$

[15]Following Mendoza and Yue (2012), we are abstracted from introducing capital accumulation. Besides, our framework already solves a portfolio problem and introducing capital as an endogenous variable to the recursive problem will make it computationally extremely challenging.

where $m^i_{j,t}$ is the imported inputs variety j, and the elasticity of substitution across varieties is given by $|\frac{1}{\nu-1}|$. The elasticity of substitution between m^d_t and m^i_t is given by $|\frac{1}{\mu-1}|$. The following parameters restrictions are imposed: $0 < \nu, \mu < 1$ and $0 <\leq \lambda < 1$. Notice that if λ is allowed to be unity, then firms would not need imported inputs for their production and thus the cost of defaulting would be zero.

The imported inputs in the economy are sold in global markets at exogenously determined and time-invariant prices p^*_j for each variety j within the range $[0, 1]$. These prices are defined relative to the price of final goods, which serves as the numeraire. The relative price of domestic inputs, p^m_t, is an endogenous equilibrium price that adjusts within the economy.

A specific subset, denoted as Ω, of the imported input varieties falls within the interval $[0, \theta]$, where θ is a value between 0 and 1. Importantly, the payment for these input varieties in subset Ω needs to be made in advance using working capital financing. This division of imported inputs is designed such that during episodes of default, where access to credit markets is restricted, the availability of imported inputs in subset Ω is not completely eliminated. Instead, although these inputs may undergo significant adjustments, they do not vanish entirely, as observed in empirical data.

The working capital loans, denoted as κ_t, are short-term loans provided by banks within the same period. Different from Mendoza and Yue (2012), working capital loans are not contracted at the risk-free real interest rate. Instead, they carry out the risk of defaulting and the risk is equal to per-period default risk observed in the firm's borrowing rate with standard loans. If the borrower defaults, firms are excluded from accessing credit. We believe exposing working capital loans to default risk is more plausible.

The standard pay-in-advance condition that determines the demand for working capital is:

$$\frac{\kappa_t}{1+r} \geq \int_0^\theta p^i_j m^i_j dj.$$

In this equation, κ represents the working capital loans, r denotes the real interest rate, and the integral term on the right-hand side represents the cost of purchasing imported intermediate goods. The profit-maximizing producers of final goods select κ_t in a way that satisfies this condition with equality.

It is important to note that domestic inputs and the imported input varieties falling within the $[\theta, 1]$ interval do not require working capital, meaning that they can be obtained without the need for upfront financing.

Final goods producers take prices w_t, r_t, p^m_t and p^i_t given in order to maximize their per period profits:

$$\pi^f_t = \epsilon_t \left(M \left(m^d_t, m^i \right) \right)^{\alpha_M} \left(L^f_t \right)^{\alpha_L} k^{\alpha^k} - w_t L^f_t - P^i_t(r_t) m^i_t - p^m_t m^d_t. \tag{E6}$$

P^i_t is the standard CES price index of imported inputs m^i_t, and given that a random θ fraction of varieties needs to be financed by working capital loans, then $P^i(r_t)$ satisfies the following:

$$P_t^i(r_t) = \left[\int_0^\theta (p_j^i(1+r_t))^{\frac{\nu}{\nu-1}} dj + \int_\theta^1 (p_j^i)^{\frac{\nu}{\nu-1}} dj \right]^{\frac{\nu-1}{\nu}}. \tag{E7}$$

We characterize the solution of final goods producers' optimization problem in two stages. In the first stage, given set of prices w_t, p_t^m and $P_t^i(r_t)$, firms solve equation (E6). The optimality conditions of the first stage are:

$$P^i(r_t) = \alpha_M \epsilon_t k^{\alpha_k} \left(\left(M \left(m_t^d, m_t^i \right) \right) \right)^{\alpha_M - mu} (L_t^f)^{\alpha_L} (1-\lambda)(m_t^i)^{\mu-1} \tag{E8}$$

$$p_t^m = \alpha_M \epsilon_t k^{\alpha_k} \left(\left(M \left(m_t^d, m_t^i \right) \right) \right)^{\alpha_M - mu} (L_t^f)^{\alpha_L} \lambda (m_t^d)^{\mu-1} \tag{E9}$$

$$w_t = \alpha^L \epsilon_t k^{\alpha_k} M_t^{\alpha_M} (L_t^f)^{\alpha_L - 1}. \tag{E10}$$

At the second stage, given firms optimal demand for the aggregate imported goods, final good producers choose their demand for each variety i, subject to a working capital constraint. In particular, they need to finance a θ fraction of their purchase of import varieties. One can show that the demand for each variety i satisfies:

$$m_{jt}^i = \begin{cases} \left(\frac{p_j^i(1+r_t)}{P^i(r_t)} \right)^{-\frac{1}{1-\nu}} M_t^i, & \text{for } j \in [0, \theta]; \\ \left(\frac{p_j^i}{P^i(r_t)} \right)^{-\frac{1}{1-\nu}} M_t^i, & \text{for } j \in [\theta, 1]. \end{cases} \tag{E11}$$

Note that, unlike Mendoza and Yue (2012), we do not assume that firms cannot access working capital loans during exclusion periods. Instead, the interest rate that the producers face depends on the price of bonds during exclusion periods, which is captured up by q^D and will be defined below. Thus, the costs rise but do not tend to infinity. Without a positive recovery assumption, one would have solved the demand function system with the limit of that system as $r_t^* \to \infty$.

Appendix E.2 Intermediate Goods Producers

The producers in the m^d sector utilize labor input denoted as L_t^m and operate under a production function given by $A(L_t^m)^\gamma$, where γ is a parameter between 0 and 1, and $A > 0$ represents both the role of a fixed factor and an invariant state of Total Factor Productivity (TFP) in the intermediate goods production sector.

Given the price of domestic inputs, p_t^m, and the wage rate, w_t, the profit maximization problem for firms in the m^d sector can be formulated as follows:

$$\max_{L_t^m} \pi_t^m = p_t^m A(L_t^m)^\gamma - w_t L_t^m \tag{E12}$$

The first order condition for the labor demand satisfies

$$w_t = \gamma p_t^m A (L_t^m)^{\gamma-1}. \tag{E13}$$

Appendix E.3 Household's problem

It is assumed that the representative household owns firms and makes the borrowing and delinquency (default) decisions on behalf of them. The representative household lacks a commitment technology, and thus cannot commit to its future default and borrowing decisions, and it decides how much non-state-contingent (standard) long-term loan as well as state-contingent (moratorium) long-term loan to borrow at each period after repayment. Introduction of new state-contingent loan which stipulates payment suspensions during risk-off episodes closely follows Hatchondo et al. (2022).[16] The timing of our paper, as in Eaton and Gersovitz (1981), intends to rule out the multiplicity dynamics.

Households choose how much to consume and supply labor to maximize expected discounted utility streams, $E_0 \sum_{t=0}^{\infty} \beta^t u(c_t, L_t)$, where $0 < \beta < 1$ is the subjective discount factor, and c_t and L_t denote consumption and labor, respectively. The period utility function $u(\cdot)$ is continuous, strictly increasing in consumption, strictly decreasing in labor, and strictly concave in both arguments. The expectation operator E_t is conditional on the information set available at period t.

Households receive a real wage per labor hour w_t, profits paid by the final goods producers π_t^f, and net proceeds obtained from intermediate goods producers π_t^i and transfers from the household (T_t). Formally, the household solves the following problem:

$$\max_{c_t, L_t} E_t \left[\sum_{t=0}^{\infty} \beta^t u(c_t, L_t) \right] \tag{E14}$$

subject to the period budget constraint

$$c_t = w_t L_t + \pi_t^f + \pi_t^i + T_t. \tag{E15}$$

Household preferences are governed by a utility function of the Greenwood et al. (1988) type, which ensures no wealth effect on labor supply.[17] In particular, we use the utility function of the form:

$$u(c_t, L_t) = \frac{\left(c_t - \frac{L_t^{1+\omega}}{1+\omega} \right)^{1-\sigma} - 1}{1-\sigma}, \tag{E16}$$

[16] Allowing for long-term maturity helps us to obtain more realistic loan rates and default frequencies (Hatchondo and Martinez (2009), Chatterjee and Eyigungor (2012)).

[17] This formulation for preferences removes the wealth effect on labor supply and helps to explain key business cycle facts for small open economies. See, for example, Mendoza and Yue (2012).

where $\sigma > 0$ is the constant relative risk aversion, and $\omega > 0$ governs the (inverse) Frisch elasticity of labor supply. The optimal labor supply is given by

$$L_t^{\omega} = w_t. \tag{E17}$$

Following Hatchondo et al. (2022), the bondholders' risk-premium shock $p_t \in \{p_L, p_H\}$ follows a Markov process such that a high-risk-premium episode starts with probability $\pi_{LH}(\epsilon) \in [0,1]$ and ends with probability $\pi_{HL} \in [0,1]$. To capture the fact that economies suffer from negative conditions in international capital markets when domestic aggregate income is low (Calvo et al., 2006), we assume that π_{LH} is a decreasing function of the TFP shock ϵ: $\pi_{LH}(y) = Min\left\{\pi_{LH0}e^{-\pi_{LH1}\log(\epsilon)-0.5\pi_{LH1}^2\sigma_{\varepsilon}^2}, 1\right\}$.

The price of sovereign bonds satisfies a no-arbitrage condition with stochastic discount factor $M(\epsilon', \epsilon, p) = exp(-r - p\varepsilon' - 0.5p^2\sigma_{\varepsilon}^2)$, where r denotes the risk-free rate at which lenders can borrow or lend. This model of the discount factor is a special case of the discrete-time version of the Vasicek (1977) one-factor model of the term structure and has often been used in models of sovereign default (e.g., Arellano and Ramanarayanan, 2012; Bianchi et al., 2018).

We introduce an endogenous link between default probability and private economic activity. This endogenous link relates to the following three ingredients. First, there is a one-to-one mapping between the household's implied one-period borrowing rate and the firm's short-term working capital loan rate. The channel of that link is as follows: a rise in borrowing increases the likelihood of loan default, and thus amplifies the interest rates that are priced by risk-averse lenders. Banks, thus, pass on the increased cost of household debt holdings to firms by increasing loan rates. The second ingredient is that domestic and foreign goods are imperfectly substitutable. The intuition is that the higher rates would translate into an efficiency loss for the firms for their production because firms will now try to use more local goods with heightened costs of production. Efficiency loss happens since foreign investment goods and their domestic counterparts are assumed to be imperfectly substitutable. The last ingredient is the positive recovery following default. Without positive recovery, the implied interest rate on the loan would be zero during default episodes. The wages would then tend to infinity, and labor would plummet to zero. Besides, positive recovery would also allow banks to recoup some of their losses which is typically the case following a household delinquency.

The household borrows using long-term-non-state contingent loans in real goods at a price q_t. Similar to the sovereign debt and default literature, Hatchondo and Martinez (2009) and Chatterjee and Eyigungor (2012), a debt issued at time t promises a stream of geometrically decreasing coupons κ, which depreciate at a rate $\delta \in (0,1]$. Thus, a household promises to pay $\kappa(1-\delta)^{n-1}$ units of consumption good in period $t+n$ for $n \geq 1$. Coupon payment κ is computed such that in the absence of default risk, the price of non-state-contingent long-term debt is equal to the price of the average one-period debt, denoted as $\frac{r+\delta}{1+r}$. This is a common formulation for long-term debt contracts to avoid keeping track of the entire maturity distribution. Hence, the dynamics of the long-term can be represented as follows:

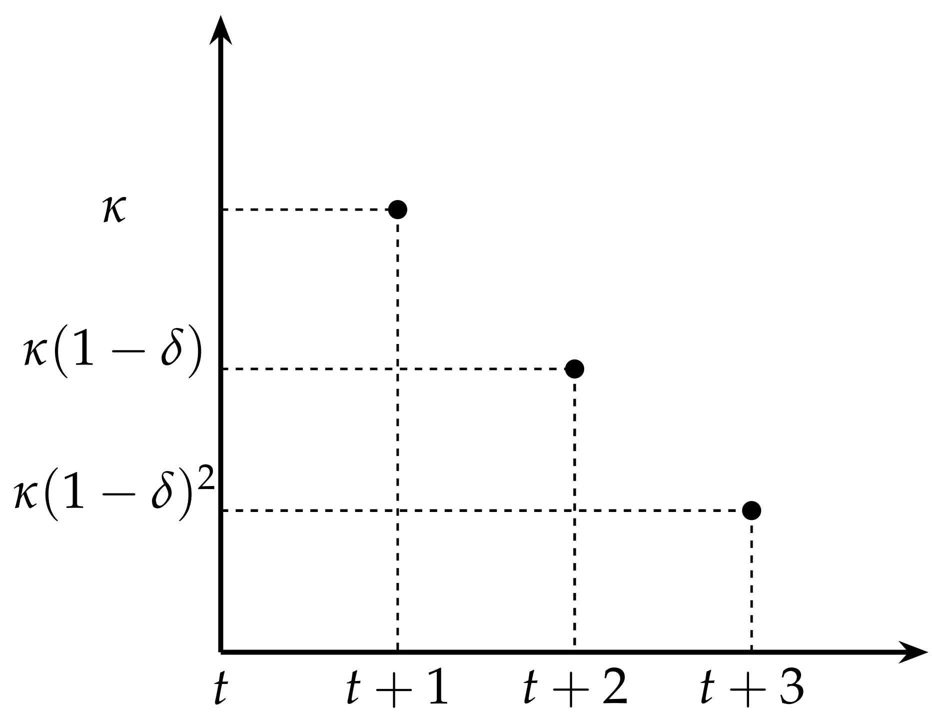
$$b_{t+1} = (1-\delta)b_t + m_t, \tag{E18}$$

where b_t and b_{t+1} are the total outstanding loan obligations at the beginning of period t and $t+1$ and m_t is the amount of loan that is received by the household in period t. Note that one-period debt is a special case of long-term debt where $\delta = 1$.

Moratorium debt b_m is also modeled to be a long-term debt as well which promise an infinite stream of coupons that decrease at the constant rate δ_m, but also allow for bond payments to be suspended in periods with $p_t = p_H$ during which banks earn the rate r_m on suspended payments. Per period coupon payments κ_m in the case of moratorium loans would then be $\frac{r+\delta_m}{1+r}$

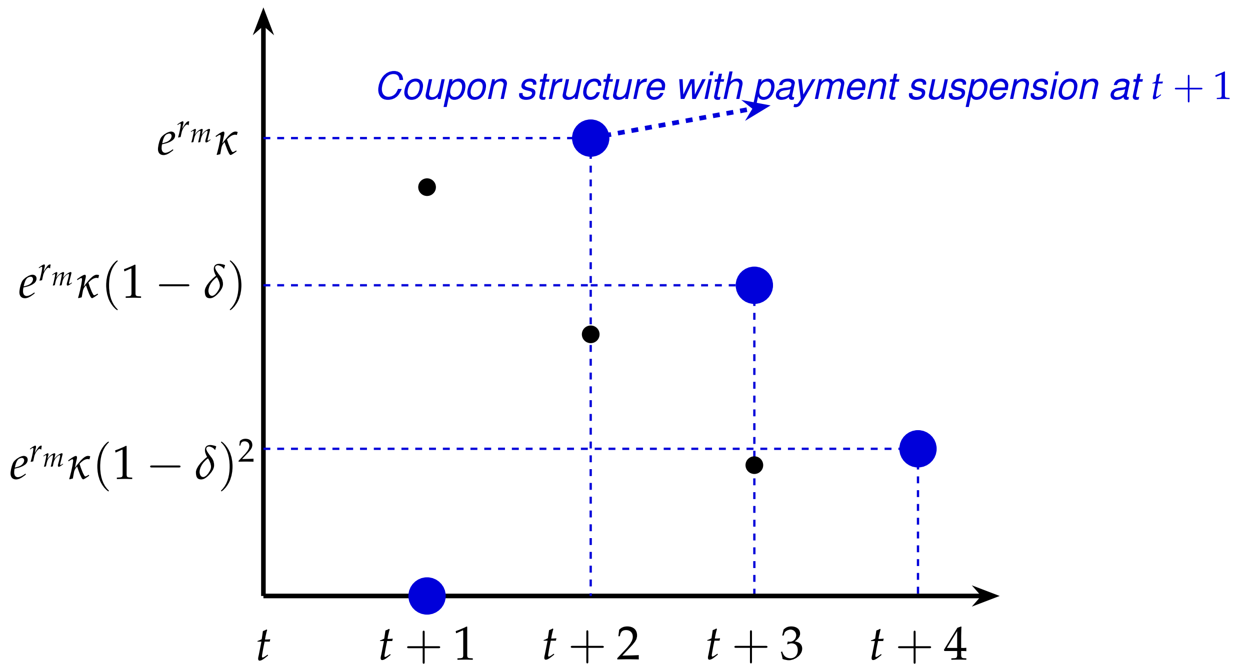
In Figures E7 and E8, we visualize the payment structure of standard loans and moratorium loans, respectively, assuming that $\delta = \delta_m$ for ease of exposition. Blue large circles represent coupon payments of moratorium loans while black dots represent coupon payments of standard loans depicted in Figure E7. Notice in Figure E8 that when the payments are suspended at time $t+1$ during a liquidity shock, the firm does not make any coupon payments. When the liquidity shock is over, the coupon accrue interest rate of r_m and the firm pays the coupon plus interest which in this case becomes $e^{r_m}\kappa$. Later, we will explore a policy analysis with this accrued interest rate r_m.

Figure E7: Coupon structure of standard loans.



If delinquency is declared, then the household and lenders restructure the debt in a Nash bargaining game. The post delinquent debt recovery rate α is determined following

Figure E8: Coupon structure of the moratorium loans are denoted by blue dots while standard loans are denoted by black dots.



the default decision during a renegotiation episode and depends on the defaulted debt of standard loans b, moratorium asset b_m, TFP shock ϵ and the liquidity state p.

As Hatchondo et al. (2022), a bankrupt firm cannot borrow and suffers a one-time utility loss $U^D(y)$.[18]

Also following Bianchi et al. (2018), we assume a fixed level of household expenditures $g > 0$. This allows us to capture rigidities in the household budget constraint that accentuate the importance of liquidity shocks. Thus, if the household is not in default and moratorium debt payments are suspended, consumption is given by

$$\begin{aligned} c &= \epsilon f\left(M\left(m_t^d, m^i\right), L^f, k\right) - P_t^i(r_t)m_t^i \\ &\quad -\kappa b + q(b', b_m', y, p)\left[b' - b(1-\delta)\right] + q_m(b', b_m', y, p)\left(b_m' - b_m e^{r_m}\right), \end{aligned}$$

where q and q_m denote the price of non-contingent loans and moratorium loans, respectively. If moratorium loan payments are not suspended, consumption is given by

$$\begin{aligned} c &= f\left(M\left(m_t^d, m^i\right), L^f, k\right) - P_t^i(r_t)m_t^i \\ &\quad -\kappa b - \kappa b_m + q(b', b_m', y, p)\left[b' - b(1-\delta)\right] + q_m(b', b_m', y, p)\left[b_m' - b_m(1-\delta_m)\right]. \end{aligned}$$

[18] In the calibration, a period in the model is a year and thus the exclusion from debt markets after defaulting lasts for a year, which is a common assumption in quantitative studies of sovereign default (Arellano, 2008; Bianchi et al., 2018), and is also within the range of empirical estimates (Gelos et al., 2011). Assuming a utility cost of defaulting instead of the also often used income cost allows us to calibrate the income process without using the simulations (because default does not affect aggregate income).

Appendix E.3.1 Cost of defaulting

In our main analysis above, we abstract from assuming additional cost of defaulting and resort to the model's endogenous dynamics. During default episodes, because of the increased cost of firms' working capital financing and the imperfect substitutability of domestic and imported goods, there is a fall in production and thus a decline in income. To improve the model's moment-matching success, as Bianchi et al. (2018), we assume a defaulting household cannot borrow, suffers a one-time utility loss $U^D(y)$. Consumption during a default episode then reads:

$$c = f\left(M\left(m_t^d, m^i\right), L^f, k\right) - P_t^i(r^{aut})m_t^i,$$

where r^{aut} denotes the interest rate during which firms face for their working capital loans.

Appendix E.4 Recursive representation

We now formulate the household's optimization problem recursively. Let $s \equiv (\epsilon, p)$ denote the vector of exogenous states, V be the value function of the household that has the option of defaulting. The household chooses to repay if the value of repayment V^R is greater than the value of default V^D. The function V satisfies the following functional equation:

$$V(b_m, b, s) = \max\left\{V^R(b_m, b, s), V^D(b_m, b, s)\right\}, \tag{E19}$$

where the household's continuation value for repayment is denoted as

$$\begin{aligned}
V^R(b, b_m, s) &= \qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad \text{(E20)} \\
&\max_{m^d\geq 0,\, m^i \geq 0,\, c\geq 0,\, L^m\geq 0,\, L^f\geq 0,\, b_m\geq 0\, b\geq 0} \left\{u\left(c, L\right) + \beta \mathbb{E}_{s'|s} V(b_m', b', s')\right\}, \\
&\text{subject to} \\
c &= \epsilon f\left(M\left(m^d, m^i\right), L^f, k\right) - P^i(r)m^i \\
&\quad -\kappa b - \left[1 - \mathcal{I}(p)\right]\kappa_m b_m + q(b_m', b', s)i + q_m(b_m', b', s)i_m, \\
i &= b' - b(1-\delta), \\
i_m &= b_m' - \left[1 - \mathcal{I}(p)\right] b_m(1-\delta_m) - \mathcal{I}(p) b_m e^{r_m}, \\
q(b_m', b', s) &\geq \underline{q}\ \forall\, b' > b(1-\delta), \\
q_m(b_m', b', s) &\geq \underline{q}\ \forall\, b_m' > \left[1 - \mathcal{I}(p)\right] b_m(1-\delta_m) + \mathcal{I}(p) b_m e^{r_m}, \\
L^f + L^m &= L, \\
A(L^m)^\gamma &= m^d,
\end{aligned}$$

where $\mathcal{I}(p)$ is an indicator function that is equal to 1 if the risk premium shock p takes the high value, and is equal to 0 otherwise, and $f(\cdot) = \left(M\left(m_t^d, m^i\right)\right)^{\alpha_M}\left(L_t^f\right)^{\alpha_L} k^{\alpha^k}$. Imported goods and the price of these goods are denoted by m^i and $P^i(r)$, respectively. The term r inside the price of imported goods is the household's implied interest rate on one-period working capital loans. That is, households borrow long-term loans while working capital loans are one-period loans. Thus, the interest rate on the working capital loans is the one-period loan version of the long-term loans. The firms' problem depends on the level of total factor productivity and the household's implied one-period borrowing rate r_t and our interest rate function maps aggregate states to the household's implied one-period borrowing rate

$$\mathcal{S}(\epsilon_t, r_t) = \mathcal{H}_s(b'_m, b', s). \tag{E21}$$

Given the interest rate function, optimal factor allocations characterize a competitive equilibrium in factor markets. Note that the benevolent household faces the same allocations of output and factors of production as the agents in the private economy. To be specific, for a given TFP shock, implied short-term borrowing rate r and long-term bond prices on standard loans and moratorium loans q, q_m, —which will be obtained below under the price function—, as well as current and next-period household loan borrowings, the optimal factor allocations (m^i, m^d, L^f, L^d, L) chosen by the representative household characterize the private sector competitive equilibrium.

A defaulting firm stay in default for one period and goes into a restructuring with the bank. In the context of debt renegotiation, a generalized Nash bargaining game is employed. The bargaining agreement determines that the market value of defaulted debt is reduced to a fraction $\alpha(b_m, b, s)$ of its original value. This means that the firms and the bank engage in negotiations, and the final outcome of the debt restructuring process results in the borrowers repaying only a portion of the original debt. Thus, the continuation value of default takes into account the restructuring process when the firm regains access to the credit markets. We assume that debt in arrears grows at the international risk-free rate r during the firm's exclusion from the credit markets. Along these lines, the value of default is

$$\begin{aligned} &V^D(b, b_m, s) = \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \text{(E22)} \\ &\qquad \underset{c \geq 0,\, L^m \geq 0,\, L^f \geq 0,\, m^d \geq 0,\, m^i \geq 0}{Max} \left\{ u(c, L) - U^D(\epsilon) + \beta \mathbb{E}_{s'|s} \left[V(\alpha(b_m, b, s) b_m, \alpha(b_m, b, s) b, s') \right] \right\}, \\ &\textit{subject to}: \\ &\qquad c = \epsilon f\left(M\left(m^d, m^i\right), L^f, k\right) - P^i(r^{aut}) m^i, \\ &\quad L^f + L^m = L, \\ &\quad A(L^m)^\gamma = m^d. \end{aligned}$$

In our Nash-bargaining game, the renegotiation stage takes only once for a single default event and a settlement is reached.[19] The threat to the borrower is that it may remain

[19]This is typically how it is designed in the literature (see Yue (2010)). Even if we allow for multiple rounds of renegotiation to have delays, we find that both the lender and the borrower typically reaches a settlement in a single renegotiation episode unless one introduces significant costs of a settlement.

in default for another episode and then can find a different bank/source to finance its borrowing and working capital. Banks, on the other hand, can only receive the bankrupted value of assets.[20]

We can then define the household's surplus in the Nash bargaining game for a given recovery rate $\alpha(b_m, b, s)$ by Δ^H, which is the difference between settling on a debt recovery rate α or remaining excluded from the banking sector forever. That is,

$$\Delta^H(\alpha; b_m, b, s) = V^R(\alpha b_m, \alpha b, s) - V^D(0, 0, s). \tag{E25}$$

The surplus to the holders of defaulted loan depend on the portfolio value of defaulted loans. If banks do not agree on a settlement, they still recoup some of their losses as the market value of debt may still carry a positive value. Below we define them. Banks agree on a settlement proposal α if the market value of their debt portfolio after accepting this offer, $M(\alpha b_m, \alpha b, s)$ is greater or equal than the market value of rejecting the proposal, $M^D(b_m, b, s)$.

Debt portfolio market value. The market value of a debt portfolio with b and b_m at the beginning of a repayment period is given by:

$$\begin{aligned} M(b_m, b, s) \quad &= \quad b\left[\kappa + (1-\delta)q\left(\hat{b}\left(b_m, b, s\right), \hat{b}_m\left(b_m, b, s\right), s\right)\right] \\ &+ \quad b_m\left[\left[1 - \mathcal{I}(p')\right]\left[\kappa_m + (1-\delta_m)q_m\left(\hat{b}\left(b_m, b, s\right), \hat{b}_m\left(b_m, b, s\right), s\right)\right]\right. \\ &+ \quad \left.\mathcal{I}(p')e^{r_m}q_m\left(\hat{b}_m\left(b_m, b, s\right), \hat{b}\left(b_m, b, s\right), s\right)\right] \end{aligned}$$

The market value of a debt portfolio when the consumer remains excluded from credit markets is given by:

$$M^D(b_m, b, s) \quad = \quad bq^D\left(b_m, b, s\right) + b_m q_m^D\left(b_m, b, s\right).$$

[20] In another version of the paper, we also consider a case in which the threat to the household is it stays excluded from the banking sector permanently. In this case the expected value of remaining excluded from the credit markets becomes

$$V^{aut}(s) = \underset{c\geq 0,\, L\geq 0,\, I^f\geq 0,\, I^d\geq 0}{Max} \left\{u(c, L) - U^D(\epsilon) + \beta\mathbb{E}_{s'|s}\left[V^{aut}(s')\right]\right\}, \tag{E23}$$

$$\begin{aligned} &subject\ to: \\ &\qquad c = \epsilon f\left(M\left(m^d, m^i\right), L^f, k\right) - P^i(r^{aut})m^i, \\ &L^f + L^m = L, \\ &A(L^m)^\gamma = m^d. \end{aligned}$$

Then, equation E25 becomes

$$\Delta^H(\alpha; b_m, b, s) = V^R(\alpha b_m, \alpha b, s) - V^{aut}(s). \tag{E24}$$

Our results remain equivalent to what we currently have.

Then the surplus to the bank from the renegotiation stage would be:

$$\Delta^B(\alpha; b_m, b, s) = M(\alpha b_m, \alpha b, s) - M^D(b_m, b, s). \tag{E26}$$

Intuitively, if lenders have all the bargaining power, they can extract the entire amount and make the borrower pay fully. If the borrower has all the bargaining power, then the borrower can make a take-it-or-leave-it offer and can get away with paying nothing. Thus, in general, we assume that the borrower has a bargaining power of $\theta \in [0,1]$ and the lender has a bargaining power of $1-\theta$. With this set up, the debt recovery rate $\alpha(b_m, b, s)$ solves the following bargaining problem:

$$\hat{\alpha}(b_m, b, s) = arg \max_{\alpha \in [0,1]} \left[\left(\Delta^H(\alpha; b_m, b, s) \right)^{\theta} \left(\Delta^B(\alpha; b_m, b, s) \right)^{(1-\theta)} \right], \tag{E27}$$
$$subject\ to:$$
$$\Delta^H(\alpha; b_m, b, s) \geq 0,$$
$$\Delta^B(\alpha; b_m, b, s) \geq 0.$$

The price of non-contingent bonds is given by

$$\begin{aligned} q(b'_m, b', s) \;=\;& \\ & \mathbb{E}_{s'|s}\left[M(\varepsilon', p) \left[d' \hat{\alpha} q\left(\hat{\alpha} b'_m, \hat{\alpha} b', s'\right) + (1-d')\left[\kappa + (1-\delta) q\left(b''_m, b'', s'\right)\right]\right]\right], \end{aligned} \tag{E28}$$

and the price of a moratorium debt is given by

$$\begin{aligned} q_m(b'_m, b', s) \;=\;& \mathbb{E}_{s'|s}\left[M(\varepsilon', p) \left[d' \hat{\alpha} q_m\left(\hat{\alpha} b'_m, \hat{\alpha} b', s'\right) \right.\right. \\ &+ (1-d')\left[\left[1-\mathcal{I}(p', g')\right]\left[\kappa_m + (1-\delta_m) q_m\left(b''_m, b'', s'\right)\right]\right. \\ &+ \left.\left.\left. \mathcal{I}(p', g') e^{r_m} q_m\left(b''_m, b'', s'\right)\right]\right]\right], \end{aligned} \tag{E29}$$

where $d' = \hat{d}\left(b'_m, b', s'\right)$ denotes the next-period equilibrium default decision, $b'' = \hat{b}\left(b'_m, b', s'\right)$ denotes the next-period equilibrium non-contingent debt decision and $b''_m = \hat{b}_m\left(b'_m, b', s'\right)$ denotes the next-period equilibrium moratorium loan decision.

The short-term interest rate r that is used by the imported good producers in the economy for their working capital financing is computed by setting $\delta = 1$. Notice that when $\delta = 1$, equation (E28) boils down to the price of one-period debt, which is determined by tomorrow's default probability and the recovery rate.

Appendix E.5 Definition of equilibrium

This paper focuses on a Markov perfect equilibrium. The household cannot commit to any future (repayment and borrowing) decisions. Hence, the household's strategies depend only on the payoff-relevant state variables.

Definition 1 (Markov perfect equilibrium) *A Markov perfect equilibrium is characterized by value functions $V(b_m, b, s)$, $V^D(b_m, b, s)$, $V^R(b, b_m, s)$, bond pricing functions $q(b'_m, b', s)$, $q_m(b'_m, b', s)$, recovery rate $\hat{\alpha}(b_m, b, s)$, default rule $\hat{d}$, transfers rule $T(b_m, b, s)$ and borrowing rules $\hat{b}, \hat{b_m}$ such that*

1. *Given the bond pricing functions q. q_m, loan recovery rate $\hat{\alpha}(b_m, b, s)$, household policy rules $\left\{\hat{d}, \hat{b}, \hat{b}_m\right\}$ solve the utility maximization problem defined in equations (E19), (E21), and (E22).*

2. Given V, q, q_m, $\hat{d}$, $\hat{b}$, $\hat{b_m}$, the recovery rate solves the bargaining problem in equation (E27).

3. *Given household policy rules $\left\{\hat{d}, \hat{b}, \hat{b}_m\right\}$, and the recovery rate $\hat{\alpha}(b_m, b, s)$, the pricing function q and q_m satisfy conditions (E28) and (E29), respectively.*

4. The transfers policy $T(b_m, b, s)$ satisfy the household's budget constraint $q(b'_m, b', s)i + q_m(b'_m, b', s)i_m - \kappa b - [1 - \mathcal{I}(p)]\, \kappa_m b_m$.

In a Markov perfect equilibrium solution, various components are resolved, including the allocations of factors within different sectors, the production processes with and without access to credit markets. From these solutions, further equilibrium variables such as wages, profits, and the price of domestic inputs are derived. This derivation is based on the optimization conditions of firms and the earlier-defined profit definitions.

To break it down:

1. Sectoral Factor Allocations and Production: The equilibrium solution involves determining how factors of production (like labor, imported and domestic inputs) are distributed across different sectors of the economy. This allocation influences the production processes in those sectors under different scenarios, including credit market access and non-access.

2. Equilibrium Wages, Profits, and Input Prices: Equilibrium values for wages (payments to labor), profits (earnings of firms), and the price of domestic inputs (cost of inputs for production) can be computed jointly while establishing the factor allocations and production processes. These values are derived from the firms' optimization strategies and the previously outlined definitions of profits.

Appendix E.6 Numerical Solution

This section briefly sketches the main numerical algorithm, relegating the details of the implementation to the Appendix E.8. To solve the model, we take a two-pronged approach. First, the competitive equilibrium is solved using the Euler equations characterized in the text. We obtain the optimal private sector allocations for any productivity shock and the short-term bond price. With these optimal private allocations in hand, we then solve the household's problem with global solution methods. In particular, solving the model relies on iterating the value functions V^R and V^D, price functions q, q_m, and the recovery rate α as well as an approximation scheme to the private sector's allocation problem. To avoid the potential multiplicity problem outlined in Krusell and Smith (2003), we first solve the equilibrium of the finite-horizon economy. We start with an initial guess for the terminal value and iterate backward until the differences in value and price functions for two subsequent periods are less than 10^{-5}. We then use the obtained values as the equilibrium of the infinite horizon economy.

Appendix E.7 Calibration

We calibrate the model economy at an annual frequency as our firm level variables are observed at annual frequency. For most parameters, we resort to the administrative Colombian data and estimate it ourselves. For the remaining parameters, we use conventional estimates reported in the literature. Table E4 presents the calibrated parameter values.

Table E4: Parameter values

	Parameter	Value	Target
Risk aversion	σ	2	Standard RBC value
Risk-free rate	r^f	4%	Standard RBC value
Standard loan decay rate	δ	0.121	Average duration of 5 years
Labor supply curvature parameter	ω	1.4	Frisch wage elasticity (2.5)
Armington weight of domestic investment	λ	0.62	Mendoza and Yue (2012)
Armington curvature parameter	ϵ	0.62	Mendoza and Yue (2012)
Dixit-Stiglitz curvature parameter	ν	0.59	Mendoza and Yue (2012)
Upper bound to use working capital	θ	0.7	Mendoza and Yue (2012)
Share of capital	α_k	0.17	Standard capital share
Share of labor	α_L	0.40	Standard labor share
Share of intermediate goods	α_M	0.43	Mendoza and Yue (2012)
Labor share of in GDP of int. goods	γ	0.70	Standard labor share
Labor share of in GDP of int. goods	A	1	Invariant TFP in m^d
Calibrated			
Discount factor	β	0.89	Default frequency (2%)
Income autocorrelation coefficient	ρ_ϵ	0.613	Operating income (0.752)
Standard deviation of innovations	σ_ϵ	3.55%	Opr. income std. deviation (0.015)
Borrower's bargaining power	θ	0.61	recovery rate
Income cost of defaulting	d_0	6.40	Spread and loan-to-assets ratio
Income cost of defaulting	d_1	55.64	Spread and loan-to-assets ratio
Probability of entering high risk premium	π_{LH0}	0.25	3 high-risk-premium episodes every twenty years
Probability of entering high risk premium	π_{LH1}	12	4% lower average income
Risk-premium shock	p_H	25	3% spread increase during high-risk-premium

The risk aversion parameter is set to 2 and the annual risk free interest rate r^f is set to 4%, the conventional values used in the literature. Amodio and de Roux (2021) estimate the elasticity of labor supply using Colombian plants data and reports it to be 2.5. Thus, we wet the labor supply curvature parameter, ω, to 1.4. This value yields a Frisch elasticity of labor supply, $\frac{1}{\omega-1}$, equal to 2.5, and is well within the range reported in the literature.[21]

[21]See, for example, Rogerson and Wallenius (2009), Christiano et al. (2009), and references therein.

The weight of domestic investment goods in the Armington aggregate of investment is based on the OECD Trade-in Value Added (TiVA) database. We set these values as in Mendoza and Yue (2012). Moreover, we set factors shares $\alpha^k = 0.17$ and $\alpha^L = 0.40$ to standard RBC values and set $1 - \alpha^k - \alpha^L$ equal to 0.43. For the remaining parameters for production, ϵ, ν, θ, we follow Mendoza and Yue (2012) and set them equal to 0.62, 0.59, and 0.70, respectively.

The median loan-to-assets ratio equals to 15.7% in our administrative data. The productivity shocks in the model follow an AR(1) process as in equation (E3). Using the operating income process of firms in our administrative data, for the period 2004 to 2019, this is the longest time frame during which the data are available prior to the inception of moratoria laws, the standard deviation coefficient and the autocorrelation coefficient of the cyclical component of operating income is 3.55% and 0.613, respectively.

Further, a penalty scheme is necessary in this class of models because otherwise the household would always default, and lenders would price it accordingly. So in equilibrium, only a limited amount of debt issuance at very high spreads can be generated. We initially resort to our model's dynamics. The endogenous penalty scheme in our model is the decline in efficiency that is followed by a fall in output. With this alone, we fail to match the spreads. Yet, our model implications remain equivalent to what we currently have in the manuscript and we are not reporting them for brevity. To improve the model's moment-matching success, we introduce an exogenous utility cost of defaulting as in Bianchi et al., 2018 which is typical in quantitative default studies. In our calibration, we target the standard loan-to-operating income ratio of 15.7 percent which corresponds to the median loan-to-operating income ratio in Colombia. We calibrate the value of the parameters of the utility cost of defaulting (d_0 and d_1) targeting the mean levels of debt and interest rate. Mendoza and Yue (2012) use the invariant state of TFP in the m^d sector, (A), to determine the cost of defaulting. As we are relying on quadratic utility cost of defaulting, we take A to be unity.

We do not observe bankruptcy in our data. Thus, we instead use non-performing loans (NPL) to target the default rate with $\beta = 0.89$.

We set δ at 0.121. With that value, the maturity of loans 5 years, which is the average loan maturity in our administrative data. The definition of duration in Macaulay (1938) is standard in calculating the long-term loan duration. Duration D is the weighted average maturity of future cash flows. A loan issued at time t makes periodic payments κ for the subsequent periods with a geometrically decay rate δ.[22] Observe that equation (E31) is 1

[22] Duration D satisfies,

$$D(\kappa) = \frac{1}{q}\left(\sum_{j=1}^{J} j\frac{\kappa(1-\delta)^{j-1}}{(1+i)^j}\right)$$

where i is the periodic yield an investor would earn if the bond is held to maturity without any defaults and it satisfies

$$q = \sum_{j=1}^{\infty} \frac{\kappa(1-\delta)^{j-1}}{(1+i)^j},$$

and the periodic yield i reads as

$$i = \frac{\kappa}{q} - \delta$$

for $\delta = 1$. The spread r_s is defined as the difference between yield i and the risk-free rate r. The annualized spread reported in the tables is computed as

$$1 + r_s = \left(\frac{1+i}{1+r}\right)^4.$$

The debt levels obtained from the simulations are equivalent to the present value of future debt obligations, which are discounted at the risk-free rate and computed as $\frac{b(1+r)}{\delta+r}$.

Appendix E.8 Numerical approximation algorithm

Continuing from Appendix E.6, we utilize a two-pronged approach. We detail these approaches below. First, set grid points for TFP shocks (ϵ) and interest rate r. For a given interest rate r, compute the standard CES price index of imported inputs $P^i(r)$ given in equation E7. Then the competitive equilibrium is solved by first defining excess demand function for the domestic input m^d as $\phi(p^m) = A(L^m)^\gamma - m^d$, given the price of domestic inputs p^m and the labor market clearing wage w which is obtained by defining an excess demand function for labor as $\phi(w) = L^f + L^m - L$ given the price of domestic inputs p^m. That is, excess demand functions are used to solve the market clearing intermediate good price p^m and the market clearing wage w. We then feed these two prices into a bi-dimensional BOBYQA (Powell) routine to obtain the optimal allocations of m^d and m^i by computing the final producers profit provided in equation (E6). With these, both excess demand functions of $\phi(p^m)$ and $\phi(w)$ are zeroed using a bisection method.

After solving the competitive equilibrium for factor allocations, we then proceed to solve the household's optimization problem which requires iterating on the value and price functions until a convergence criteria of 10^{-5} is obtained. Functions are evaluated at equally spaced grid points. When evaluations fall outside of the grids, we approximate our functions by interpolating them with B-splines for both loan types and linearly interpolating them for income. For standard and moratorium loans b, b_m, 40 grid points each, and for TFP shock ϵ, 30 grid points are used, whereas we utilize 100 Gauss-Legendre quadrature points to evaluate expectations over income into the subsequent period. Below we outline these steps in detail.[23]

1. First solve the competitive equilibrium using the Euler equations characterized in the text and then obtain the optimal private sector allocations for any TFP shock and the short-term bond price.

with which D becomes

$$D = \frac{1}{q(1-\delta)} \lim_{J\to\infty} \sum_{j=1}^{J} j \left(\frac{1-\delta}{1+i}\right)^j \tag{E30}$$

$$= \frac{1+i}{i+\delta}. \tag{E31}$$

[23] Önder (2023a) shows the superiority of using black-box optimizers over taste-shocks, particularly when solving a portfolio allocation problem.

2. Initial guesses of V^R, v^D, q, q_m and α are set at the their corresponding levels in a finite-horizon economy as follows:
   - $V^R(b_m, b, s) = u(c, L)$ where $c = \epsilon f\left(M\left(m^d, m^i\right), L^f, k\right) - P^i(r^{aut})m^i - \kappa b - \kappa_m b_m$.
   - $v^d(b_m, b, s) = u(c, L)$ where $c = \epsilon f\left(M\left(m^d, m^i\right), L^f, k\right) - P^i(r^{aut})m^i$.
   - and $q = 0$, $q_m = 0$, $\alpha = 0$.

   All factor allocations that are obtained in the first step are functions of the TFP shock ϵ and the interest rate r which is a one-period debt version of q, can be obtained through a mapping function in equation (E21).

3. The optimization problem described by equations (E19) and (E22) is solved at multiple grid points for loans (b, b_m), TFP shock ϵ, and global liquidity shock p. The goal is to find the globally optimal solution for the borrowing decisions in the next period. To achieve this, a search is conducted by generating 100 grid points for each of the portfolio components b' and b'_m. The initial values of the standard and moratorium loans b and b_m are set with 40 grid points each. Initially, for a fixed choice of b', the corresponding optimal grid for b'_m is found. This optimal point is then utilized as the initial guess for a one-dimensional Brent routine in FORTRAN, which helps pinpoint the precise optimal value of b'_m for a fixed b' with double precision. Finally, having obtained the fixed value of b' and the corresponding optimal value of b'_m, a two-dimensional optimization Powell routine is employed. This routine is used to solve for the optimal portfolio of (b', b'_m) for each combination of (b_m, b, ϵ, p) resulting from the grids. In summary, this iterative process involves solving the optimization problem at multiple grid points to identify the globally optimal portfolio choices for borrowing decisions under various combinations of shocks and loan components.

4. With obtained policy functions, solve the bargaining game between lenders and borrowers defined in equation (E27)

5. Iterate the procedure defined above for equations (E19) to (E29) until the ergodic differences in two iterations remains the same.

6. Invoke local search methods within the neighborhood of the obtained candidate optima (b', b'_m) for each grid points of (b_m, b, ϵ, p) in the previous step.

7. Iterate the local search methods for equations (E19) to (E29) in the text until convergence criteria of 10^{-5} is obtained.

With the equilibrium value functions, pricing and recovery rate functionals as well as the decision rules for borrowing and default, we simulate the model. In particular, we:

1. Set the number of samples $N = 2000$, number of periods $T = 1501$ and $T_0 = 500$.

2. Use a random number generator to draw sequences of ε_t for $t = 1, 2, ..., T$ to compute the income of the subsequent periods and to evaluate the continuation value of default. We fix these drawn shocks to use them for each sample $n \in N$.

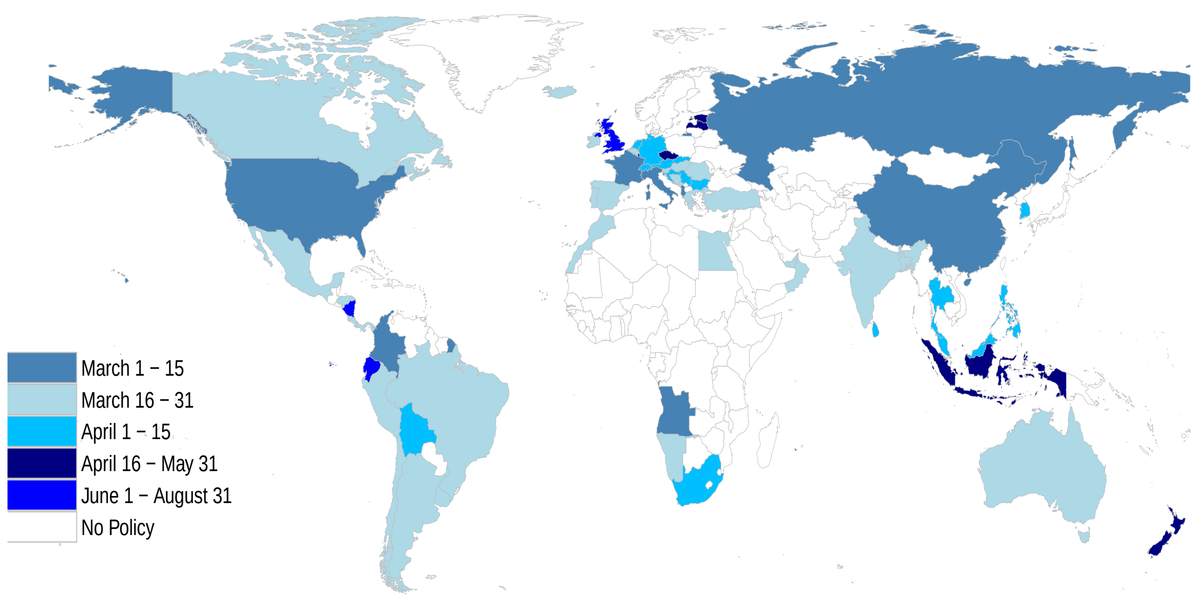
3. Set the initial TFP shock ϵ to be mean $\epsilon = 1$ with no global liquidity shocks and debt holdings b_m, b to be zero.

4. Cut the first T_0 periods of each sample before computing the moments of the simulation so that randomly chosen initial values will not have any influence on moments.

The moments reported in all tables are computed from the 2000 simulated sample paths such that each sample includes 20 years without a default observation. The sample period begins at least 5 years after regaining access to the credit markets following a default episode. Business cycle moments are reported after HP-detrending them with a smoothing parameter of 100. We also make sure that both global search methods and local search methods generate almost the same moments and policy functions.

Appendix F Moratoria measures in other countries

Figure F9: Evolution of Treated and non-Treated Loans during 2020



The figure displays the nations that have implemented a form of moratorium policy.

- Albania
  - Period: 13/03/2020 – 31/08/2020: The Bank of Albania (2020) introduced a short-term moratorium by allowing financial institutions to grant payment deferrals up to 3 months for households and businesses negatively affected by the crisis. The payment deferrals were only for loan installments and were granted by request of the borrower until May 31, 2020. The moratorium was later extended to August 31.

- Andorra
  - Period: 11/06/2020 – 31/03/2021: On April 18, a moratorium on loan repayment was approved by the Association (2020a) with an expiring date on December 31, 2020. This legislative moratorium was aimed at natural persons. Later, on June 11, the ABA agreed to introduce a non-legislative sector-wide moratorium to postpone loan repayment up to 12 months, targeting businesses and households impacted by the crisis. The moratorium only included payment suspension of loan installments and, in December 2020, the deadline for requesting these measures was extended until March 31, 2021.
- Angola
  - Period: 3/03/2020: On March 30, the National Bank of Angola (2020) approved a 60-day moratorium on loan repayments for borrowers significantly affected by the pandemic. This moratorium included suspension of both capital and interest payments without additional charges by request of the borrower in an opt-in basis.
- Argentina
  - Period: 19/03/2020 - currently in force: In accordance with the provisions of the Central Bank of the Argentine Republic (2020), all financial entities in the system may offer a special line of credit to micro, small and medium-sized enterprises at a maximum annual interest rate of 24%. On the other hand, the BCRA ordered the temporary flexibility of the parameters with which bank debtors are classified. The current classification system takes into account, among other variables, the number of days in arrears for each debtor. From today until September 2020, 60 days will be added to the classification of each debtor for each category, allowing to contemplate the difficulties caused by the crisis in various branches of economic activity.
- Australia
  - Period: 20/03/2020: On March 20, the Australian Banking Association (2020) announced a six-month payment deferral for existing loans from small businesses negatively impacted by the health crisis. This assistance package was requested by borrowers in an opt-in basis and included deferrals on loan repayments and fees.
- Austria
  - Period: 3/04/2020: On April 3, the Government of Austria announced a moratorium on loan repayments for consumer and business borrowers from micro enterprises (CMS (2020)). The policy applies to loan agreements concluded before March 15 and includes a temporary suspension of both principal and interest payments.

- Bangladesh
  - Period: 19/03/2020 – 31/12/2020: On March 19, the Bangladesh Bank provided a moratorium facility on loan repayments for borrowers until September 30, 2020 (KPMG (2020)). The moratorium was later extended until the end of December 2020.
- Barbados
  - Period: 20/03/2020 – 30/09/2020: On March 20, the Government (2020) announced a six-month debt moratorium for existing loans of individuals and businesses negatively affected by the crisis. The moratorium only included suspension of payment of loan installments, and, during the moratorium period, loans were not classified as non-performing. These measures became expired at the end of September 2020.
- Belgium
  - Period: 22/03/2020 – 30/06/2021: On March 22, the of Belgium (2020) announced a six-month moratorium on existing loans aimed at viable borrowers facing difficulties due to the COVID 19 crisis. This moratorium entailed a payment deferral until September 30, which later was extended to the end of the year. In December 2020, the moratorium was extended to June 2021, and it was decided that beneficiaries could be granted deferral of payments up to a holiday period of 9 months in total before and after the extensions. This moratorium included payment deferrals of only loan installments and banks could not charge additional fees.
- Bolivia
  - Period: 1/04/2020: On April 1, the Government of Bolivia (2020) announced a six-month general payment deferral relief on loan repayments for individual and corporate borrowers during the emergency period declared by the government due to the pandemic. This relief measure was applied to all credit loans in an opt-out basis and included deferral of both loan installments and interest payments without additional charges.
- Bosnia and Herzegovina
  - Period: 20/03/2020 – 30/06/2021: On March 20, the of the Republic Srpska (2020) and the of the Federation of Bosnia and Herzegovina (2020) adopted a six-month moratorium on repayment of loans for performing borrowers with less than 90 days past due that were negatively impacted by crisis. The moratoria included suspension of payment of installments, interest, and fees. The expiration date of the moratoria was extended from December 31, 2020, to June, 2021.

- Brazil
  - Period: 17/03/2020 - 29/12/2021: The Ministry of Economy of Brasil (2020) made the conditions for the renegotiation of the debt available to all taxpayers, with the exception of debts with the Severance Compensation Fund (FGTS) for criminal fines. This modality allows the initial payment, referred to 1% of the total amount of the debts, in up to three months. The remaining installments will be deferred 90 days. Another benefit is the longer term for the installment payment. For legal persons, the payment of the balance can be divided into up to 81 months. In the case of natural persons, micro or small companies, educational institutions, the deadline to be part of the measure was extended until December 29, 2021.
- Brunei
  - Period: 1/04/2020: On April 1, the Ministry of Finance and Economy Brunei (2020) announced the adoption of a six-month payment deferral on loan repayments for corporate borrowers in affected sectors. This deferral included principal payments only.
- Bulgaria
  - Period: 10/04/2020: On April 10, the Bulgarian National Bank (2020) approved a six-month postponement on loan repayments for individual and business borrowers with no more than 90 days past due as of March 1, 2020. The relief included suspension of principal and/or interest payments, and borrowers were able to request the postponement to their banks in an opt-in basis. These measures were later extended, so loan payments could be deferred until the end of 2021.
- Cabo Verde
  - Period: 1/04/31 – 30/09/2021: On March 31, the of Cabo Verde (2020) decreed a debt moratorium on loan repayment for performing borrowers with no outstanding loan payments overdue for more than 90 days as of March 28, 2020. Moratorium was granted to both individuals and businesses without charges and involved a suspension of principal and interest payments. The expiration date of the moratoria was extended from September 30, 2020, to September 30, 2021.
- Canada
  - Period: 17/03/2020: On March 17, six of the largest banks in Canada announced measures to offer individual and small business borrowers a six-month payment deferral on mortgage loan repayments (National Bank of Canada (2020)). Affected borrowers could request the relief to their banks in an opt-in basis.

- Chile
  - Period: 23/03/2020 - currently in force: According to the measures taken by the Council of the Commission for the Financial Market (2020) (*Consejo de la Comisión para el Mercado Financiero, CMF*), individuals could apply for regulatory exceptions to facilitate the possibility of postponing up to three installments in the payment of mortgage loans. This special treatment is aimed at debtors who were up to date in their obligations when the state of emergency was decreed by the authorities. Likewise, to help individuals and SMEs, the Commission also made changes to the regulation so that banks can increase the term of consumer loans by up to six months, without this being considered a renegotiation for provisions purposes.
- China
  - Period: 1/03/2020: On March 1, through the Repayment Postponement Circular, the People's Bank of China, adopted a postponement on repayments of loans due after January 25, 2020 (White & Case (2020)). These measures were aimed at borrowers from small and medium-sized enterprises (SMEs) with liquidity difficulties due to the health crisis. The deferral included both principal and interest payments.
- Costa Rica
  - Period: 31/03/2020 – 31/08/2020: On March 31, the of The Republic of Costa Rica (2020) introduced a two-month debt temporary moratoria on loan repayments of principal and interest for both individual and corporate borrowers with less than 100 million colones. The moratorium was free of charges and from June 1 to August 31, 2020, the moratorium was restricted for only suspension of loan installments.
- Croatia
  - Period: 1/04/2020: On March 20, the Croatian Banking Association (2020) announced a three-month payment deferral relief on loan repayments for individual and corporate borrowers negatively impacted by the health crisis. Borrowers could request the relief to their corresponding banks in an opt-in basis since April 1, the suspension only included principal payments, and interest continued to accrue.
- Curaçao and Sint Maarten
  - Period: 20/03/2020 – 17/11/2020: On March 20, the of Curaçao and Maarten (2020) announced a three to six-month moratorium on loan payments of interest and principal for all borrowers. Commercial banks could offer the relief without making an adequate provision. On November 18, 2020, the CBCS ended the general moratorium.

- Cyprus
  - Period: 30/03/2020 – 30/06/2021: In accordance with the Law of the Taking of Emergency Suspension Measures by Financial Institutions and Regulatory Authorities and the Decree by the of Finance of the Republic of Cyprus (2020), a general moratorium on repayments of loans was introduced between March 30 until December 31 2020 for both natural and legal borrowers with less than 30 days past due at the end of February 2020. During moratorium, payment of loan installments and interest was suspended and banks could not charge interests on interest. This moratorium was extended until June 2021 with a stricter criterion, targeting loans from most affected sectors due to the pandemic that had not receive the suspension before.

- Czech Republic
  - Period: 17/04/2020: On April 17, the Government of the Czech Republic adopted a moratorium on loan repayments of up to three or six months for individual and corporate borrowers (Ministry of Finance of the Czech Republic (2020)). This relief applied to existing loans concluded before March 26 and with no more than 30 days past due as of the same date. The suspension was only for loan installments, without additional charges, and borrowers could apply to the relief in an opt-in basis.

- Ecuador
  - Period: 22/08/2020 - 20/05/2021: According to the measures taken by the National Assembly of Ecuador (2020) at the Organic Law of Humanitarian Support (*Ley Orgánica de Apoyo Humanitario*), by mutual agreement, debtors may subscribe with their creditors pre-bankruptcy agreements of an exceptional nature through which they can establish conditions, terms and the reduction, capitalization or restructuring of the obligations earrings of any nature.

- Egypt
  - Period: 22/03/2020: On Mach 22, the Central Bank of Egypt (2020) announced instructions to implement a six-month postponement on loan installments for individual and corporate borrowers. This deferral was applied to all credit loans without additional penalties in an opt-out basis and interest continued to accrue.

- Estonia
  - Period:21/04/2020: On April 20, 2020, the Estonian Financial Supervisory Authority (2020) issued guidelines for a moratorium on loan repayments for up to 12 months for individual and business borrowers without payment difficulties prior to the crisis. The relief could be requested in an opt-in basis and banks could not rise interest rates.

- France
  - Period: 15/03/2020: On March 15, the French Banking Federation (2020) announced support measures including a payment deferral up to six-months on loan repayments for borrowers in small and medium-sized enterprises (SMEs) negatively impacted by the crisis. The relief was only for loan installments and was later extended in the tourism sector by a payment deferral up to 12 months and an application deadline of December 31, 2020.
- Germany
  - Period: 1/04/2020 – 30/6/2020: On March 27, the German Government approved a three-month payment deferral relief on loan repayments for affected individual and business borrowers from micro-enterprises until June 30, 2020 (Federal Ministry of Justice of Germany (2020)). These measures came into force in April 1 and applied to contracts concluded before March 8, 2020. Borrowers could request the relief in an opt-in basis and the deferral included principal or interest payments.
- Greece
  - Period: 17/03/2020 – 30/09/2021: On March 17, the Hellenic Bank Association (2020) announced a six-month payment deferral relief on loan repayments for business borrowers facing difficulties due to the COVID 19 crisis. This moratorium involved suspension of loan installments until the end of September 30 and affected borrowers could request this relief to their banks in an opt-in basis.
- Honduras
  - Period: 21/03/2020 – 30/06/2020: On March 21, the National Commission of Banks and Insurance (2020) approved a series of measures for supervised institutions to grant grace periods upon request of individual or business borrowers operating in sectors affected by the crisis. The temporary suspension of payments was free of charge, grace periods could not exceed June 30, 2020, interest continued to accrue, and credit rating was frozen until October 2020.
- Hong Kong
  - Period: 1/05/2020 – currently in force: On April 17, the Authority (2020) announced a Pre-approved Principal Payment Holiday Scheme starting on May 1. This scheme included payment deferrals for performing corporate borrowers with no more than 30 days past due on May 1. Payment holidays aimed at payment of principal and were up to 6 months. The scheme was extended from October 2020 to the end of October 2022.

- Hungary
  - Period: 19/03/2020 – 31/10/2022: On March 18, the Government of Hungary (2020) adopted a general moratorium on all loan repayments for existing loans of individual and corporate borrowers. The suspension of payments was for all loans, unless the borrower opted out, and included loan installments, interest, and fees. The moratorium was extended from December 31, 2020, to October 31, 2021, for all borrowers, and to October 31, 2022, for natural persons from vulnerable groups or corporate borrowers that were significantly affected by the crisis.
- Iceland
  - Period: 22/03/2020: On March 22, the Central Bank of Iceland (2020) announced instructions to implement a six-month payment deferral relief measure on loan repayments for performing corporate borrowers with less than 60 days overdue as of the end of February 2020 and that were negatively affected by the health crisis. Borrowers could request the relief in an opt-in basis and the deferral included interest and installments.
- India
  - Period: 27/03/2020: On March 17, the Reserve Bank of India (2020) announced a regulatory package that included a three-month moratorium on repayments of loans due between March 1 and May 31, 2020, for corporate borrowers. The moratorium was only for loan installments and interest continued to accrue.
- Indonesia
  - Period: 21/04/2020: On March 30, various local banks in Indonesia announced moratorium relief programs for individual and corporate borrowers negatively affected by the crisis (The Jakarta Post (2020)). Most banks targeted micro, small and medium-sized enterprises (MSMEs) or affected sectors and decided on case-by-case basis the suspension period.
- Ireland
  - Period: 19/03/2020: On March 18, the Banking & Payments Federation (2020) announced support measures including payment breaks up to three months on loan repayments for personal and business borrowers facing difficulties due to the pandemic, focusing on mortgage and small and medium-sized enterprises (SMEs) loans. The relief could be requested in an opt-in basis, and it was later extended to allow payment breaks up to six months in total.
- Italy

- Period: 10/03/2020 – 31/03/2021: On March 10, the Association (2020b) announced a debt moratorium on existing loans at January 31, 2020 for borrowers from small and medium-sized enterprises (SMEs) up to 1 year. Initially, the moratorium only included suspension of payments of loan installments, and beneficiaries had until June 30, 2020, to apply. Later, the moratorium was extended to non-SMEs performing loans that were negatively affected by the pandemic and to payments of interest. The deadline for application was later postponed to March 31, 2021.

- Latvia
  - Period: 5/05/2020: On May 5, the Finance Latvia Association (2020) announced a moratorium on loan repayments up to six months for business borrowers without financial difficulties before March 12. The moratorium involved suspension of only principal payments and borrowers could request the relief in an opt-in basis until June 12, 2020.

- Luxembourg
  - Period: 17/04/2020: On April 17, the Luxembourg Bankers' Association (2020) adopted a six-month moratorium on repayments of existing loans as of March 18, 2020. Borrowers requested the moratorium in an opt-in basis until June 30 for a maximum period of 6 months and included postponements of both principal and interest payments. This measure was aimed at corporate borrowers with liquidity issues due to the pandemic.

- Malaysia
  - Period: 1/04/2020 – 12/2021: On March 25, the Central Bank of Malaysia (2020) announced a six-month debt moratorium on all loan repayments for performing borrowers from small and medium-sized enterprises (SMEs) with less than 90 days past due as of April 1, 2020. The moratorium was automatic, unless the borrower opted out, included a suspension of both interest and principal payments, and banks could not charge compound interest. It was later extended from September 30, 2020, to the end of December 2021, targeting still affected borrowers.

- Maldives
  - Period: 1/03/2020 – 31/12/2021: The Bank of Maldives (2020) adopted a six-month moratorium on loan repayments for individual and business performing borrowers with overdue not exceeding 30 days and negatively affected by the pandemic. The moratorium could be requested in an opt-in basis, included both principal, and interest payments and lasted from March 1 until September 30, 2020. The bank didn't charge compound interest, credit classifications were frozen, and interest continued to accrue. The relief was later extended until the end of December 2020.

- Malta
  - Period: 14/04/2020 – 30/09/2021: On April 13, the of Malta (2020) together with the Government of Malta introduced a six-month debt moratorium on loan repayments on loan installments and interest for borrowers with no outstanding loan payments overdue prior to March 1, 2020, and whose income was materially affected by the health crisis. The moratorium was granted without additional charges and borrowers had until June 30 to apply. It was later extended until September 30, 2021.
- Mexico
  - Period: 27/03/2020: On March 26, the Association of Mexican Banks (2020) announced a set of measures including a payment deferral relief up to four months for individual and corporate borrowers without payments overdue as of February 28, 2020. Borrowers could request to their banks the relief in an opt-in basis and the deferral was for principal and/or interest payments.
- Montenegro
  - Period: 20/03/2020 – 31/12/2021: The of Montenegro (2020) introduced a general moratorium on loans repayment for up to 90 days available for individual and commercial loans on March 19, 2020. On April 20, 2021, the bank extended the period of beneficiaries of using the moratorium until December 31, 2021. During the time of moratorium, beneficiaries did not have to pay loan installments, fees or interest and loan classifications were frozen. On October 22, 2020, another six-month moratorium targeting natural persons was announced. Eligibility aimed at loans classified as performing and that did not have more than 90 days past due as of December 31, 2019.
- Morocco
  - Period: 19/03/2020 – 30/06/2020: On March 19, the Government of Morocco (2020) announced the establishment of a moratorium on loan repayment for individual and business borrowers from very small and medium-sized enterprises (VSMEs) facing difficulties because of the pandemic. The moratorium was until June 30 and without additional fees or penalties.
- Namibia
  - Period: 26/03/2020: On March 26, the Bank of Namibia (2020) introduced a set of measures including a loan payment moratorium from six months up to 2 years for individuals, small and medium sized enterprises (SMEs) experiencing difficulties due to the pandemic. The moratorium included both loan installments and interest payments.

- New Zealand
  - Period: 23/4/2020 – 31/03/2021: On April 23, the Association (2020c) announced a six-month loan repayment deferral scheme for borrowers from small businesses financially impacted by the pandemic. These temporary relief measures applied to payment of interest, or all loan payments, and interest continued to accrue. The scheme was later extended until March 31, 2021.
- Nicaragua
  - Period: 20/06/2020 – 31/12/2020: On June 19, the Superintendency of Banks and other Financial Institutions (2020) adopted a debt moratorium up to six months on loan repayments for existing loans with a high credit rating (A or B) as of March 31. The suspension included payments of principal and/or interest and, during grace periods, credit rating was frozen, and banks could not calculate compound interest. The deadline for requesting the grace periods ended on December 31, 2020.
- Oman
  - Period: 18/03/2020: On March 18, the Central Bank of Oman (2020) announced a six-month payment deferral on loan repayments for borrowers from small and medium-sized enterprises (SMEs) impacted by the pandemic. The deferral was for both loan installments and interest payments and did not affect credit classification.
- Panama
  - Period: 17/03/2020 – 30/06/2021: On March 16, the Superintendency of Banks of Panama (2020) allowed banks to grant grace periods on loan payments for performing borrowers with less than 90 days past due or borrowers that were negatively affected by the pandemic. Banks could not charge compound interest, loan credit classifications were frozen, and interest continued to accrue. Later, the relief was restricted for both performing and financially affected borrowers and was extended until June 30, 2021.
- Peru
  - Period: 27/03/2020 - currently in force: The Superintendency of Banking (2020) (*Superintendencia de Banca, Seguros y AFP, SBS*) empowered financial entities and cooperatives to reschedule the credits of their clients and cooperative partners (companies and / or individuals), who, being up to date with their payments, due to the health emergency, have difficulties in continuing to pay their credits on time. This rescheduling will not affect the risk rating of these clients in the SBS Risk Center.

- Philippines
  - Period: 2/04/2020: The Philippine Government announced a 30-day grace period on all loan repayments falling due within the quarantine period (March 17 to April 12) with effect from April 2 (Philippine News Agency (2020)). During the payment suspension period, banks could not charge compound interest or additional fees or charges.
- Portugal
  - Period: 27/03/2020 – 31/09/2020: On March 27, the Bank of Portugal (2020) adopted a moratorium on loan repayments for individual and corporate borrowers classified as micro, small or medium-sized enterprises, with no more than 90 days overdue of payments as of March 18. Borrowers who met these eligibility conditions could request, in an opt-in basis, these support measures, which included suspension of principal and/or interest payments.
- Romania
  - Period: 30/03/2020 – 31/12/2020: On March 30, the Government of Romania (2020) adopted a series of relief measures for allowing a temporary suspension of loan repayments up to 9 months, but no more than December 31, to individual and business borrowers from small and medium-sized enterprises (SMEs) affected by the crisis. The suspension included deferrals of loan installments and interest, and requesting borrowers could not have payments overdue as of the date of establishment of the state of emergency.
- Russia
  - Period: 4/03/2020 – 30/07/2020: On April 3, the Government of Russia (2020) announced a payment deferral programme on loan repayments up to six months for borrowers from small and medium-sized enterprises (SMEs) operating in impacted industries. The payment deferrals were for both principal and interest payments and were granted by request of the borrower until September 30, 2020.
- Serbia
  - Period: 1/04/2020 – 30/09/2020: On March 18, the of Serbia (2020) introduced a general moratorium on loan repayments for at least 90 days. Banks were obligated to offer the relief to all clients until March 31 and, unless borrowers refused, loan installments were suspended, but interest continued to accrue on principal not due. On July 28, 2020, the NBS offered another moratorium for borrowers which lasted from August 1 to September 30, 2020.
- Singapore

- Period: 31/03/2020: On March 31, the Monetary Authority of Singapore (2020) announced a payment deferral package for performing borrowers from small and medium-sized enterprises (SMEs) with not more than 90 days overdue as of April 6, 2020. These measures were requested by borrowers in an opt-in basis and included deferrals on principal payments of secured term loans up to December 31, 2020.

- Slovakia
  - Period: 2/04/2020 – 15/07/2021: On April 2, the National Council of the Slovak Republic (2020) adopted measures for financial institutions to grant small employers and entrepreneurs a payment deferral up to 9 months on loan repayments during the COVID-19 pandemic. Borrowers requested this relief measure in an opt-in basis and the deferral included principal and/or interest payments for loans with less than 30 days past due as of the date of the request.

- Slovenia
  - Period: 20/03/2020 – 31/03/2020: On March 18, the Government of the Republic of Slovenia (2020) announced the adoption of a twelve-month moratorium on loan repayments aimed at individual and corporate borrowers negatively affected by the pandemic. The payment deferrals covered all types of loan liabilities, were without additional costs, and maturity was extended for the duration of the deferral. In December, the moratorium was later extended to March 31, 2020, and the duration of the deferral was restricted to 9 months.

- South Africa
  - Period: 1/04/2020: The South African Government (2020) adopted a payment holiday for affected borrowers from small, medium, and micro enterprises (SMMEs) up to six months from April 2020. This relief applied only to loans granted by the Small Enterprise Finance Agency (SEFA).

- South Korea
  - Period: 1/04/2020 – 30/09/2020: On April 1, the Financial Services Commission (2020) implemented a payment deferral on repayment of existing loans with maturity date up to September 30, 2020. This relief was available in an opt-in basis for corporate borrowers from small and medium-sized enterprises (SMEs) affected by COVID-19 and without overdue payments. The program included a six-month maturity extensions and deferral of interest payments.

- Spain

- Period: 18/03/2020: On March 17, the Government of Spain (2020) set out measures involving a three-month moratorium on repayments of mortgage loans, including both commercial and consumer loans, for individual borrowers economically affected by the pandemic. Borrowers could request the moratorium to their lenders until September 29, 2020.

- Sri Lanka
  - Period: 1/04/2020 – 31/03/2021: On March 24, the Central Bank of Sri Lanka (2020) introduced a six-month moratorium on loan repayment for business borrowers from small and medium-sized enterprises (SMEs) in industries negativity affected by the pandemic and for individual borrowers. The moratorium included suspension of payments of both principal and interest. It was later extended for another six months until March 31, 2021.

- Switzerland
  - Period: 20/04/2020: On April 16, the Government of Switzerland adopted a three-month moratorium on loan repayments aimed at borrowers from small and medium-sized enterprises (SMEs) without over-indebtedness as of December 31, 2019 (Lenz & Staehelin (2020)). Borrowers could request the relief in an opt-in basis and the ordinance entered into force on April 20, 2020.

- Thailand
  - Period: 8/04/2020 – 22/10/2020: On April 7, the Bank of Thailand (2020) introduced a six-month blanket loan payment holiday aimed at small and medium-sized enterprises (SMEs) with a credit line size less than 100 million baht. The deferral of payments included interest and/or loan installments, did not affect credit history, and interest continued to accrue. This measure was terminated on October 22, 2020.

- The Netherlands
  - Period: 19/03/2020 – 31/07/2020: On March 19, the Dutch Union of Banks (2020) agreed to offer corporate borrowers from small and medium-sized enterprises (SMEs) a six-month payment deferral for loans of up to 2.5 million euros. This relief included both suspension of interest and principal payments.

- Trinidad and Tobago
  - Period: 31/03/2020 – 30/09/2021: On March 24, the Central Bank of Trinidad and Tobago (2020) introduced a series of regulations for a three-month moratorium on loan repayments for performing loans with less than 90 days past due as of March 1, 2020. The moratorium targeted affected borrowers, included suspension of interest and/or principal payments and delinquency status was

frozen. It was extended from May 1 to December 31, 2020. A new moratorium was adopted for performing borrowers with less than 90 days past due as of May 1, 2021, between May 1 and September 30, 2021.

- Turkey
  - Period: 18/03/2020: On March 18, through the Economic Stability Shield Program, a three-month moratorium on loan repayments was announced, by the Presidency of Turkey (2020), aimed at companies with cash flow difficulties because of the pandemic. This moratorium included payment deferrals of both loan installments and interest.

- United Arab Emirates
  - Period: 27/03/2020 – 31/12/2021: On March 15, the Central Bank of United Arab Emirates (2020) introduced a support scheme to provide relief in form of payment deferrals on loan repayments for affected corporate borrowers from small and medium-sized enterprises (SMEs) and individuals. These postponements were for principal and/or interest payments. The deferral program was later extended until December 31, 2021.

- United Kingdom
  - Period: 26/06/2020 – 30/03/2021: On June 26, a moratorium on loan repayments was adopted through the Corporate Insolvency and Governance Act for business borrowers unable to pay its debts (Norton Rose Fulbright (2020)). The moratorium was granted for 20 business days and 30 business days for small companies, and borrowers could request the relief to a court. It was later extended until March 30, 2021.

- United States of America
  - Period: 3/03/2020 – 20/04/2020: On March 21, the Governor of State of New York (2020) adopted a measure for financial entities to grant a 90-day forbearance to individual and business borrowers experiencing financial difficulties due to the pandemic. This relief measure was requested by affected clients in an opt-in basis and lasted until April 20, 2020.

- Uruguay
  - Period: 19/03/2020 - currently in force: The Superintendency of Financial Services (2020) (*La Superintendencia de Servicios Financieros, SSF*) authorizes financial intermediation Institutions, Financial Services Companies and Credit Administrators with higher assets, to extend the maturity terms of fixed-term or amortizable loans corresponding to the loan portfolio to the Non-Financial Sector, for up to 180 days both of the payment of capital and of interest, without

modifications in the accounting classification of the operations, nor in the classification into risk categories of the debtors. These term extensions will be made prior agreement with the clients except when they do not generate interest, in which case the communication to the debtor will suffice so that he can express his refusal. The interest rate to be applied during the extension of the term may not be higher than that agreed in the original loan.