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Policy Rules and Large Crises in Emerging Markets*

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Abstract

Emerging countries have increasingly adopted rules to discipline government policy. The COVID-19 shock lead to widespread suspension and modification of these rules. We study rules and flexibility in a sovereign default model with domestic fiscal and monetary policies and long-term external debt. We find welfare gains from adopting monetary targets and debt limits during normal times. Though government policy cannot itself counteract fundamental shocks hitting the economy, the adoption of rules has a significant impact on policy, macroeconomic outcomes and welfare during large, unexpected crises. We also find moderate gains from suspending monetary targets during a crisis and large losses from abandoning debt limits.

JEL Classification: E52, E62, F34, F41, G15.

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1 Introduction

Since the early 2000s, Latin American countries have increasingly adopted rules to strengthen their fiscal frameworks, promote debt sustainability, and increase the credibility of fiscal and monetary policies. However, the COVID-19 shock led to the widespread use of escape clauses and *ad-hoc* suspensions or modifications of these rules to support domestic economies.[1] In this paper, we study the value of fiscal and monetary rules in emerging markets and the merits of flexibility during large crises.

We extend Espino, Kozlowski, Martin, and Sánchez (2022), EKMS hereafter, to understand the role of rules constraining government policy, both during normal times and crises. Our benchmark is a model of sovereign default with domestic policies and long-term external debt. The inclusion of default risk is crucial as it reflects the challenges in adopting policy rules in emerging markets: weak institutions and the nature and magnitude of the shocks hitting these economies.[2] Domestic policies are often blamed for poor macroeconomic performance in these countries (e.g., see Kehoe, Nicolini, and Sargent, 2020) and as such, are natural candidates for rules. Long-term debt also plays an important role, as rules may be used to correct, among other things, excessive indebtedness due to a debt-dilution problem which is absent with one-period debt—see Hatchondo, Martinez, and Sosa-Padilla (2016).

The environment is a tradable-nontradable (TNT) small open economy, as in Uribe and Schmitt-Grohé (2017). Firms produce non-tradable goods and exported goods; agents consume non-tradable goods and imported goods. As in EKMS, consumers need money to finance their purchases of non-tradable goods, which gives rise to a demand for fiat money.[3] The government provides a valued public good and makes transfers to individuals; labor taxes, money creation, and long-term external debt in foreign currency finance government expenditures. The government cannot commit to future policy actions except when specific policy rules are in place.

We use the COVID-19 pandemic as a natural experiment, capturing the type a large,

[1] Appendix C discusses policy responses in Latin America to COVID-19.

[2] Fraga, Goldfajn, and Minella (2003) use the example of the challenges with inflation targeting in Brazil when, in 2002, it faced a sudden drop in capital inflows that led to a nominal depreciation of 50% and a large gap between the inflation target and actual inflation.

[3] Though we model domestic government liabilities as fiat money, one could interpret them more generally to include debt issued domestically in local currency.

complex and unpredictable crises that often hit emerging countries. Specifically, the economy experiences a combination of adverse shocks: lower productivity, increased government transfers, increased trade costs and increased demand for liquidity. These shocks are unexpected, severe and last a year. By construction, the combination of shocks reproduces the main economic outcomes due to the COVID-19 shock, on impact: drop in real GDP, increase in government expenditure, contraction in imports and fall in inflation. As is standard in the literature, we allow the penalty for sovereign debt default to vary with the state of the economy and calibrate this penalty to match the rise in credit spreads during the first year of the pandemic.

In our benchmark, the government is assumed to be discretionary, i.e., there are no policy rules in place. The government's response to the crisis involves a rise in the fiscal deficit, a significant portion of which is monetized, leading to higher inflation in the future. The model performs fairly well in reproducing non-targeted moments, such as the drop in employment and exports, the decrease in tax revenues, the increase in debt-to-GDP and the depreciation of the currency. The crisis implies a high welfare cost: households would be willing to forgo 13% of non-tradable consumption to avoid it.

We then study two types of policy rules: a monetary rule, which fixes the money growth rate, and a fiscal rule, which limits the level of debt. We begin by choosing the optimal values for each rule, assuming they are adopted at the discretionary steady state, i.e., during normal times. For robustness we also compute welfare when debt at adoption is zero and find that, though the gains may vary somewhat, the prescriptions for each rule are very similar.

Fixing the money growth rate, which in a steady state would target the inflation rate, offers positive but relatively small welfare gains. The monetary rules trades off the cost of imposing a sub-optimal policy mix and the gains from mitigating a time-consistency problem in debt issuance due to how future policies affect current money demand. The optimal prescription implies contracting the money supply—but leaving the money supply constant offers similar gains. These results are consistent with those in the literature, e.g., see Martin (2015) for a study in the context of a closed economy.

The optimal fiscal rule limits debt issuance, but not significantly below the discretionary steady state. However, welfare gains are an order of magnitude larger than for monetary rules. A debt limit alleviates a debt-dilution problem, which arises when governments issue long-term debt. In essence, investors anticipate that additional borrowing by future governments will increase the risk of default on long-term bonds issued by the current government and, thus, offer a lower price for these bonds. Putting a debt ceiling that is not too tight goes a long way in alleviating this problem.

Next, for a given policy rule, we let the economy converge to its steady state under repayment and then hit it with the combination of shocks we described above. We consider three scenarios: (i) the rule is active all the time; (ii) the rule is suspended during the period of the crisis but reimposed right afterwards; and (iii) the rule is abandoned during the crisis and never readopted. We draw several lessons from these exercises.

When policy rules are imposed at all times, the economy still experiences a sharp contraction in output and an increase in government spending. Rules, and more generally, government policy, cannot significantly counteract the drop in GDP or the raise in (exogenous) transfers. However, rules affect the policy mix implemented during the crisis and afterwards. Thus, we observe important differences in the dynamics of tax revenue, inflation and currency depreciation. These policies, in turn, affect the response of credit spreads, employment, exports and imports. Of particular note, credit spreads barely rise during the crisis when a debt limit is in effect.

There are gains from being flexible when subject to a monetary rule, since this allows the government to implement a better policy mix given the state of the economy, particularly during a severe crisis. The gains from abandoning the rule are also positive but much smaller than suspending it. The gains from suspending a debt ceiling during the crisis are not significant, while the costs of abandoning it are large. Investors already impose enough discipline on debt issuance so flexibility is not as valuable. Abandoning the debt limit foregoes its large long-run benefits and thus, leads to an overall welfare loss.

Related literature

The basic setup here connects this paper with the literature on sovereign default started by Eaton and Gersovitz (1981) and the quantitative models proposed by Aguiar and Gopinath (2006), Arellano (2008), Hatchondo and Martinez (2009), and Chatterjee and Eyigungor (2012). However, we incorporate fiscal policy as in Cuadra, Sánchez, and

Sapriza (2010) and monetary policy as EKMS.

Analyzing fiscal policy rules in the context of sovereign default links this paper with Hatchondo, Roch, and Martinez (2022). However, they do not consider a monetary economy, so they miss the interplay between monetary and fiscal policy rules. In addition, their analysis does not consider the cost of sustaining a rule during a large unexpected shock.

The analysis of monetary policy flexibility relates to the findings in Bianchi and Mondragon (2018). They also find that not being able to adjust monetary policy leaves a government more vulnerable. However, they emphasize the role of monetary policy in reducing the possibility of a rollover crisis. We focus on how adjustments in monetary policy allow for a better policy mix in response to a large crisis.

The most recent paper related to our work is Arellano, Bai, and Mihalache (2020), which also studies the effects of the COVID-19 shock on emerging economies. They argue that default-risk may limit the response to the epidemic and, consequently, find substantial gains from debt relief. In contrast, we only use COVID-19 as a benchmark of a shock with large economic consequences. We analyze how emerging markets cope with it by adjusting external debt and domestic fiscal and monetary policies.

This paper also connects this paper and the literature on political economy and rules focused on developed economies. Azzimonti, Battaglini, and Coate (2016) studies balanced budget rule in a non-monetary economy where a legislature makes policy choices. Martin (2015) studies the effects of increasing central bank independence and adopting inflation targets. Martin (2022) analyzes fiscal rules and their effectiveness for curbing government spending in a monetary economy in which the government is prone to overspending. Notably, these papers abstract from long-term debt and default, which play important roles in our setup.

The paper is structured as follows. Section 2 describes the environment and characterizes the monetary equilibrium. Section 3 formulates the problem of the government and defines a Markov-perfect equilibrium. Section 4 describes how we calibrate the model. Section 5 describes the fiscal and monetary rules we study and how we select their optimal value. Section 6 describes how we model a large, unexpected crisis and compares the response under discretion and policy rules. Section 7 concludes.

2 Model

2.1 Environment

We study a small open economy populated by many identical infinitely-lived agents. Time is discrete. In our recursive formulations, a variable's prime indicates that it corresponds to the next period level.

Preferences, endowments, and technology. There are three private goods in the economy. First, a non-tradable good that is consumed and produced domestically; these quantities are denoted c^N and y^N, respectively. Second, there is a tradable imported good that is consumed domestically but not produced. Let c^T denote the consumption of this imported good. Third, there is a tradable export good that is not consumed domestically and is only produced to be exported. Let y^T denote the production of this export good.

There is also a public good provided by the government. A linear technology transforms one unit of the non-tradable good into one unit of the public good, g.

The representative household is endowed with one unit of time each period, which can be either consumed as leisure, ℓ, or supplied in the labor market, h. Thus, $\ell + h = 1$.

A time-separable, expected discounted utility function represents preferences. Let the period utility be given by

$$u(c^N, c^T) + v(\ell) + \vartheta(g),$$

where u, v, and ϑ are strictly increasing, strictly concave, C^2, and satisfy standard boundary conditions. Let $\beta \in (0,1)$ denote the discount factor. In what follows, u_j denotes the partial derivative of u with respect to the consumption good c^j, with $j = \{N, T\}$, v_ℓ denotes the derivative of v with respect to $\ell = 1 - h$, and ϑ_g denotes the derivative of ϑ with respect to g. We assume that preferences are separable in the non-tradable good and the imported good and so the cross derivatives are assumed to be zero; i.e., $u_{NT} = u_{TN} = 0$.

An aggregate production technology transforms hours worked, h, into non-tradable output, y^N, and exportable goods, y^T. This technology is represented by a cost function $F : \mathbb{R}^2_+ \to \mathbb{R}_+$, which is strictly increasing, strictly convex, and homogeneous of degree one.

Feasible levels of (y^N, y^T, h) must satisfy

$$A(I)F(y^N, y^T) - h \leq 0. \tag{1}$$

The technological parameter $A(I)$ refers to the inverse of total factor productivity. It depends on I, which is the government's decision of whether to default or not. This technological parameter will also be affected during the large crisis as detailed in the following sections.

Market structure. Agents can exchange both tradable and non-tradable goods, as well as domestic currency (fiat money). Trading of other financial assets are restricted to the government. Prices are denominated in domestic currency (i.e., pesos) and given by P^X, P^M, and P^N for exports, imports, and non-tradable goods, respectively. Let W denote the nominal wage in units of the domestic currency. Let M^d denote individual nominal money holdings.

The nominal exchange rate E is defined as the units of domestic currency necessary to purchase one unit of foreign currency (i.e., pesos per dollar). There is a cost, $\phi \geq 0$, to trade internationally. This cost will also change during the large crisis.

The law of one price holds for tradable goods, and so $P^X = Ep^T(1-\phi)$ and $P^M = E(1+\phi)$, where p^T is the international price of export good which is deterministic. The international price of importable goods has been normalized to 1. Thus, p^T also stands for the terms of trade, while $\frac{p^T(1-\phi)}{(1+\phi)}$ denotes *effective* terms of trade.

In order to study a stationary environment, we normalize nominal variables by the stock of the money supply, M.

Let μ denote the growth rate of the money supply, and so, $M' = (1+\mu)M$ denotes its law of motion. Define the corresponding normalized variables as $p^N = P^N/M$, $w = W/M$, $e = E/M$ and $m = M^d/M$.

Households face a cash-in-advance constraint to purchase non-tradable goods so that

$$p^N c^N \leq \theta m, \tag{2}$$

i.e. (normalized) expenditure on non-tradable goods, $p^N c^N$, cannot exceed (normalized) money balances available at the beginning of the period, m, times θ. The parameter θ refers to a measure of the velocity of circulation. It will also be affected during the large crisis below.

Government. The government provides a public good, g, determined endogenously and produced using a linear technology as mentioned above. In addition, there are government transfers to the households, which are endogenously given. Let $\gamma > 0$ be the real value (in units of non-tradable output) of those transfers, which will change during the large crisis to represent a sudden need of additional expenditures.

The government has access to the following instruments to finance expenditures: (i) it can tax labor income, wh, at rate τ; (ii) it can increase the money supply at rate μ, and (iii) it can issue debt in international credit markets if not excluded.

The government can issue long-term bonds that pay in units of foreign currency. Each bond issued promises a deterministic infinite stream of coupons that decreases at an exogenous constant rate so that a fixed fraction $\delta \in (0,1]$ matures every period.[4] Consequently, δB represents the corresponding payment of maturing coupons while $B' - (1-\delta)B$ denotes the issuance of new bonds at a price q, which in equilibrium depends on the government's portfolio. Therefore, $q[B' - (1-\delta)B]$ are funds collected from issuing new debt, expressed in foreign currency units.

The consolidated (fiscal and monetary) government budget constraint in (normalized) units of domestic currency can be expressed as

$$p^N(g+\gamma) + e\delta B \leq \tau wh + \mu + eq[B' - (1-\delta)B]. \tag{3}$$

Below, we study the implications of alternative degrees of discretion to set these three instruments available for the government to finance its expenditures.

Government's decisions. Each period, the government has to make several decisions. First, it decides whether to default on its debt or not. Second, the government decides how to issue of new debt and it sets the labor tax and the money growth rate depending on potential restrictions imposed by rules described in detail below.

More precisely, a government that did not default is in good credit standing, $I = P$, while a government in default is in bad credit standing, $I = D$. When the government repays the debt and, conditional on whether there is a rule that restricts new issuances or

[4] As in Hatchondo and Martinez (2009), this simplified payment structure still permits summarizing all past long-term debt issuances into the number of long-term coupon obligations that mature in the current period.

not, the government can get new borrowing, deciding the debt level for the next period B'. When the government defaults, it avoids paying the debt services but receives a temporary bad credit standing. In this case, the government loses immediate access to financial markets. Every period after exclusion of financial markets, the government regains a good credit standing status and reenters financial markets with zero debt obligations with probability π . With probability $1-\pi$, the government stays excluded from financial markets.

Representative household. The endogenous aggregate state of the economy consists of the amount of foreign debt, B, and the default status I defined above. Agents know the government's default state at the beginning of each period before making any decision.

All domestic prices, government policies, and the laws of motion of the aggregate state variables are functions of the aggregate state (B, I). To simplify notation, we omit this dependence. The individual state variable is the household's (normalized) money balances at the beginning of the period, m.

Given the current state I, the government's policy function for borrowing $\mathcal{B}$ implies a law of motion for debt from B to B'. Similarly, the government policy function for repayment $\mathcal{P}(B)$ and the current state I imply the law of motion of the default status, from I to I'. Then, the problem of the representative household is

$$V(m, B, I) = \max_{(c^N, c^T, m', h)} u(c^N, c^T) + v(1-h) + \vartheta(g) + \beta \mathbb{E}\left[V(m', B', I')|B, I\right]$$

subject to

$$\begin{aligned} p^N c^N + e(1+\phi)c^T + m'(1+\mu) &\leq (1-\tau)wh + m + p^N \gamma, \\ p^N c^N &\leq \theta m, \end{aligned}$$

the law of motions for B and I, $(c^N, c^T, m') \geq 0$ and $h \in [0, 1]$. Note that $V(m, B, I)$ denotes the agent's value function as a function of individual and aggregate state variables. Conditional on (B, I), the only source of aggregate uncertainty faced by the domestic agents is the ex-ante random decision of the government on whether to default or not next period, I'. Thus, $\mathbb{E}[V(m', B', I')|B, I]$ is the conditional expectation of the agent's value function in the next period, given current aggregate state (B, I).

Representative firm. Local firms produce non-tradable and tradable goods by hiring labor according to the technology represented by F. Constant returns to scale and competitive markets imply that we can assume that the industry behaves as a competitive representative firm.

Given prices, (p^N, e, w), and the government default decision, I, this firm solves the static problem

$$\max_{(y^N, y^T, h)\geq 0} \{p^N y^N + e(1-\phi)p^T y^T - wh\}$$

subject to

$$A(I)F(y^N, y^T) - h \leq 0.$$

Observe that the firm does not need to take into account the laws of motion of the aggregate state variables due to the static nature of its problem.

2.2 Recursive monetary competitive equilibrium

Recall that for all states (B, I), the domestic prices are $w(B, I), e(B, I), p^N(B, I)$, the policy functions for the firm are $y^N(B, I), y^T(B, I)$, and the policy functions of the representative agent are $c^N(m, B, I)$, $c^T(m, B, I)$, $m'(m, B, I)$, $h(m, B, I)$. Then, the following definition states the conditions for a recursive competitive monetary equilibrium.

Definition 1. *Given the government laws of motion for* (B, I)*, a monetary and fiscal policy* (τ, μ, g, B')*, a* ***recursive monetary competitive equilibrium*** *consists of policy functions for the representative agent* (c^N, c^T, m', h)*, policy functions for the representative firm* (y^N, y^T)*, and a domestic price system* (w, e, p^N) *such that:*

(1) Given the laws of motion for (B, I) *and a monetary and fiscal policy* (τ, μ, g)*, the policy functions* (c^N, c^T, m', h) *solves the representative household's problem;*

(2) Given a domestic price system (p^N, e, w)*, the policy functions* (y^N, y^T) *solve the representative firm's problem;*

(3) The budget constrain of the government (3) is satisfied;

(4) Markets clear. That is, for all (B, I)*: (i) The money market clears,* $m'(1, B, I) = 1$*; (ii) the market for non-tradable goods clears,* $c^N(1, B, I) + g = y^N(1, B, I)$*; and (iii) the labor market clears,* $A(I)F(y^N(1, B, I), y^T(1, B, I)) = h(1, B, I)$*.*

It is convenient to observe that the balance of payments, expressed in units of foreign currency, results from consolidating the household's and the government's budget constraints and thus

$$(1-\phi)p^T y^T - (1+\phi)c^T = \delta B - q[B' - (1-\delta)B], \tag{4}$$

where the left-hand side of the expression above is the trade balance, while the right-hand side is the change in the country's net asset position plus implicit debt interest payments.

3 Markov perfect equilibrium

The benchmark economy

In this section, we describe the benchmark setting in which the government does not commit to future policies, i.e., there are no rules and so the government has full degree of discretion. Consequently, the government chooses whether to repay its debt, borrowing, labor income taxes, and money growth rate every period. In the next section, we describe the alternative settings in each of which the government commit to a certain rule that restricts its choices.

We consider a Markov perfect equilibrium where the government making its policy decisions considers that its behavior affects the equilibrium allocations, taking as given its behavior in the future.

We follow the primal approach and thus solve for allocations and debt choices that are implementable in a monetary competitive equilibrium as described above. In order to proceed, we use equilibrium conditions to replace domestic prices (p^N, w, e) and policies (μ, τ) in the government budget constraint (3).

Therefore, the government budget constraint in a monetary competitive equilibrium, expressed in units of utility, is

$$\begin{aligned} u_T c^T + \beta \mathbb{E}\left[\Omega(c^{N\prime}, c^{T\prime}, y^{T\prime}, g')|I\right] - v_\ell A(I) F(c^N + g, y^T) \\ + \frac{(1-\phi)}{(1+\phi)} \frac{u_T p^T F_N}{F_T}\left[c^N\left(1 - \frac{1}{\theta}\right) - \gamma\right] \geq 0, \end{aligned} \tag{5}$$

where

$$\Omega(c^N, c^T, y^T, g) \equiv \frac{c^N}{\theta}\left[\theta u_N + (1-\theta)\frac{(1+\phi)}{(1-\phi)}\frac{u_T p^T F_N}{F_T}\right].$$

Condition (5) depends on households' decisions $(c^N, c^T, y^T, c^{N\prime}, c^{T\prime})$, current and future, and government choices for debt repayment and public good provision, g (see Appendix A for the derivation). Note that future decisions are a function of the state, (B, I).

Suppose the government is currently in good credit standing and not excluded from international credit markets. At the beginning of that period, the government decides between repaying $(I = P)$ and defaulting $(I = D)$ on its debt. If it decides to default, the government loses access to the current international credit market, to which it reenters in the future with probability π and zero debt obligations.

Define the value of the optimal decision problem as

$$\hat{\mathcal{V}}(B, \varepsilon) = \max\{V^P(B) + \varepsilon, V^D\}, \tag{6}$$

where V^P and V^D denote the value of repayment and default, respectively, defined below. An idiosyncratic additive shock to utility also influences this decision. We assume that ε has mean zero and is distributed logistic; i.e., ε follows

$$F(\varepsilon) = \frac{\exp[\varepsilon/\zeta]}{1 + \exp[\varepsilon/\zeta]},$$

where $\zeta > 0$ is the scale parameter of the distribution, which controls the variance of the ε shocks. We denote $\mathcal{I}(B, \varepsilon)$ as the government's default policy function. Under these assumptions, the policy function for repayment conditional only on B is $\mathcal{P}(B)$ is

$$\mathcal{P}(B) \quad = \quad \Pr(V^P(B) - V^D \geq -\varepsilon) = \frac{\exp[V^P(B)/\zeta]}{\exp[V^P(B)/\zeta] + \exp[V^D/\zeta]}, \tag{7}$$

for any B (see EKMS).

Every period, after deciding on whether to repay or default on its debt, the government implements the corresponding policies for that period, internalizing the response of private domestic agents, international lenders, the future government policies, and the evolution of credit standing. A period policy consists of choices on the amount of future debt, the money growth rate, the tax rate, and government expenditure.

If the government is currently repaying, the probability that it will remain in repayment status tomorrow, conditional on B', is given by $\mathcal{P}(B')$ as in (7). On the other hand, if the government is currently in default, the probability that it will transition to repayment status tomorrow is given by $\pi\mathcal{P}(0)$.

Every period, the government chooses a debt level (only when repaying) and the allocation (c^N, c^T, y^T, g) to implement optimal domestic policies. These choices need to satisfy the balance of payment, (4), the government budget constraint, (5), and a non-negativity constraint regarding the Lagrange multiplier for the cash-in-advance constraint (see Appendix A, Equation (25)).

When the government is in repayment status, $I = P$, its policies are a function of the state B. Let the relevant aggregate policy functions be denoted by $\{\mathcal{B}, \mathcal{C}^N, \mathcal{C}^T, \mathcal{Y}^T, \mathcal{G}\}$. When the government is in default, $I = D$, and the aggregate policy functions are denoted $\{\bar{\mathcal{C}}^N, \bar{\mathcal{C}}^T, \bar{\mathcal{Y}}^T, \bar{\mathcal{G}}\}$ which are independent of the state B as the debt level is reset to 0.

Repayment. The problem of the government in the repayment state is

$$V^P(B) = \max_{(B', c^N, c^T, y^T, g)} \{u(c^N, c^T) + v(1 - F(c^N + g, y^T)) + \vartheta(g) + \beta \mathcal{V}(B')\} \tag{8}$$

subject to

$$(1-\phi)p^T y^T - (1+\phi)c^T - \delta B + q[B' - (1-\delta)B] = 0, \tag{9}$$

$$u_T c^T + \beta \mathbb{E}\left[\Omega(c^{N\prime}, c^{T\prime}, y^{T\prime}, g')|P\right] - v_\ell A(P) F(c^N + g, y^T) + \frac{(1-\phi)}{(1+\phi)} \frac{u_T p^T F_N}{F_T} \left[c^N \left(1 - \frac{1}{\theta}\right) - \gamma\right] \geq 0, \tag{10}$$

$$u_N - \frac{(1-\phi)}{(1+\phi)} \frac{u_T p^T F_N}{F_T} \geq 0. \tag{11}$$

As mentioned, the constraints in the government's problem correspond to the balance of payment, (4), the government budget constraint, (5), and the non-negativity constraint, (25). Note that the expectation term in the government budget constraint is conditioned on the current state being $I = P$. The transition probabilities are $\mathcal{P}(B')$ for repay and $(1 - \mathcal{P}(B'))$ for default.

Default. The problem of the government in the default state is

$$V^D = \max_{(c^N, c^T, y^T, g)} \{u(c^N, c^T) + v(1 - F(c^N + g, y^T)) + \vartheta(g) + \beta[\pi \mathcal{V}(0) + (1-\pi)V^D]\} \tag{12}$$

subject to

$$(1-\phi)p^T y^T - (1+\phi)c^T = 0, \tag{13}$$

$$u_T c^T + \beta \mathbb{E}\left[\Omega(c^{N\prime}, c^{T\prime}, y^{T\prime}, g')|D\right] - v_\ell A(D) F(c^N + g, y^T)$$
$$+ \frac{(1-\phi)}{(1+\phi)} \frac{u_T p^T F_N}{F_T} \left[c^N \left(1 - \frac{1}{\theta}\right) - \gamma\right] \geq 0, \tag{14}$$

$$u_N - u_T p^T \frac{(1-\phi)}{(1+\phi)} \frac{F_N}{F_T} \geq 0. \tag{15}$$

As the government is excluded from international credit markets, the balance of payments is simply the trade balance—which must be zero. The expectation term in the government budget constraint is conditioned on the current state being default ($I = D$); hence, the relevant transition probabilities are $\pi\mathcal{P}(0)$ for repay and $(1-\pi\mathcal{P}(0))$ for default.

Bond prices and credit spreads. In equilibrium, zero expected profits by risk-neutral international lenders implies that

$$Q(B') = \frac{1}{1+r}\left[\mathcal{P}\left(B'\right)\left(\delta + (1-\delta) Q\left(\mathcal{B}(B')\right)\right)\right] \tag{16}$$

We compute credit spreads on sovereign bonds (CS) as a proxy of EMBI (Emerging Markets Bonds Index). Let $Q^{EMBI}(B)$ be the implicit spot price in the secondary market for the outstanding sovereign debt B at the beginning of the period before the government decides whether to default or not, which is given by

$$Q^{EMBI}(B) = \mathcal{P}(B)[\delta + (1-\delta) Q(\mathcal{B}(B))] \tag{17}$$

To compute the sovereign credit spread that is implicit in Q^{EMBI}, we compute the yield as the return that an investor would earn if he holds the bond to maturity (forever), and no default is declared. This yield, expressed as $(1+r)(1+CS(B))$, is then computed as

$$Q^{EMBI}(B) = \sum_{j=0}^{\infty} \frac{\delta(1-\delta)^j}{(1+r)^j (1+CS(B))^{j+1}} \tag{18}$$

Therefore, sovereign credit spread is

$$CS(B) = \frac{\delta}{Q^{EMBI}(B)} + \frac{(1-\delta)}{(1+r)} - 1 \tag{19}$$

We now define the equilibrium for the benchmark economy without rules.

Definition 2. *A* ***Markov perfect equilibrium*** *is characterized by a set of value* *functions* $\{V^P(B),\, V^D\}$*; policy functions for the government,* $\{\mathcal{P}, \mathcal{B}, \mathcal{C}^N, \mathcal{C}^T, \mathcal{Y}^T, \mathcal{G}\}$ *and* $\{\bar{\mathcal{C}}^N, \bar{\mathcal{C}}^T, \bar{\mathcal{Y}}^T, \bar{\mathcal{G}}\}$*; and bond price function* Q *such that the following conditions are satisfied:*

(i) Given Q*, the value functions* (V^P, V^D) *satisfy* (8) *and* (12)*, and the corresponding policy functions are* $\{\mathcal{P}, (\mathcal{B}, \mathcal{C}^N, \mathcal{C}^T, \mathcal{Y}^T, \mathcal{G})\}$ *and* $\{\bar{\mathcal{C}}^N, \bar{\mathcal{C}}^T, \bar{\mathcal{Y}}^T, \bar{\mathcal{G}}\}$*;*

(ii) Given $(\mathcal{P}, \mathcal{B})$*, the bond price equation* Q *satisfies* (16)*;*

(iii) Government policies and values are consistent with future policies and values.

In the following sections, we refer to the steady-state level of debt and the corresponding policies. Of course, the presence of the additive utility shocks implies that the steady state involves a stationary debt distribution since there is still a chance of default. The referenced steady-state level of debt is the level at which the economy converges after a long time if the shocks ε are such that there is no default. More precisely, that level of debt B^{SS} is such that $\mathcal{B}(B^{SS}) = B^{SS}$.

4 Calibration

This section discusses the calibration of the model to the average of six Latin American countries. First, it describes the functional forms adopted for the quantitative analysis and discusses the sources of the parameters set externally. Then it describes the values of parameters set to match the long-term average of critical statistics. Then, it explains the calibration of an unanticipated shock resembling COVID-19. The calibration uses the benchmark economy without rules because it mimics the behavior of an economy with rules abandoned during the crisis.

4.1 Functional forms

The utility functions for consumption and leisure are

$$\begin{aligned} u(c^N, c^T) &= \alpha^N \frac{\left(c^N\right)^{1-\sigma}}{1-\sigma} + \alpha^T \frac{\left(c^T\right)^{1-\sigma}}{1-\sigma}, \\ v(\ell) &= \alpha^H \frac{\ell^{1-\varphi}}{1-\varphi}, \end{aligned}$$

Note that $1/\sigma$ is both the intra-temporal elasticity of substitution between c^N and c^T, and the inter-temporal elasticity of substitution. The utility associated with the public good is

$$\vartheta(g) = \alpha^G \log(g),$$

which is a standard representation in the optimal taxation literature and close to empirical estimates.

The function describing the labor requirement for production is

$$F(y^N, y^T) = \left[\left(y^N\right)^\rho + \left(y^T\right)^\rho\right]^{1/\rho},$$

where $\frac{1}{1-\rho}$ is an elasticity of substitution, determining how costly it is to change the composition of y^N and y^T that is produced, in terms of labor units.

4.2 Exogenous parameters

Table 1 shows the values of parameters set externally. The annual risk-free interest rate is 3%, in line with the average real interest rate of the world since 1985 in King and Low (2014). We calibrate φ to 1.50 so that the Frisch elasticity is one-half on average.[5] The values of α^T and θ are normalized to one, while ϕ is normalized to zero—we will allow θ and ϕ to vary when we study aggregate shocks. Given the duration of a default episode from Das et al. (2012) and the length of exclusion after restructuring from Cruces and Trebesch (2013), we choose an expected period of exclusion after a default of 6 years, which implies $\pi = 1/6$. We calibrate $\delta = 0.2$ to get a maturity of five years as in Hatchondo and Martinez (2009).

Table 1: Parameters calibrated externally

Parameter	Description	Value	Basis
r	risk-free rate	0.03	long-run average
φ	curvature of leisure	1.50	Frisch elasticity
α^T	preference share for c^T	1.00	normalization
θ	velocity of circulation	1.00	normalization
ϕ	trade cost	0.00	normalization
π	re-entry probability	0.17	exclusion duration
δ	fraction of maturing coupons	0.20	debt maturity
σ	curvature of $u(c^N, c^T)$	0.50	EKMS
ρ	elasticity of substitution in $F(y^N, y^T)$	1.50	EKMS

We follow EKMS to set $\sigma = 0.5$ and $\rho = 1.5$. Here, we briefly summarize the rationale for these choices. Setting $\sigma < 1$ is sufficient for the non-negativity constraint in

[5] We can calibrate this parameter externally because we target hours, as explained below.

the government's problem to be satisfied with strict inequality (it is also necessary when transfers γ are zero). This choice implies that imported goods are gross substitutes for non-tradable goods, as in the estimates of Ostry and Reinhart (1992).[6] The value of ρ determines the elasticity of substitution between y^N and y^T in the cost function F. A number larger than one guarantees that the production possibilities frontier is concave. As shown in EKMS, the value of $\rho = 1.5$ allows the model reproduce the response of real GDP to term-of-trade shocks.

4.3 Targeted steady state moments

The next set of parameters are jointly calibrated to match a set of long-run averages in the steady-state benchmark economy during periods without default. We use data collected by the World Bank for Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Uruguay from 1991 to 2018. Table 2 presents the value of the parameters and the matched moments. Although all the parameters are jointly determined, it is useful to think about the connection between moments and targets.

Table 2: Parameters calibrated internally and matched statistics

Parameter	Value	Statistic	Target
β	0.8563	Inflation, %	3.800
γ	0.1082	Transfers/GDP	0.117
α^H	0.9366	Employment/Population	0.587
α^G	0.4397	Gov. Consumption/GDP	0.133
α^N	2.7880	Exports/GDP	0.209
ω_0	1.4575	Real GDP	1.000
ω_1	0.1034	Debt/GDP	0.365
ζ	0.0663	Default, %	2.000

The value of the discount factor $\beta = 0.8563$ helps the model reproduce an annual inflation rate of 3.8%. The parameter $\gamma = 0.1082$ matches the ratio of transfers to GDP, which in the data average 11.7%. The value of $\alpha^H = 0.9366$ allows the model to hit the long-run average for the employment-to-population ratio, 0.59. The weight in the utility of the government consumption good, $\alpha^G = 0.4397$, delivers government consumption over GDP of 13.3%. The parameter $\alpha^N = 2.7880$ allows the model to reproduce the ratio of exports to GDP, which is 21% in the data.

[6]Note, however, the estimates in Ostry and Reinhart (1992) are in the range of 1.22–1.27 while our calibration implies an elasticity of 2.

Recall that $A(I)$ is a measure of the inverse of labor productivity, as a function of the repayment state, I. Set $\frac{1}{A(P)} = \omega_0 = 1.4575$ to normalize steady state output to one, which makes some statistics easier to read. We assume that the economy experiences a drop in productivity when the government is in default, and so $\frac{1}{A(D)} = \omega_0 - \omega_1$. The value of $\omega_1 = 0.1034$ reproduces the external debt-to-GDP ratio in the repayment state, which is 18.5%. Finally, the scale parameter in the distribution of taste shocks, $\zeta = 0.0663$, determines the risk of sovereign default in the steady-state and is calibrated to reproduce a default rate of 2.0% annual.

5 Fiscal and monetary policy rules

We aim to understand the role of rules constraining government policy during a crisis. In this section, we design the fiscal and monetary policy rules we use in the exercises below. These rules take the form of additional constraints in the problem of the government. Importantly, we impose policy rules only in the repayment state (i.e., the government in the default state is fully discretionary) and only one at a time.

The monetary policy rule consists of fixing the money growth rate, so that $\mu = \mu^*$ at all times. In Appendix A we derive μ as a function of allocations. We can use that expression to impose the following additional constraint to the government's problem under repayment,

$$\frac{(1+\phi)}{(1-\phi)} \frac{F_T}{u_T p^T F_N} \frac{\theta\beta\mathbb{E}\left[\Omega(c^{N\prime}, c^{T\prime}, y^{T\prime}, g')|P\right]}{c^N} - 1 = \mu^*$$

The left-hand side of the constraint above is the implementation of a particular money growth rate in equilibrium, as a function of allocations in the repayment state. The right-hand side is the money growth rate target. Note that in steady state, inflation is equal to the money growth rate. In general, inflation may fluctuate even though the money growth rate is kept constant under the rule.

The fiscal policy rule takes the form of a debt ceiling or limit. The government is then constrained to maintain a debt level that does not exceed a certain threshold, B^*. This rule imposes the following additional constraint to the government's problem in the repayment state,

$$B' \leq B^*$$

We design rules to maximize the welfare of households. In Appendix B we also show how to compute welfare when international investors need to be compensated for the loss in the value of debt after a rule is adopted.

Our measure of welfare is a one-time compensation in non-tradable consumption, Δ, that leaves the representative household indifferent between two alternative regimes. First, define $V^P(B,\Delta)$ as the value in the repayment state given compensation Δ as,

$$\begin{aligned} V^P(B,\Delta) &= u\left((1+\Delta)\,c^N, c^T\right) + v(1-h) + \vartheta(g) + \beta\mathcal{V}(B') \\ &= V^P(B) - \frac{\alpha^N (c^N)^{1-\sigma}[1-(1+\Delta)^{1-\sigma}]}{1-\sigma} \end{aligned}$$

Similarly, let $V^D(\Delta)$ be the value in the default state given compensation Δ,

$$\begin{aligned} V^D(\Delta) &= u\left((1+\Delta)\,c^N, c^T\right) + v(1-h) + \vartheta(g) + \beta\delta\mathcal{V}(0) + \beta(1-\delta)\,V^D \\ &= V^D(\Delta) - \frac{\alpha^N (c^N)^{1-\sigma}[1-(1+\Delta)^{1-\sigma}]}{1-\sigma} \end{aligned}$$

Then, the *ex ante* value (before the extreme value shock is realized) is given by

$$\mathcal{V}(B,\Delta) = \zeta \log\left[exp\left(\frac{V^P(B,\Delta)}{\zeta}\right) + exp\left(\frac{V^D(\Delta)}{\zeta}\right)\right]$$

Let $\mathcal{V}^R(B)$ be the corresponding value function under policy rule $R = \{\mu^*, B^*\}$. Then, for a given level of debt and a specific policy rule, the welfare measure Δ solves

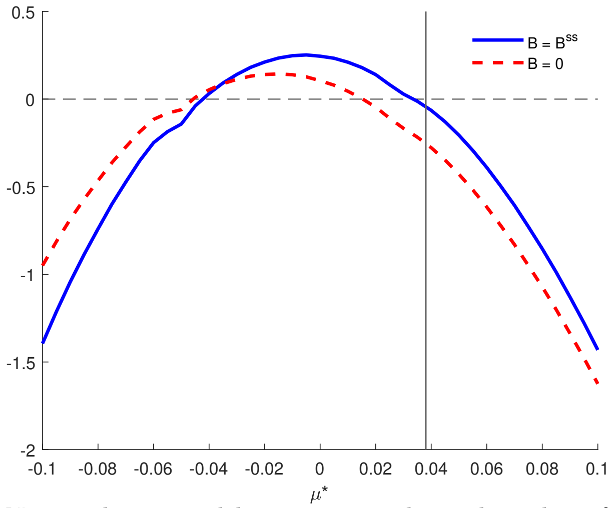
$$\mathcal{V}(B,\Delta) = \mathcal{V}^R(B)$$

Therefore, Δ is a function of the level of debt B and the specific target of the policy rule. In the analysis below, we will compute welfare at zero debt, $B = 0$, and at the repayment steady state, $B = B^{SS}$, for a range of targets for the monetary and fiscal rules. Our selection criterion will be to adopt rules that maximize welfare at the repayment steady state.

5.1 Monetary policy rule

Figure 1 plots the welfare gains from imposing a monetary rule, for a range of targets. When initial debt is zero (the dashed line), the optimal monetary rule fixes the money growth rate at $\mu^* = -1.5\%$; when initial debt is at the repayment steady state (the solid line), the optimal target is $\mu^* = -0.5\%$. Both these targets are negative and well below the discretionary steady state of 3.8% (indicated by the vertical solid line). Potential welfare gains are 0.14% and 0.25% of non-tradable consumption, respectively.

Figure 1: Welfare gains Δ as a function of money growth rate target μ^*



Note: The vertical line corresponds to the value of the policy in steady state without rules.

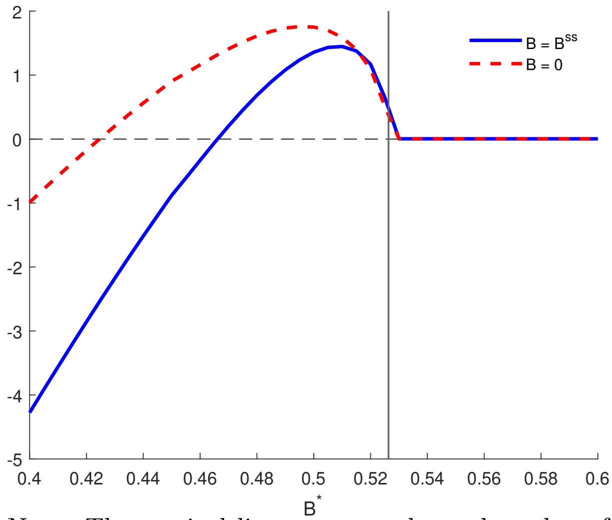
Fixing the money growth rate has two offsetting effects. On the one hand, it forces the current government to implement a suboptimal policy mix—relying on money creation too little or too much. On the other hand, it corrects a time-consistency problem in debt choice. As explained in EKMS, current debt choice is affected by the fact that it affects future fiscal and monetary policies; the latter has an effect on current money demand and thus, the government budget constraint, which future governments do not take into account. A constant money growth rate eliminates this channel. As shown in EKMS this channel is also absent when the income and substitution effects on money demand are exactly offset—a case which arises here when $\sigma = 1$. In Appendix B we show how, when $\sigma = 1$, there are no positive gains from a monetary rule.

The potential welfare gains from a monetary rule are small, which is a standard result in the literature that analyzes the welfare costs of inflation. Furthermore, imposing a money growth rate that is either too low or too high may yield large welfare losses. These results are consistent with those in Martin (2015) for inflation targets in closed economies.

5.2 Fiscal Rule

Figure 2 plots the welfare gains from imposing a fiscal rule, for a range of debt ceilings. The optimal debt ceiling is very similar, regardless of initial debt. Welfare, however, strongly depends on initial debt. If adopting the fiscal rule when debt is zero, the optimal limit is 0.495 and welfare gains are equal to 1.76% of non-tradable consumption. When adopting the rule at the repayment steady state, the optimal limit is 0.510 and welfare gains are equal to 1.45%. In either case, imposing a limit that is too tight may lead to large welfare losses while imposing a limit above the discretionary steady state has no impact.

Figure 2: Welfare gains Δ as a function of debt limit B^*



Note: The vertical line corresponds to the value of the policy in steady state without rules.

The welfare gains from imposing a debt limit stem from a debt-dilution problem. This refers to the reduction in the value of existing debt triggered by the issuance of new debt that increases the probability of default. The current government cannot control the amount of new debt issued by future governments and rational investors anticipate that additional borrowing by future governments will increase the risk of default on long-term bonds issued by the current government and, thus, offer a lower price for these bonds. The current government benefits from constraining future borrowing up to a debt limit $B^* < B^{SS}$ since this increases the funds collected by bonds that it issues today—i.e., it increases the price of newly-issued debt. Hence, a properly imposed debt limits alleviates the debt dilution problem.

The debt dilution problem is mitigated as the maturity of debt decreases. In the extreme case that the government only issues one-period debt (i.e., when $\delta = 1$), the debt dilution problem disappears altogether and there is no benefit from imposing a debt limit. See Appendix B for further analysis.

5.3 Long-run implications of policy rules

Table 3 presents the long-run implications of the optimal policy rules with computed above. We let the economies run in the repayment state and report the long-run averages. The first column displays the case with discretion (i.e., no rules), which was calibrated in the previous section. The second column fixes the money growth rate at -0.5%. The most significant differences relative to discretion is the correspondingly lower inflation inflation and the higher revenue over GDP necessary to make-up for the lost seigniorage. Debt over GDP and the default probability do not change significantly, while the changes in macroeconomic variables are minor.

Table 3: Rules vs. discretion—long-run statistics

	Discretion	Money growth $\mu^* = -0.5\%$	Debt ceiling $B^* = 0.51$
Debt / GDP	0.365	0.363	0.352
Inflation	0.038	-0.005	0.036
Revenue / GDP	0.240	0.269	0.238
Expenditure / GDP	0.250	0.251	0.250
Real GDP	1.000	0.993	1.000
Employment	0.587	0.586	0.587
Exports /GDP	0.209	0.200	0.207
Default probability	0.020	0.021	0.011

The third column set a debt limit of 0.51. This implies a lower debt-to-GDP ratio than under discretion, which then allows for inflation and tax revenue to be lower as well. The biggest change is in the default probability, which roughly halves. Despite these changes, macroeconomic variables remain essentially unaltered.

6 Rules vs. discretion during crises

In this section we study the role of fiscal and monetary rules during a large crisis. First, we propose a benchmark of a large crisis, which consists of many unexpected shocks, and calibrate the model to replicate it under the discretion, i.e., in the absence of policy rules. Second, we study how the economy reacts when a specific rule is in place during the crisis and compare it to the discretionary case. Then, we analyze the effects of temporarily suspending the rule or abandoning it altogether. We use these exercises to compute the value of flexibility during a large crisis. Finally, we study whether the value of flexibility depends on specific shocks.

6.1 Modeling a large crisis

We use the COVID-19 pandemic as a model of a large unexpected crisis. We calibrate the shock to the benchmark (discretionary) economy to resemble the economic impact of COVID-19 on five macro variables in 2020: real GDP growth, government expenditures, imports, inflation and credit spreads. Appendix D shows how these targeted moments were estimated. We model the crisis as a combination of shocks lasting one period.

First, the multiple measures imposed by government authorities across the world, aimed at reducing the spread of the virus, restricted production in some sectors (Carrieri et al., 2021). As a result, a significant number of firms were hit hard through a variety of channels, such as: lockdowns, quarantine or home isolation for staff, fall in productivity and capacity, higher costs, demand collapse, supply-chain disruptions and generalized uncertainty (Ebeke et al., 2021). We model this impact as a drop in productivity ω_0, from 1.4575 to 1.4126, to match the observed 9.5% fall in real GDP growth in 2020.

Second, governments engaged in expansionary fiscal policies to mitigate the impact of the pandemic. For the most part, these measures took the form of direct transfers to households and businesses. We model this fiscal assistance as an increase in exogenous transfers, γ, from 0.1082 to 0.1343, calibrated to match the temporary increase of 4.1% in government expenditure over GDP.

Third, the pandemic disrupted global trade. The initial health measures involving travel restrictions, border closures and lockdowns affected trade in good and services by disrupting freight transport, business travel and the supply of services that rely on individual presence abroad (World-Trade-Organization, 2020). These policies had an impact on trade costs, mainly through their effects on transport and travel costs, as international trade is heavily dependent upon transmission of individuals and goods across borders (Vo and Tran, 2021). Shipping costs did, in fact, increase around 350% from May 2020 to June 2021 (Dickinson and Zemaityte, 2021). We model this impact as an increase in trade costs, ϕ, from 0 to 0.1014. This shock can be interpreted as either a drop in the efficiency of transporting goods or as an increase in trade restrictions. The increase in ϕ is calibrated to match the fall in imports of 15.4%.

Fourth, there was a flight to liquidity (Novick et al., 2022). Early on in the pandemic, and in spite of a significant decrease in cash payments, the demand for cash rose significantly in Europe between March 2020 and May 2021 (Panetta, 2021). The same is true for England, a phenomenon that the Bank of England considers could be explained by an increasing role for cash as a store of value (Caswell et al., 2020). In fact, much of the strong demand for banknotes can be attributed to people's desire to hold cash for precautionary or store-of-wealth purposes (Bayer et al., 2019), a behavior consistent with other periods of economic uncertainty (Guttmann et al., 2021). The use of cash as store of value was also evidenced in many other countries, including Brazil (Ashworth and Goodhart, 2020). We model this liquidity shock as a decrease in θ, i.e., a temporary increase in the demand for money (alternately, a fall in the velocity of circulation). With a constant θ, the monetary expansion which arises endogenously in response to the other shocks, would have generated a large increase in inflation. However, actual inflation was relatively low in 2020, about 0.2%, and then increased significantly in 2021, to around 6.3%. The temporary drop in θ, from 1 to 0.8408, rationalizes the behavior of inflation in our model and is calibrated to match the fall in inflation in 2020.

Lastly, sovereign debt spreads increased during 2020, especially in the early parts of the pandemic. To reproduce this fact, we allow the default penalty to vary with the state of the economy, which is the standard approach since Arellano (2008). We assume that labor productivity in default is a function of the other four shocks

$$1/A(D) = \omega_0 - \max\{\omega_1 + \omega_2 \times gap(\omega_0, \gamma, \theta, \phi), 0\}$$

where *gap* is the deviation from steady state of the GDP in dollars.[7] Thus, $\omega_2 > 0$ lowers the cost of default when output is low.[8] We calibrate $\omega_2 = 0.1391$ to match the increase in credits spreads of 96 basis points during 2020.

[7]The gap is measured in terms of output in foreign currency (dollars) since this captures the country's capacity to repay its debt. However, our approach is flexible and the gap could alternatively be specified using exports or real GDP.

[8]Note that the advantage of this specification is that the gap is exogenous and depends only on parameters. In particular, to compute this relationship, we use a Taylor expansion so that $gap(s) = \sum_i \text{elast}_i \frac{\Delta s_i}{\bar{s}}$, where $\text{elast}_i = \frac{\partial Y^{USD}}{\partial s_i} \frac{\bar{s}}{Y^{USD}}$, the sum is over $s_i = \{\omega_0, \theta, \gamma, \phi\}$, the derivative is the change in output measured in dollars with respect to each s_i (taken at the steady state), and Δs_i is the change in s_i with respect to its value in steady state.

6.2 The impact of large crises under discretion

The top panel of Table 4 shows how we match the five targeted moments. Since the shocks are calibrated jointly, the fit is not perfect. In particular, the model overpredicts the increase in government expenditure and, to a lesser extent, the fall in imports.

Table 4: Response to COVID-19 shock—benchmark model

	Data	Model
Targeted		
Δ Real GDP, %	-9.5	-9.5
Δ Expenditure / GDP, pp	4.1	4.6
Δ Imports, %	-15.4	-15.6
Δ Inflation, pp	-0.2	-0.2
Δ Credit spreads, bps	96.2	96.3
Non-targeted		
Δ GDP USD, %	-18.6	-20.8
Δ Employment, pp	-7.3	-3.2
Δ Exports, %	-13.2	-10.7
Δ Debt / GDP, pp	5.2	11.2
Δ Tax rate, pp	-0.8	-6.3
Δ Money growth rate, pp	28.9	13.2
Δ Depreciation, pp	8.2	12.3
Δ Inflation in 2021, pp	6.3	14.3
Welfare gain of shock, %		-12.8

Note: Δ stands for the change in 2020, unless specified otherwise.

The model reproduces the changes in non-targeted macroeconomic variables, which are shown in the middle panel. Importantly, the model correctly predicts the signs of the changes in every case. Quantitatively, it matches well the contraction in GDP in dollars, but underpredicts the falls in employment and exports. In terms of policy, the model overreacts for debt, taxes and depreciation, while it underreacts in money growth. Though the monetary policy response is somewhat muted, inflation in the model for 2021 is higher than in the data. Despite these differences, the model captures the overall impact of the COVID-19 shock, which is our baseline to understand the effects of large crises more generally.

The last row of Table 4 presents the welfare cost of the unexpected COVID-19 shock. To measure welfare, we consider the equivalent increment in non-tradable consumption during one period to keep utility constant. We find that the crisis had a high economic cost to individuals, equivalent to a one-period drop in non-tradable consumption of 12.8%.

6.3 The impact of large crises under policy rules

We now analyze how large crises interact with policy rules. The main results are presented in Table 5. The rules we study are those computed in Section 5, which maximized welfare at the discretionary steady state. The monetary rule involves fixing the money growth rate at -0.5%. The fiscal rule consists of a debt ceiling set at 0.51. For each case, we let the economy converge to the corresponding steady state under repayment. Note that economies with different policy rules converge to different levels of debt.

Next, we hit the economy with the combination of unexpected shocks we modeled in the previous section. Though we used COVID-19 as a reference, we think of this event as representative of the type of large crises that often hit emerging markets. We consider three scenarios: (i) the policy rule remains in effect at all times; (ii) the policy rule is abandoned during the period of the crisis but is reinstated in subsequent periods; and (iii) the policy rule is abandoned and never again reinstated. The first scenario offers a contrast to the discretionary economy of the previous section and let us understand the effect of losing a policy instrument during a crisis. The second scenario captures the idea of an escape clause, which is often embedded in legislation constraining government policy. The third scenario models a situation where the suspension of the rule erodes the political support to reimpose it.

Since the crisis is unexpected and lasts only one period, the case when the rule is suspended dominates, in terms of welfare, the case when it is always applied. Basically, the two problems are equivalent, except that the former has one less constraint. The welfare implications of abandoning a rule is ambiguous: the higher flexibility during the crisis is traded-off with the cost of not having the rule in place afterwards. The next exercises analyze analyze how this trade-off is resolved in the model and how the net effect varies for different rules and shocks shocks.

6.3.1 Monetary rule

Let us first consider a monetary rule that fixes the money growth at -0.5% annual. Recall that this value maximized welfare when starting from the steady state under discretion, as explained and derived in Section 5. For the three cases we consider, which differ in how the rule is applied during the crisis, Table 5 shows the impact of the shock on an array of variables while Figure 3 displays the dynamics for selected policies and

Table 5: Response to a large crisis—rules vs. flexibility

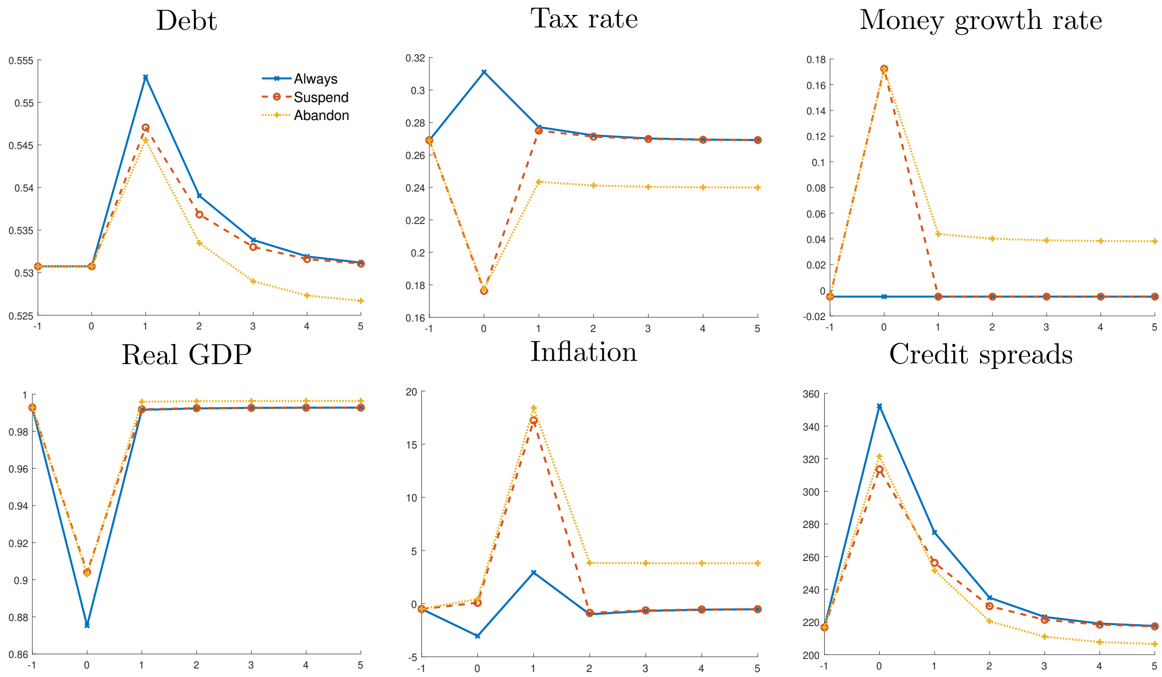
	Money growth, $\mu^* = -0.5\%$			Debt ceiling, $B^* = 0.51$		
	Always	Suspend	Abandon	Always	Suspend	Abandon
Δ Real GDP, %	-11.8	-8.9	-9.1	-9.4	-9.6	-9.5
Δ GDP USD, %	-19.2	-21.8	-22.1	-21.6	-20.2	-20.4
Δ Employment, pp	-4.5	-3.0	-3.0	-3.2	-3.2	-3.1
Δ Imports, %	-23.9	-12.7	-12.9	-17.9	-13.4	-14.4
Δ Exports, %	-20.2	-7.5	-7.3	-9.0	-12.3	-11.6
Δ Debt / GDP, pp	10.5	11.6	11.6	9.7	11.6	11.6
Δ Tax rate, pp	4.2	-9.3	-9.2	-6.0	-6.6	-6.5
Δ Expenditure / GDP, pp	5.1	4.5	4.5	4.4	4.7	4.6
Δ Primary deficit / GDP, pp	0.9	13.7	13.6	10.4	11.3	11.1
Δ Money growth rate, pp	0.0	17.7	17.7	14.1	12.2	12.6
Δ Credit spreads, bps	135.7	96.8	104.8	32.4	55.7	140.6
Δ Default probability, pp	5.6	4.7	5.1	2.4	2.3	2.8
Δ Inflation, pp	-2.5	0.6	0.9	0.7	-1.0	-0.8
Δ Inflation 2021, pp	3.4	17.7	18.9	13.4	15.6	14.6
Δ Depreciation, pp	4.5	14.8	15.4	14.4	10.2	11.0
Δ Depreciation 2021, pp	-2.7	3.9	6.7	-0.2	6.2	3.5
Welfare gain of shocks, %	-13.1	-12.6	-12.9	-12.7	-12.6	-14.0
Welfare gain of flexibility, %		0.6	0.2		0.2	-1.4

Note: Δ stands for the change in 2020, unless specified otherwise. The initial state is the repayment steady state with the corresponding policy rule in effect; when the shocks hits the economy, the policy rule may remain in place ("always"), be suspended for that period ("suspend"), or be abandoned on that period and thereafter ("abandon").

outcomes.

The column labeled "always" on Table 5 shows the impact of the crisis when the government cannot respond by varying the money growth rate. In contrast to the discretionary case, the government now raises taxes to finance the increased spending. Furthermore, inflation is a bit more negative on impact but increases by much less in the period afterwards. Correspondingly, the variation in currency depreciation is significantly muted when the government is following the monetary rule. The real economy performs slightly worse under the rule, with real GDP, GDP measured in dollars, exports and imports falling by more—the latter two variables significantly so. On the flip side, employment contracts less. Credit spreads—which are measured on impact, before any policy response—increase significantly more with the rule. Essentially, the lower flexibility translates into a higher default probability. Despite this difference, debt-to-GDP

Figure 3: Dynamics of a large crisis under a monetary rule



Note: In $t = -1$ the economy is in the repayment steady state under the monetary rule. Shocks are realized in $t = 0$.

dynamics are quite similar under discretion and with the monetary rule. Overall, the cost of the crisis when the government is constrained by the monetary rule is equivalent to a one-time reduction in non-tradable consumption of 13.1%, which is slightly larger than under discretion.

Next, we consider the effect of temporarily suspending the monetary rule during the period of the crisis, as shown by the column "suspend" on Table 5 and the dashed lines on Figure 3. Suspending the monetary rule lets the government respond to the crisis in a similar way than under discretion: the money growth rate increases sharply while taxes fall significantly. Consequently, real GDP, employment, exports and imports all contract less that when the rule is imposed at all times. Inflation and currency depreciation are significantly higher when the rule is suspended, both on impact and in the period afterwards. As a result, GDP in dollars contracts slightly more when the rule is suspended. The added flexibility also implies that credit spreads and the default probability do not increase as much when the shocks hit the economy. As shown in Figure 3 the case with rule suspension converges very rapidly to the case when the rule is always in effect; most of the differences are during the crisis and in the period immediately after. Importantly, suspending the monetary rule improves welfare by 0.6% of non-tradable consumption.

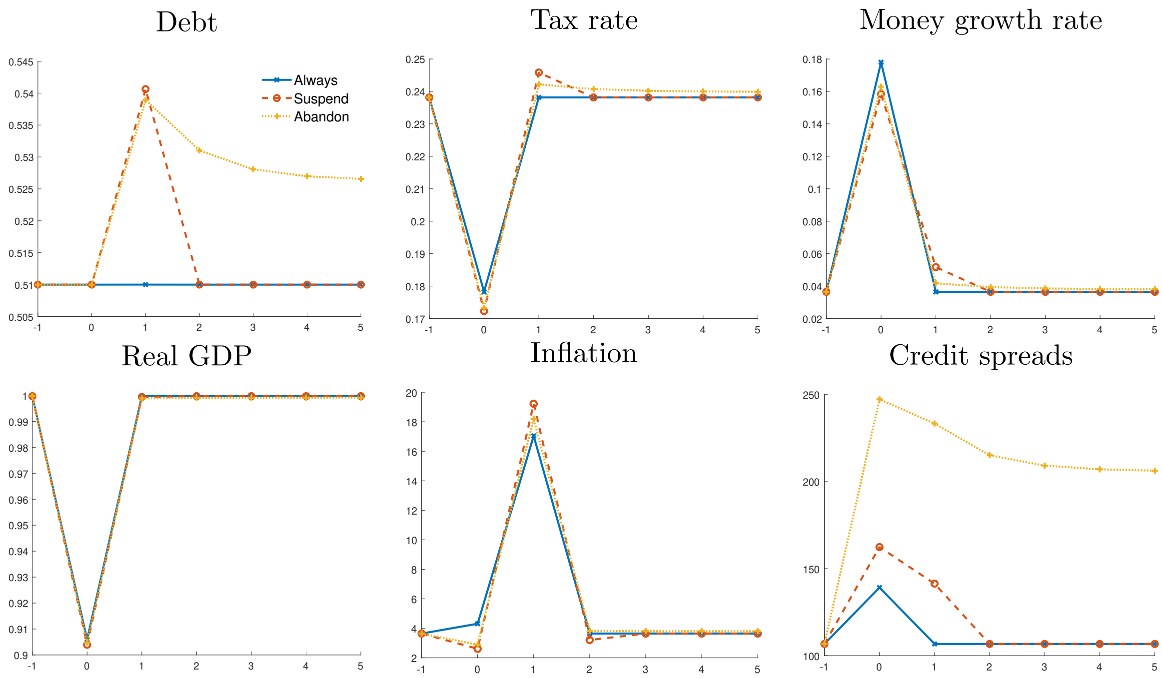
The last case we examine is when the monetary rule is abandoned. The results are presented in the column "abandoned" on Table 5 and the dotted lines on Figure 3. On impact, the real economy and government policy behave similarly when the rule is suspended or abandoned. The main differences are in the periods afterwards, as the transition out of the crisis depends on whether the rules is reinstated or not. In the latter case, the economy converges back to the discretionary steady state. As a result, credit spreads, default probability, inflation and currency depreciation are all slightly worse when the monetary rule is abandoned. Finally, we note that abandoning the rule is markedly worse than suspending it, but slightly better than applying it always. We conclude that for the monetary rule, the gains from flexibility during a large crisis outweigh the benefits of a more disciplined policy in normal times.

6.3.2 Fiscal rule

Now we study the effects of a fiscal rule that constrains the level of debt to 0.51. This rule maximizes welfare when starting from the steady state under discretion, as derived in Section 5. As with the monetary rule, Table 5 and Figure 4 show the impact of the crisis under three scenarios for how the rule is applied during this event. When the crisis hits, the government is now not able to raise debt as it would if it was unconstrained. Consequently, debt remains constant when the rule is imposed all the time—note, however, that debt over GDP still fluctuates as output reacts to the shocks and the policy response. Relative to the discretionary case, a government facing a binding debt ceiling responds to the crisis by dropping taxes by less, raising expenditure by less and increasing the money growth rate my more. The contraction in output and employment is very similar in both cases. Inflation dynamics is similar as well, with only minor quantitative differences. There are some important differences, however. On impact, the rise in credit spreads is only 32 basis points when the debt ceiling is always in place; this is about a third of the increase in the discretionary case. Overall, the welfare cost of the crisis is equivalent to 12.7% of non-tradable consumption, only slightly smaller than under discretion.

Suspending the fiscal rule during the crisis allows the government to issue debt during that period and implement a policy response similar to that under discretion. Hence, relative to the case when the rule is always in effect, taxes fall by more, spending in-

Figure 4: Dynamics of a large crisis under a fiscal rule



Note: In $t = -1$ the economy is in the repayment steady state under the fiscal rule. Shocks are realized in $t = 0$.

crease by more and the money growth rate increases by less. On impact, credit spreads increase by more when the fiscal rule is suspended. Note, however, that the default probability increases by less. The added flexibility allows the government to respond more efficiently—hence the drop in default probability—but the increase in debt dilutes the value of previously-issued debt, which explains the rise in spreads. In the end, the welfare cost of the crisis is smaller when the fiscal rule is suspended, about 0.2% less in terms of non-tradable consumption.

When the rule is abandoned rather than suspended for a period, debt and credit spreads behave very differently in the transition out of the crisis. In contrast, the dynamics of other polices and outcomes are very similar. Debt rises about the same in both cases but is more persistent and converges to a higher level when the fiscal rule is abandoned. Credit spreads increase significantly on impact and converge to a much higher number when the rule is abandoned. The default probability increases a bit more when compared to the cases when the fiscal rule is in effect always or suspended temporarily. Again, the sharp rise in credit spreads is not explained by changes in the default probability but by debt dilution. Abandoning the debt ceiling foregoes the large gains associated with this constraint and thus, implies an actual welfare loss: the cost of the crisis is 1.4% of non-tradable consumption higher than keeping the fiscal rule in place at all times.

We draw some lessons for the desirability of flexibility during large crises. When the government is subject to a monetary rule, there is value in being flexible during a crisis, i.e., from allowing a temporary suspension of the constraint. The reason is that flexibility allows the government to implement a better policy mix given the state of the economy. The gains from abandoning the rule are also positive but perhaps not large enough to make this a general result. For the case of a debt ceiling, the gains from suspending the rule during the crisis are not significant, while the costs of abandoning it are large. Investors already impose enough discipline on debt issuance as evidenced by the response in the discretionary case—the discount on the debt reflects the default probability—so flexibility in this case is not as valuable. Abandoning the fiscal rule foregoes its large long-run benefits, which is why it leads to an overall welfare loss.

6.4 Unpacking the gains from flexibility during large crises

We conclude our analysis by studying how different shocks interact with the gains from flexibility, i.e., the value of suspending or abandoning a given policy rule during a crisis. Table 6 shows the welfare gains associated with suspending or abandoning a rule, for a given set of shocks. The symbols $\surd$ and $\times$ denote whether the corresponding shock is active or not. The first row includes all the shocks we considered above and thus, replicates the findings from Table 5. We then take away one shock each time and compute welfare relative to the case when the rule is in effect at all times.

Table 6: Welfare gains from flexibility, %

Shocks				Monetary rule		Fiscal rule	
ω_0	γ	ϕ	θ	Suspend	Abandon	Suspend	Abandon
$\surd$	$\surd$	$\surd$	$\surd$	0.6	0.2	0.2	-1.4
$\times$	$\surd$	$\surd$	$\surd$	0.5	0.1	0.2	-1.5
$\surd$	$\times$	$\surd$	$\surd$	0.3	-0.1	0.2	-1.5
$\surd$	$\surd$	$\times$	$\surd$	0.4	0.1	0.1	-1.6
$\surd$	$\surd$	$\surd$	$\times$	0.2	-0.1	0.2	-1.4

As we explained above, suspending a rule is always beneficial since the crisis in unanticipated and lasts only one period. Suspending the monetary rule loses much of its value for the cases when there are no shocks to γ or θ. Furthermore, absent either of these shocks leads to welfare loses when the monetary rule is abandoned. In other words, having the money growth rate as an instrument is especially valuable when there are shocks to transfers (exogenous spending) or money demand.

In contrast, the results for flexibility under a fiscal rule do not depend much on the type of shock that hits the economy. As we explained above, markets already discipline debt issuance effectively during a crisis, so the gains from suspension are small. Moreover, the loss from abandoning the debt ceiling stem from foregoing the long-run gains from imposing it and thus, are not very sensitive to the specific shock.

7 Conclusions

We studied the value of policy rules in emerging countries and the gains from flexibility during large unexpected crises. Our findings support the widespread adoption of rules in recent times. Both monetary and fiscal rules lead to welfare gains in normal times as they mitigate time-consistency problems in debt choice. Debt limits are particularly beneficial as the debt-dilution problem is severe.

During a crisis, there is a value from suspending rules temporarily as this allows governments to implement more appropriate policy mixes. However, suspension during trying times opens the door to outright abandonment of pre-existing norms. Our results indicate that abandoning debt limits leads to large welfare losses, so caution is warranted when tinkering with this type of rules in response to adverse shocks.

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Appendix

A Derivation of the government budget constraint

Necessary and sufficient first-order conditions to characterize the firm's problem imply that the wage and exchange rate can be express as functions of (y^N, y^T, p^N, p^T),

$$w = \frac{p^N}{A(I)F_N}, \tag{20}$$

$$e = \frac{p^N F_T}{(1-\phi)p^T F_N}. \tag{21}$$

Using (20) and (21), the necessary first-order conditions for the agent's problem imply

$$p^N = \frac{\theta}{c_N}, \tag{22}$$

$$\tau = 1 - \frac{(1+\phi)}{(1-\phi)}\frac{v_\ell A(I)F_T}{u_T p^T}, \tag{23}$$

$$1+\mu = \frac{(1+\phi)}{(1-\phi)}\frac{F_T}{u_T p^T F_N}\frac{\theta\beta\mathbb{E}\left[\Omega(c^{N\prime}, c^{T\prime}, y^{T\prime}, g')|B, I\right]}{c^N}, \tag{24}$$

where

$$\Omega(c^N, c^T, y^T, g) \equiv \frac{c^N}{\theta}\left[\theta u_N + (1-\theta)\frac{(1+\phi)}{(1-\phi)}\frac{u_T p^T F_N}{F_T}\right].$$

The Lagrange multiplier for the CIA constraint (2) is non-negative and thus,

$$u_N - \frac{(1-\phi)}{(1+\phi)}\frac{u_T p^T F_N}{F_T} \geq 0. \tag{25}$$

Combining the government budget constraint, (3), and the balance of payments, (4), we can re-express the government budget constraint as a relationship between the external sector (the trade balance) and the public sector (the primary surplus plus seigniorage):

$$\tau w h - p^N(g+\gamma) + \mu - e((1-\phi)p^T y^T - (1+\phi)c^T) \geq 0. \tag{26}$$

Using (1) and (20)–(24), condition (26) simplifies to

$$\left[1 - \frac{(1+\phi)}{(1-\phi)}\frac{v_\ell A(I)F_T}{u_T p^T}\right]F(c^N+g, y^T) - F_N(g+\gamma) - F_T y^T + \frac{(1+\phi)}{(1-\phi)}\frac{F_T c^T}{p^T}$$
$$- \frac{c^N F_N}{\theta} + \frac{(1+\phi)}{(1-\phi)}\frac{F_T}{u_T p^T}\beta\mathbb{E}\left[\Omega(c^{N\prime}, c^{T\prime}, y^{T\prime}, g')|B, I\right] \geq 0. \tag{27}$$

Using the fact the F is homogeneous of degree one, i.e., $F(c^N+g, y^T) = F_N(c^N+g) + F_T y^T)$, we can rearrange (27) to obtain (5).

B Robustness on the welfare gains of policy rules

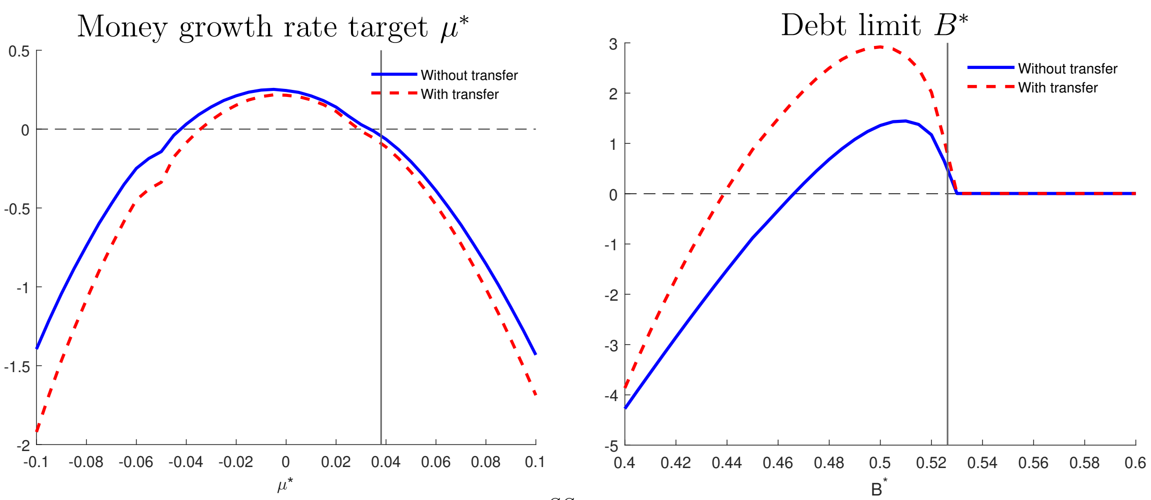
B.1 Alternative welfare measure

Define a compensating transfer to international investors as $T^R(B) = b\left(Q^R(b) - Q(B)\right)$ where (Q^R, Q) denote the bond price in a setting with a rule $R = \{\mu^*, B^*\}$ and the discretionary economy, respectively. Then, the alternative measure of the equivalent compensation Δ solves

$$\mathcal{V}(B, \Delta) = \mathcal{V}^R\left(B - T^R(B)\right)$$

Figure 5 compares our benchmark welfare criterion (without compensating transfers) and the alternative welfare criterion described above (with welfare transfers). As we can see, though welfare measures can differ, especially for the debt limit, the optimal constraint is very similar for fiscal and monetary rules under either criterion.

Figure 5: Welfare gains Δ as a function of rule

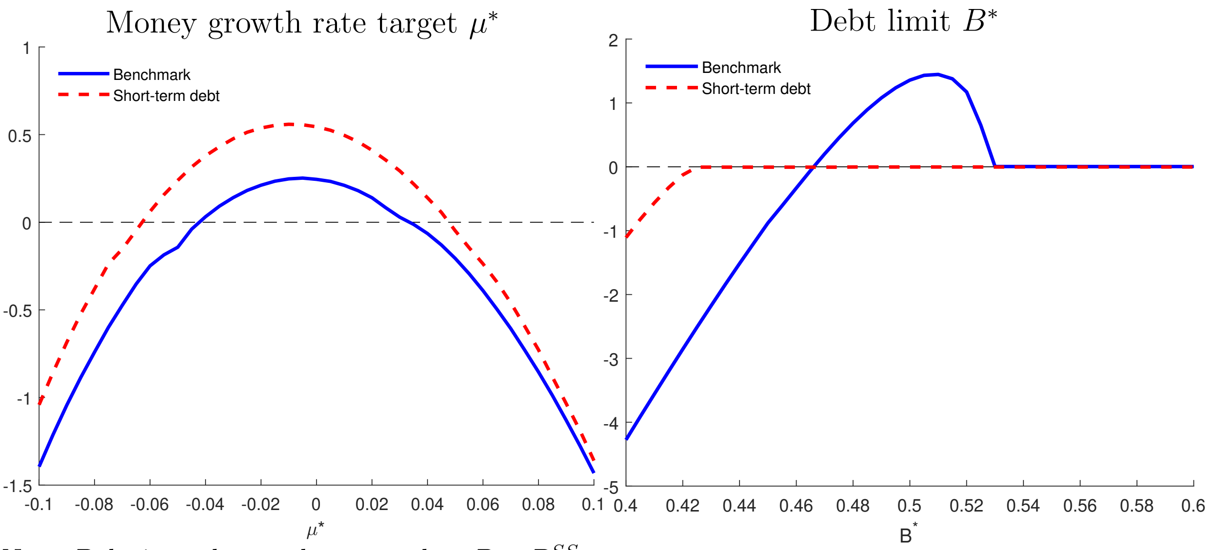


Note: Debt is at the steady state value, $B = B^{SS}$. The vertical line corresponds to the value of the policy in steady state without rules.

B.2 Short-term debt

Figure 6 compares welfare under monetary and fiscal rules, for the cases with short- and long-term debt.

Figure 6: Welfare gains Δ: long-term vs. short-term debt



Note: Debt is at the steady state value, $B = B^{SS}$.

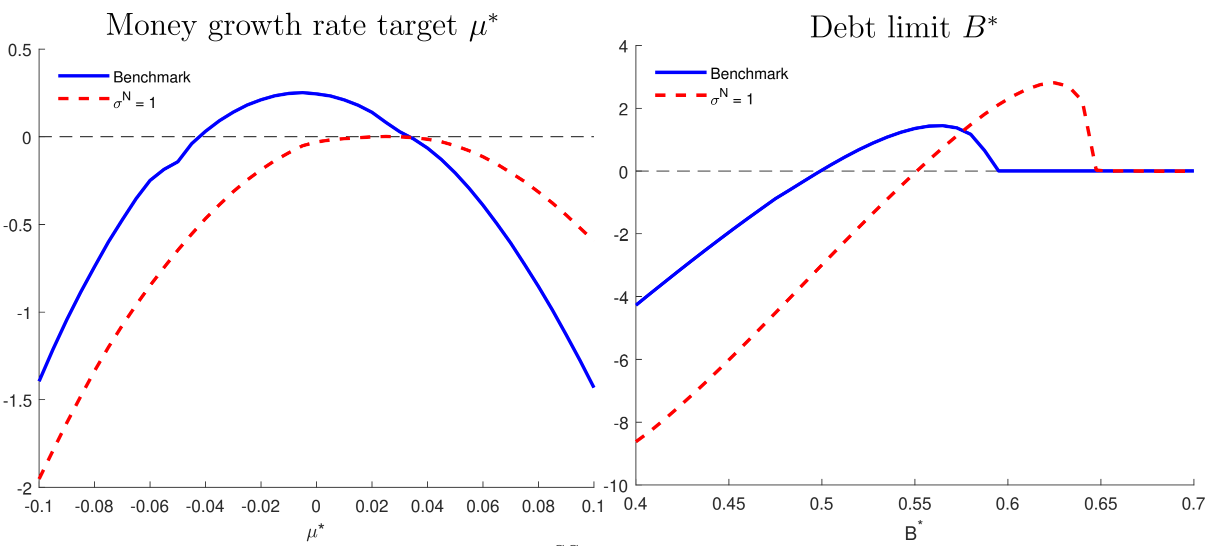
B.3 Money demand

Assume

$$u(c^N, c^T) = \alpha^N \frac{\left(c^N\right)^{1-\sigma^N}}{1-\sigma^N} + \alpha^T \frac{\left(c^T\right)^{1-\sigma^T}}{1-\sigma^T}$$

We keep $\sigma^T = \sigma$, as in the benchmark calibration, and consider two cases: $\sigma^N = \sigma < 1$ and $\sigma^N = 1$. In the latter case, the intertemporal distortion in debt choice, which stems from a time-consistency problem due to the demand for money, disappears. Here, there are no benefits from targeting the money growth rate. See Figure 7.

Figure 7: Welfare gains Δ: $\sigma^N < 1$ vs. $\sigma^N = 1$



Note: Debt is at the steady state value, $B = B^{SS}$.

C Policy response to COVID-19 in Latin America

Davoodi, Elger, Fotiou, Garcia-Macia, Han, Lagerborg, Lam, and Medas (2022) shows how COVID-19 led to the wide use of escape clauses or resort to ad-hoc suspensions or modifications of policy rules. The goal of these temporary suspensions limiting fiscal and monetary policy was to gain flexibility to support households and firms. In this section, we briefly present the evidence in Latin American countries.

In the years before the pandemic, Argentina introduced austerity measures, following an agreement with the IMF, severely restricting fiscal policy (see IMF, 2018). Despite this reality, once the COVID-19 pandemic started, the national government incorporated protection measures for mitigation of the socio-economic consequence of the pandemic. These programs included: health spending, support for workers and other vulnerable groups, support for firms in hard-hit sectors, and forbearance and credit guarantees for bank lending (IMF, 2021). Argentina's Central Bank responded to COVID-19 directly financing expansionary fiscal policy. The country did not follow the inflation-targeting regime followed in previous years or the previous agreement with the IMF to limit the growth rate of monetary aggregates (IMF, 2018; Roza, 2021).

In Brazil, Congress decided to lift the government's obligation to comply with the primary balance target for 2020 (CEPAL, 2020b) to tackle the pandemic. The Brazilian federal government set in motion a series of policies to protect the poorest workers and to keep businesses from falling. The Central Bank showed itself as flexible and pledged to "deploy its arsenal of monetary, exchange rate and financial stability policies to fight the current crisis." (McGeever, 2020). However, after the economy began a normalization path, most liquidity support measures were withdrawn in 2021. The interest rate was elevated to 4.25% by June (IMF, 2021).

Before the COVID outbreak, Chile's robust macroeconomic framework was characterized by prudent fiscal policy and successful inflation targeting monetary policy (OECD, 2021). Actions to tackle the pandemic crisis include higher healthcare spending, subsidies for vulnerable households and unemployment benefits, provision of food baskets and basic products for middle-class families, cash transfers, etc. (IMF, 2021). The Central Bank of Chile acted by using both conventional and non-conventional tools for counter-cyclical purposes. The first measure was reducing the monetary policy rate by 125 basis points

(IMF, 2021; KPMG, 2020). It was accompanied by a new funding facility and open-market operations. Once economic activity began picking up, the monetary authorities decided to raise the monetary policy rate to 0.75% (CEPAL, 2021)—arguably, a return to the inflation targeting objective.

In Colombia, the fiscal rule, which was incorporated in 2011 to determine budget policy (Hernando Vargas-Herrera and Romero, 2022), was suspended in order to tackle the pandemic (IMF, 2021). After the peak of the crisis, the government included in its 2021 budget measures to reactivate the economy and extend programs supporting households and firms, as well as infrastructure investment IMF (2021). The Central Bank of Colombia reduced interest rates starting in March 2020. This led to the lowest intervention interest rate in the history of Colombia at 1.75% (Bocanegra, 2022). Public and private bond purchases by Bank of the Republic were part of a wider response to the Covid-19 shock (Hernando Vargas-Herrera and Romero, 2022).

Mexico's fiscal response to the COVID-19 shock was modest when compared to its peers (Ahmed Hannan et al., 2020). Starting as early as March 2020, the Chamber of Deputies allowed the creation of the Emergency Prevention and Response Fund. In order to do this, the government was authorized to eliminate the totality of the primary surplus target set in 2020, which also amounted to 0.7% of GDP CEPAL (2021). Measures taken were aimed to ensure sufficient financial resources for the Ministry of Health, support for household and firms, credit and liquidity strengthening and proper functioning of financial markets (IMF, 2021). The above-the-line fiscal measures in 2020 amounted to 0.7 percent of GDP while below-the-line measures in 2020 amounted to around 1.2 percent of GDP IMF (2021). Starting in February 2020, the Central Bank of Mexico, *Banco de México*, reduced its reference interest rate in 300bps through February 2021 (Banxico, 2020). In terms of credit flows, the Central Bank reduced regulatory deposits and opened financial facilities for commercial and development banks with hopes to channel resources to SMEs and individuals. Additionally, the authorities incorporated a new tool that permitted the Central Bank to intervene in offshore non-deliverable forwards markets with foreign actors during European and Asian trading hours (IMF, 2021). After the crucial moments of the pandemic, the central bank led a policy of rate hikes starting in June 2021 in response to inflation risks. As before, one could interpret this as a return to the central inflationary objective the authorities previously had.

Peru was one of the countries where the virus hit the hardest (CEPAL, 2021; Jaramillo and Ñopo, 2020). It also had a strong policy response in 2020, as it is reflected in the increase of the non-financial public sector deficit in 2020, mainly explained by purchases of health-related goods and services, transfers to families and other current expenditure (CEPAL, 2021). This was in line with the governments dismissal, supported by the Fiscal Council, of its budgetary fiscal rule and 30% of GDP debt limit for 2020-2021 (Fitch, 2020). Since the announcement of the national state of emergency, the Central Bank of Peru, *Banco Central de Reserva del Perú*, took measures dedicated to the reduction of financing costs, liquidity provision and reduction of interest rate volatility (Montoro et al., 2020). To that end, the authorities decided upon an unprecedented expansionary monetary policy, cutting the reference rate by 200 basis points to a historic low of 0.25%. The Central Bank also expanded the range of guarantees and collateral that financial entities could use for repo operations and extended the maturities of liquidity operations. Furthermore, the bank incurred in monetary injections through two programs aimed at boosting credit conditions (Armas and Montoro, 2022). The Central Bank only increases the benchmark interest rate to 0.50% in August of 2021. Naturally, these measures are an alteration of the previous Central Bank's role (CEPAL, 2021).

In Uruguay, the new government took measures to address the health emergency. These include, relaxation of rules for claiming the unemployment insurance, expanded assistance to the most vulnerable groups and expanded sick leave benefits (IMF, 2021). Additionally, in April 2020, the government announced the creation of a Coronavirus Fund, drawn from public business contributions and salaries of public workers, as well as the implementation of an investment stimulus plan to keep money coming into Uruguay via tools such as tax exemptions for large-scale ventures (Horwitz, 2020). Furthermore, some tax and pension obligations were either postponed or reduced. The same goes for utility payments for some companies. Since the beginning of the virus outbreak, Uruguay's Government Debt began to rise. Nevertheless, prudent fiscal management and economic recovery helped to improve fiscal accounts, namely, lower the fiscal deficit in 2021 to below its 2019 level, despite increased COVID19-related expenditures (World-Bank, 2022). The Central Bank of Uruguay, *Banco Central del Uruguay*, took measures to maintain an adequate level of liquidity by reducing reserve requirements for deposits in commercial banks (Fernández and Tiscornia, 2020) - as well as to avoid disruptions in the money market (IMF, 2022). Another central aspect of the monetary policy implied the reduction of the reference interest rate (Bucacos et al., 2022), which goes in line with the expansionary monetary policy to maintain access to credit (CEPAL, 2020a). Later, the new authorities at the Central Bank of Uruguay announced a change to the monetary policy that put more weight against inflation and changed the prior monetary aggregates instrument for an interest rate one.

D Economic impact of COVID-19 in Latin America

This section presents the moments that are used to calibrate the large shock such that it resembles the COVID-19 crisis. Recall that the shock matches the economic impact of COVID-19 on five macro variables in 2020: (1) real GDP growth, (2) Expenditures/GDP, (3) Imports growth, (4) inflation, and (5) credit spreads.

To obtain the targeted moments from the data, we compute the impact of the COVID-19 crisis on a given moment by computing the difference between the observed value for that moment and the forecast for that moment in the *IMF World Economic Outlook of October of 2019* (pre-pandemic). Table 7 shows, as an example, how the targeted impact on real GDP growth in 2020 was obtained. On average, real GDP growth was -7.4% on 2020 but, since the WEO of October of 2019 expected the average real GDP growth to be 2.1% in 2020, we estimate that the impact on COVID-19 on real GDP growth in 2020 was -9.5%. Note also that although there are differences in the impact across countries, ranging from -6.1% in Brazil to -14.6% in Peru, all countries suffered a deep contraction of real GDP as a consequence of COVID-19. This presents a perfect opportunity to evaluate the cost/benefits of temporary suspension of policy rules in emerging markets.

Table 7: Estimating COVID-19 impact on 2020 real GDP growth

Country	(1) Actual	(2) WEO forecast	(1) - (2) Impact
Argentina	-9.9	-1.3	-8.6
Brazil	-4.1	2.0	-6.1
Chile	-5.8	3.0	-8.9
Colombia	-6.8	3.6	-10.4
Mexico	-8.3	1.3	-9.6
Peru	-11.0	3.6	-14.6
Uruguay	-5.9	2.3	-8.2
Average	-7.4	2.1	-9.5

Source: Authors estimations using data from the IMF WEO (October, 2019).