Policy Rules and Large Crises in Emerging Markets

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Policy Rules and Large Crises in Emerging Markets∗

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Abstract

In response to the COVID-19 pandemic, Latin American countries temporarily suspended rules limiting debt, fiscal and monetary policies. Despite this increase in flexibility, the crisis implied a substantial deterioration of macroeconomic variables (e.g., real GDP declined by 9.5%) and high welfare costs (which we estimate as equivalent to a 13% one-time reduction in non-tradable consumption). This paper studies a sovereign default model with fiscal and monetary policies to assess the policy response and evaluate the gains from flexibility in times of severe distress.

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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 on fiscal and monetary policies to support domestic economies.\(^1\) This paper studies the value of flexibility in fiscal and monetary policies during large crises in emerging markets.

Our laboratory consists of a model of sovereign default with domestic policies and long-term external debt, plus rules constraining government policy. 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.\(^2\) We study 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 Espino, Kozlowski, Martin, and Sánchez (2022), 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. There are two types of policy rules: fiscal and monetary.

We use the COVID-19 episode as a natural experiment, which captures the idea of a large, unpredictable crisis that hits the economy along multiple fronts. Specifically, the economy experiences a drop in productivity, increased government transfers, increased trade costs, and increased demand for liquidity. These unexpected shocks reproduce, by construction, the main economic outcomes due to the COVID-19 shock: the drop in real GDP, the increase in government expenditure, the contraction in imports, and the drop in inflation. We also allow the penalty for sovereign debt default to vary with the

\(^1\)Appendix A 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 also interpret them more generally to include debt issued domestically in local currency as long as this debt is liquid to some extent.
state of the economy and, thus, match the concurrent rise of credit spreads. The model performs well in replicating non-targeted moments such as the nominal depreciation of the currency, the response of tax revenues, and the drop in employment. In the absence of policy rules, the government’s response to the shock involves a rise in the fiscal deficit, a significant portion of which is monetized, leading to higher inflation in the future. This combination of shocks and policy response carries a high welfare cost: households would be willing to forgo 13% of non-tradable consumption to avoid the crisis.

To understand the value of rules vs. flexibility, we conduct counterfactual exercises, comparing the government’s response to the shocks when constraints are imposed and when they are temporarily suspended. The results indicate that the policy restrictions during severe crises, i.e., a lack of flexibility, leads to welfare losses, a deterioration of macroeconomic aggregates and higher sovereign debt spreads.

We begin our analysis by studying the value of having access to a menu of policy instruments to respond to shocks. Specifically, we focus on cases when income taxes, external debt or the quantity of money cannot be changed during a crisis. First, we find that holding taxes constant during the crisis leads to real GDP falling even more, by about 1 percentage point. This restriction is particularly interesting in the context of emerging markets since it could represent a situation when the political party in charge lacks the power to pass legislation to decrease taxes. Second, we consider the case when sovereign debt is held constant, which could represent, for example, distress in global debt markets and a drying-up of international credit. In this case, the country needs a larger trade balance surplus, which is achieved with a larger real currency depreciation. This significant reallocation of resources is costly in terms of welfare but softens the decline in real GDP. Third, keeping the money growth rate constant at the steady state level (which we calibrate at 4% annual) succeeds in keeping prices and the exchange rate stable. However, it implies an increase in taxes to substitute for the missing seigniorage. This policy generates a larger decline in real GDP, about 2 percentage points, a more significant increase in sovereign debt spreads and a significant reduction in welfare.

Next, we study the impact of imposing standard fiscal rules, such as deficit-to-GDP and debt-to-GDP limits, and monetary policy rules, such as inflation and currency depreciation targets. We find that these constraint typically imply higher welfare costs than
simply keeping specific policy instruments constant.

Maintaining a primary deficit rule turns out to be costly during the crisis. Basically, it forces the government to raise taxes in order to pay for the additional transfers. In contrast, if the rule were suspended during the shock, the government would let taxes fall to help smooth the impact of the shock, and thus, increase the primary deficit significantly. With an active deficit rule, real GDP drops an additional 2.3 percentage points in the period of the shock. The welfare cost of this restriction is about 0.4% of non-tradable consumption.

Not allowing debt-to-GDP to increase during the crisis implies a significant welfare loss, equal to 5% of non-tradable consumption, which is an order of magnitude larger than any of the other scenarios we study. The resulting currency depreciation during the shock is much more severe with this constraint. The reason is that the government now needs to repay its debt in foreign currency. Hence, net exports need to increase substantially, which is achieved through a large depreciation. The boom in exports and a significant decline in imports result in a smaller decline in real GDP than in the unconstrained case. Interestingly, in this case, macroeconomic performance and welfare go in opposite directions.

Targets on nominal variables, such as inflation and currency depreciation, indirectly limit the money growth rate. During a large crisis, meeting these targets implies a contraction in the money growth rate, which is the opposite of what would occur with flexible policies. Both these rules imply policies that differ significantly from the discretionary case and impose high welfare costs, 0.6% to 0.7% of non-tradable consumption. Notably, in the case of a constant depreciation rate, real GDP falls by an additional 3 percentage points and sovereign debt spreads increase twice as much. However, since they imply a more negligible real depreciation, the decline in GDP measured in dollars is almost 3 percentage points smaller than a temporary suspension of this target.

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, it incorporates into this setup fiscal policy as in Cuadra, Sánchez, and Sapriza (2010) and combines it with monetary policy as Espino, Kozłowski,
Analyzing fiscal policy rules in the context of sovereign default links this paper with Hatchondo, Roch, and Martinez (forthcoming). 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 the impossibility of adjusting 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 Are, 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 an example 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 (2021) analyzes fiscal rules and their effectiveness for curbing government spending in a monetary economy in which the government is prone to overspending.

The paper is structured as follows. Section 2 describes the environment and characterizes the monetary equilibrium. Section 3 formulates the problem of the government. Section 4 describes how we calibrate the model’s steady state and the large crisis. Section 5 studies the quantitative implications. Section 6 concludes.

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4See also Martin (2011) for a model studying the joint determination of fiscal and monetary policy in a closed economy.
2 Model

2.1 Environment

The environment is a discrete-time small open economy populated by many identical infinitely-lived agents. In the model’s recursive formulation, a variable’s prime indicates that it corresponds to the next period.

Preferences, endowments, and technology. There are three private goods in the economy. First, a non-tradable good is consumed and produced domestically; these quantities are denoted $c^N$ and $y^N$, respectively. Second, there are tradable imported goods 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.

The government also provides a public good. 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, $\ell$ or supplied in the labor market, $h$. Thus, $\ell + h = 1$.

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

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

where $u$, $v$, and $\vartheta$ 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 $j = \{N, T\}$, $v_\ell$ denotes the derivative of $v$ with respect to $\ell = 1 - h$, and $\vartheta_g$ denotes the derivative of $\vartheta$ with respect to $g$. Given the functional forms, the cross derivatives are 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 $F : \mathbb{R}_{+}^2 \rightarrow \mathbb{R}_{+}$, which is strictly increasing, strictly convex, and homogeneous of degree
one. Given $h$, feasible levels of $(y^N, y^T)$ must satisfy

$$A(I)F(y^N, y^T) - h \leq 0.$$  \hspace{1cm} (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 be affected during the large crisis we model 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 will be 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 we model in the following sections.

The law of one price holds for tradable goods, and so $P^X = E p^T (1 - \phi)$ 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 $p^T (1 - \phi) (1 + \phi)$ denotes effective terms of trade.

Let $\mu$ 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 when purchasing non-tradable goods,

$$p^N c^N \leq \theta m,$$  \hspace{1cm} (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 $\theta$. The parameter $\theta$ refers to a measure of the velocity of circulation. It will also be affected during the large crisis we model.
**Government.** The government provides a public good, \( g \), produced using a linear technology that transforms one-to-one non-tradable goods into the public good. Let \( \gamma > 0 \) be the real value (in units of non-tradable output) of exogenous government transfers. These transfers will change during the large crisis to represent a sudden change in the needs expenditures.

The government has access to the following instruments to finance expenditures: (i) it can tax labor income, \( \tau w h \), at rate \( \tau \); (ii) it can increase the money supply at rate \( \mu \), 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.\(^5\) Consequently, \( \delta B \) 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

\[
p^N(g + \gamma) + e\delta B \leq \tau w h + \mu + eq[B' - (1 - \delta)B].
\]  
(3)

Each period, the consolidated government makes several decisions. First, it decides whether to default or not. Second, it issues new international debt and sets the labor tax and the money growth rate.

The government can default on its debt. A government that did not default is in good credit standing, \( I = P \), while a government in default has \( I = D \). When the government repays the debt, it can get new borrowing, deciding the debt level for the next period \( B' \). When the government defaults, it avoids paying the debt 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

\(^5\)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.
\[ \pi \]. 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 \( I \), which specifies whether the government is in default (\( I = D \)) or not (\( I = P \)). 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 \( B \) implies a law of motion for debt from \( B \) to \( B' \). Similarly, the government policy function for repayment \( P(B) \) 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

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

subject to

\[
p^N c^N + e(1 + \phi)c^T + m'(1 + \mu) \leq (1 - \tau)wh + m + p^N r,
\]

\[
p^N c^N \leq m\theta,
\]

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 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

$$A(I)F(y^N, y^T) - h \leq 0. \tag{6}$$

The firm does not need to know the laws of motion of the aggregate state variables due to its problem’s static nature.

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 \((\tau, \mu, g)\), 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 \((\tau, \mu, g)\), the policy functions \((c^N, c^T, m', h)\) solves the representative household’s problem;

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

3. The budget constraint of the government (3) is satisfied;

4. Markets clear: (i) The money market clears, \(m = 1\); (ii) The market for non-tradable clears, \(c^N(1, B, I, s) + g = y^N(B, I)\) for all \((B, I)\), (iii) The labor market clears, \(A(I)F(y^N, y^T) = h(1, B, I)\) for all \((B, I)\).

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

$$(1 - \phi)p^T y^T - (1 + \phi)c^T = \delta B - q[B' - (1 - \delta)B], \tag{7}$$
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

First, we describe the benchmark in which the government does not commit to future policies, i.e., there are no rules. Consequently, the government chooses whether to repay its debt, borrowing, labor income taxes, and money growth rate every period. 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 \((\mu, \tau)\) in the government budget constraint (3).

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

\[
\frac{(1 + \phi)}{(1 - \phi)} \left[ u_T c^T + \beta \mathbb{E} \left[ u'_N c'^N \right] - v_t A(I) F(c^N + g, y^T) \right] \geq u_T p^T F_N \left( \gamma - c^N \left[ 1 - \frac{1}{\theta} \right] \right),
\]

which depends on households’ policy functions \((c^N, c^T, y^T, c'^N, c'^T)\), current and future, and the government choice \(g\) (see Appendix B for the derivation).

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 \(\pi\) and zero debt obligations.

We denote \(I(B, \varepsilon)\) as the government’s default policy function and define the value of the optimal decision as

\[
\hat{V}(B, \varepsilon) = \max \{ V^P(B) + \varepsilon, V^D \},
\]

where \(V^P\) and \(V^D\) denote the value of repayment and default, respectively, defined below. An idiosyncratic additive shock also influences this decision to utility. We assume that \(\varepsilon\)
has mean zero and is distributed logistic; i.e., \( \varepsilon \) 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 \( \varepsilon \) shocks. Under these assumptions, the policy function for repayment conditional only on \( B \) is \( \mathcal{P}(B) \) is
\[
\mathcal{P}(B) = \Pr(V^P(B) - V^D \geq -\varepsilon) = \frac{\exp[V^P(B)/\zeta]}{\exp[V^P(B)/\zeta] + \exp[V^D/\zeta]},
\]
for any \( B \) (see Espino et al., 2022).

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 (10). 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, (7), the government budget constraint, (8), and a non-negativity constraint regarding the Lagrange multiplier for the cash-in-advance constraint (see Appendix B, Equation (28)).

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 \( \{B, C^N, C^T, Y^T, G\} \). When the government is in default, \( I = D \), and the aggregate policy functions are denoted \( \{\bar{C}^N, \bar{C}^T, \bar{Y}^T, \bar{G}\} \) 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
\[
V^P(B) = \max_{(B',c^N,c^T,y^T,g)} \{ u(c^N, c^T) + v(1 - F(c^N + g, y^T)) + \vartheta(g) + \beta V(B') \}
\]
(11)
subject to
\[(1 - \phi)p^T y^T - (1 + \phi)c^T - \delta B + q[B' - (1 - \delta)B] = 0, \quad (12)\]
\[\frac{(1 + \phi)}{(1 - \phi)} \left[ u_T c^T + \beta \mathbb{E} \left[ u'_N c'_N | P \right] - v_t A(P) F(c^N + g, y^T) \right] \geq u_T p^T F_N \left( \gamma - c^N \left[ 1 - \frac{1}{\theta} \right] \right), \quad (13)\]
\[u_N - u_T p^T \left( \frac{1 - \phi}{1 + \phi} \right) \frac{F_N}{F_T} \geq 0. \quad (14)\]

As mentioned, the constraints in the government’s problem correspond to the balance of payment, (7), the government budget constraint, (8), and the non-negativity constraint, (28). 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
\[V^D = \max_{(c^N, c^T, y^T, g)} \left\{ u(c^N, c^T) + v(1 - F(c^N + g, y^T)) + \vartheta(g) + \beta \left[ \pi V(0) + (1 - \pi)V^D \right] \right\} \quad (15)\]
subject to
\[(1 - \phi)p^T y^T - (1 + \phi)c^T = 0, \quad (16)\]
\[\frac{(1 + \phi)}{(1 - \phi)} \left[ u_T c^T + \beta \mathbb{E} \left[ u'_N c'_N | P \right] - v_t A(D) F(c^N + g, y^T) \right] \geq u_T p^T F_N \left( \gamma - c^N \left[ 1 - \frac{1}{\theta} \right] \right), \quad (17)\]
\[u_N - u_T p^T \left( \frac{1 - \phi}{1 + \phi} \right) \frac{F_N}{F_T} \geq 0. \quad (18)\]

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
\[Q(B') = \frac{1}{1 + r} \left[ \mathcal{P}(B') \left( \delta + (1 - \delta)Q(B(B')) \right) \right] \quad (19)\]

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

$$Q^{EMBI}(B) = \mathcal{P}(B)[\delta + (1 - \delta)Q(B)]$$  \hspace{1cm} (20)

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

$$Q^{EMBI}(B) = \sum_{j=0}^{+\infty} \frac{\delta(1-\delta)^j}{(1+r)^j(1+CS(B))^{j+1}}$$  \hspace{1cm} (21)

Therefore, sovereign credit spread is

$$(1+CS(B)) = \frac{\delta}{Q^{EMBI}(B)} + \frac{(1-\delta)}{(1+r)}$$  \hspace{1cm} (22)

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, $\mathcal{P}$, $\{B, C^N, C^T, Y^T, G\}$ and $\{\bar{C}^N, \bar{C}^T, \bar{Y}^T, \bar{G}\}$; and bond price function $Q$ such that the following conditions are satisfied:

(i) Given $Q$, the value functions $(V^P, V^D)$ satisfy (11) and (15), and the corresponding policy functions are $\mathcal{P}$, $\{B, C^N, C^T, Y^T, G\}$ and $\{\bar{C}^N, \bar{C}^T, \bar{Y}^T, \bar{G}\}$;

(ii) Given $(\mathcal{P}, B)$, the bond price equation $Q$ satisfies (19);

(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 or the policies at the steady state. Of course, even with only the additive utility shocks, the steady state involves a debt distribution since there is 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 $\varepsilon$ are such that there is no default. More precisely, that level of debt $B^*$ is such that $B(B^*) = B^*$. 

14
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

\[
\begin{align*}
    u(c^N, c^T) &= \alpha^N \left( \frac{(c^N)^{1-\sigma^N}}{1-\sigma^N} + \frac{(c^T)^{1-\sigma^T}}{1-\sigma^T} \right), \\
    v(\ell) &= \alpha^H \left( \frac{\ell^{1-\varphi}}{1-\varphi} \right).
\end{align*}
\]

We will set $\sigma^N = \sigma^T = \sigma$ and so $1/\sigma$ 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.\(^6\)

The function describing the labor requirement for production is

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

where $1/\rho$ 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.

\(^6\)A more general representation with constant relative risk aversion, $\alpha^G (y^{1-\nu} - 1)/(1 - \nu)$, converges to log-utility as $\nu$ approaches 1. Nieh and Ho (2006) estimates values of $\nu$ around 0.8. Azzimonti et al. (2016), among others, uses log-utility for the public good. See also the discussion in Debortoli and Nunes (2013).
4.2 Exogenous parameters

Table 1 shows the values of the 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 the value of $\varphi$ to 1.50 so that the Frisch elasticity is one-half on average.\(^7\) Considering 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 $\pi = 1/6$.

Table 1: Parameters externally calibrated

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Value</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>$r$</td>
<td>risk-free rate</td>
<td>0.03</td>
<td>long-run average</td>
</tr>
<tr>
<td>$\varphi$</td>
<td>curvature of leisure</td>
<td>1.50</td>
<td>Frisch elasticity</td>
</tr>
<tr>
<td>$\pi$</td>
<td>re-enter probability</td>
<td>0.17</td>
<td>exclusion duration</td>
</tr>
<tr>
<td>$\alpha^T$</td>
<td>preference share for $c^T$</td>
<td>1.00</td>
<td>normalization</td>
</tr>
<tr>
<td>$\sigma^N$</td>
<td>curvature of $c^N$</td>
<td>0.50</td>
<td>Espino et al. (2022)</td>
</tr>
<tr>
<td>$\sigma^T$</td>
<td>curvature of $c^T$</td>
<td>0.50</td>
<td>Espino et al. (2022)</td>
</tr>
<tr>
<td>$\rho$</td>
<td>elasticity of substitution $(y^N, y^T)$</td>
<td>1.50</td>
<td>Espino et al. (2022)</td>
</tr>
<tr>
<td>$\delta$</td>
<td>fraction of maturity coupons</td>
<td>0.20</td>
<td>5 years maturity</td>
</tr>
</tbody>
</table>

Following Espino et al. (2022), we set $\sigma^N = \sigma^T = 0.5$ and $\rho = 1.5$. Setting $\sigma^T < 1$ is sufficient for the non-negativity constraint in the government’s problem to be satisfied with strict inequality (it is also necessary when transfers $\gamma$ are zero). This choice implies that imported goods are gross substitutes for non-tradable goods, as in the estimates of Ostry and Reinhart (1992).\(^8\) The value of $\rho$ determines the elasticity of substitution between $y^N$ and $y^T$ in the cost function. A number larger than 1 guarantees that the reaction of GDP to terms production possibilities frontier is concave. As shown in Espino et al. (2022), the value of $\rho = 1.5$ helps the model reproduce the respond of real GDP to term-of-trade shocks. Finally, we choose $\delta = 0.2$ to get a maturity of five years as in Hatchondo and Martinez (2009).

4.3 Targeted moments in steady state

The next set of parameters are jointly calibrated to match a set of long-run averages in the steady-state benchmark economy during normal times. We use data collected

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\(^7\)We can calibrate this parameter externally because we target the value of $h$.

\(^8\)However, the estimates in Ostry and Reinhart (1992) are in the range of 1.22–1.27 and our calibration implies an elasticity equal to 2.
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 internally calibrated and matched statistics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Statistic</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta$</td>
<td>0.8563</td>
<td>Inflation, %</td>
<td>3.800</td>
</tr>
<tr>
<td>$\gamma$</td>
<td>0.1082</td>
<td>Transfers/GDP</td>
<td>0.117</td>
</tr>
<tr>
<td>$\alpha^H$</td>
<td>0.9366</td>
<td>Employment/Population</td>
<td>0.587</td>
</tr>
<tr>
<td>$\alpha^G$</td>
<td>0.4397</td>
<td>Gov. Consumption/GDP</td>
<td>0.133</td>
</tr>
<tr>
<td>$\alpha^N$</td>
<td>2.7880</td>
<td>Exports/GDP</td>
<td>0.209</td>
</tr>
<tr>
<td>$\omega_0$</td>
<td>1.4575</td>
<td>Real GDP</td>
<td>1.000</td>
</tr>
<tr>
<td>$\omega_1$</td>
<td>0.1034</td>
<td>Debt/GDP</td>
<td>0.365</td>
</tr>
<tr>
<td>$\zeta$</td>
<td>0.0663</td>
<td>Default, %</td>
<td>2.000</td>
</tr>
</tbody>
</table>

The value of the discount factor $\beta = 0.86$ helps the model produce an annual 3.8% inflation rate. The parameter $\gamma = 0.11$ matches the ratio of transfers to GDP, which in the data average 11.7%. The value of $\alpha^H = 0.94$ 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, $\alpha^G = 0.44$, delivers government consumption over GDP of 13.3%. The parameter $\alpha^N = 2.8$ takes a value that allows the model to reproduce the ratio of exports to GDP, which is 21% in the data.

Recall that $A$ is a measure of the inverse of labor productivity. Then, the value of productivity in repayment $\omega_0 = \frac{1}{A(P)} = 1.46$ is set so that the steady state output is normalized to one making some statistics easier to read. The remaining two parameters are important determining the debt-to-GDP ratio and the default rate in the economy only with additive utility shocks. We assume that the economy experiences a drop in productivity when the government is in default, and so it is $\omega_0 - \omega_1 = \frac{1}{A(D)}$. The value of $\omega_1 = 0.1$ is used to reproduce the external debt-to-GDP ratio in the repayment state, which is 18.5%. Finally, the scale parameter in the distribution of taste shocks, $\zeta = 0.07$, determines the risk of sovereign default in the steady-state and is calibrated to reproduce a default rate of 2.0% annual.
4.4 Calibrating a large unexpected crisis

The next section evaluates the role of policy responses to a large crisis. The economy starts in the steady-state level of debt under the respective policy rule environment. Then, the economy is unexpectedly hit by a large shock. We calibrate the large shock to resemble 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. Appendix C shows how these targeted moments were estimated. This subsection describes the changes in the parameters that shape the large crisis.

First, note that multiple lockdown measures imposed by government authorities all across the world implied restricting production in some sectors with aims of reducing spread of the virus (Carrieri et al., 2021). As a result, companies were hit hard through different channels including lock-downs, staff under quarantine or home isolation, productivity and capacity reductions, higher costs, demand collapse, supply-chain disruptions and generalized uncertainty (Ebeke et al., 2021). We model this as a drop in productivity $\omega_0$ to match the 9.5% drop in real GDP in 2020.

The second exogenous shock corresponds to a temporary increase of transfers $\gamma$. This change captures the sudden need to make more transfers to the households and it increases during a crisis while it is independent of the government’s decision regarding whether to default or not. The increment in $\gamma$ is so that it matches the temporary increase of 4.1% in government expenditures. Recall that the target of 4.1%, and all of the other targets in this subsection, was obtained following the procedure described in Appendix C and illustrated with the example of real GDP growth.

Third, the pandemic disrupted global trade. The initial health measures involving travel restrictions, border closures and lock-downs affected trade in good and services by disrupting freight transport, business travel, and 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 real shock as an increase in trade costs, $\phi > 0$, and can either be interpreted as a drop in the efficiency of transporting
goods or as an increase in restrictions to trade. The increment in $\phi$ is so that the model reproduces the drop in imports of 15.4%.

Fourth, the virus outbreak also resulted in a liquidity crisis with a flight to cash (Novick et al., 2022). For example, during the early pandemic, in spite of a significant decrease in cash payments, cash money demand 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 pursuit of cash as storage of value was also evidenced in many other countries, including Brazil (Ashworth and Goodhart, 2020). We model this liquidity shock as a decrease in $\theta$ interpreted as a temporary increase in the demand of money (alternately, a fall in the velocity of circulation). The change in the parameter $\theta$ is calibrated to match the drop in inflation in 2020 of 0.19%. Intuitively, with a constant $\theta$ the monetary expansion would generate a large increase in inflation. However, the data shows that inflation in 2020 was relatively low, in fact it decreased by 0.19%. Contrary, inflation in 2021 was much larger, around 6.3%. The transitory increase in money demand, the drop in $\theta$, rationalizes this inflation behavior in our model.

Lastly, the sovereign debt spreads increased during this period, especially in the first part of the pandemic. To make sure the model reproduce the availability of external financing, we allow the default penalty to vary with the state of the economy as it is standard since Arellano (2008). We assume that labor productivity in default is a function of the previous four shocks

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

where $\text{gap}$ is the deviation of the GDP in dollars from steady state value due to shocks during the large crisis. Thus, $\omega_2 > 0$ makes the default cost lower during period of lower output.\(^9\) We calibrate $\omega_2$ to match the increase in spreads of 96 basis points during 2020.\(^10\)

\(^9\)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.

\(^10\)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 $\text{gap}(s) = \ldots$
4.5 Macro variables’ responses to the COVID-19 crisis

The top panel of Table 3 shows how the model replicates the five moments during the COVID-19 crisis. This finding should not be surprising since we calibrate the shock to reproduce these responses, as explained in the previous subsection. The model also reproduces the changes in other important macroeconomic variables, shown in the middle panel. Note that the model predicts the signs of the changes correctly in every case. It overreacts slightly regarding the depreciation and the fall in GDP measured in US dollars. The model predicts a more substantial tax rate fall and a smaller drop in employment. Interestingly, the model generates a slight response of 2020 inflation (as targeted), while it generates a more significant inflation response in 2021, as seen in the data (non-target). Finally, the model is consistent with the increase in the debt-to-GDP ratio, the increment in the money growth rate, and the fall in exports. While it is valuable that the model can capture these changes well, the analysis aims not to explain the crisis. This calibration aims to illustrate how large crises affect emerging markets.

Table 3: The response to the COVID-19 crisis

<table>
<thead>
<tr>
<th></th>
<th>Data</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Δ Real GDP, %</td>
<td>-9.5</td>
<td>-9.5</td>
</tr>
<tr>
<td>Δ Expenditure / GDP, pp</td>
<td>4.1</td>
<td>4.6</td>
</tr>
<tr>
<td>Δ Imports, %</td>
<td>-15.4</td>
<td>-15.6</td>
</tr>
<tr>
<td>Δ Inflation, pp</td>
<td>96.2</td>
<td>96.3</td>
</tr>
<tr>
<td>Δ Credit spreads, bps</td>
<td>-0.2</td>
<td>-0.2</td>
</tr>
<tr>
<td>Δ Depreciation, pp</td>
<td>8.2</td>
<td>12.3</td>
</tr>
<tr>
<td>Δ GDP USD, %</td>
<td>-18.6</td>
<td>-20.8</td>
</tr>
<tr>
<td>Δ Employment, pp</td>
<td>-7.3</td>
<td>-3.2</td>
</tr>
<tr>
<td>Δ Debt / GDP, pp</td>
<td>5.2</td>
<td>11.2</td>
</tr>
<tr>
<td>Δ Tax rate, pp</td>
<td>-0.8</td>
<td>-6.3</td>
</tr>
<tr>
<td>Δ Money growth rate, pp</td>
<td>28.9</td>
<td>13.2</td>
</tr>
<tr>
<td>Δ Exports, %</td>
<td>-13.2</td>
<td>-10.7</td>
</tr>
<tr>
<td>Δ Inflation 2021, pp</td>
<td>6.3</td>
<td>14.3</td>
</tr>
<tr>
<td>Welfare of COVID surprise, %</td>
<td>-12.8</td>
<td></td>
</tr>
</tbody>
</table>

Note: Δ stands for change in that variable.

The last row of Table 3 presents the welfare cost of the unexpected COVID-19 crisis. To measure welfare, we consider the equivalent increment in non-tradable consumption during one period to keep utility constant, as explained in Appendix D. We find a high

\[ \sum \text{elast}_i \Delta s_i \], where elast_i = \( \frac{\partial Y_{USD}}{\partial s_i} \frac{s_i}{s_i^{steady}} \), 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 \( \Delta s_i \) is the change in \( s_i \) with respect to its value in steady state.
crisis cost, equivalent to a one-period change of −12.8% in non-tradable consumption from its steady-state value.

Next, we study the quantitative implications in two economies. First, one that keeps the rule in place during the crisis. And second, in a counterfactual economy in which the rule is abandoned during the crisis period but then returns to the corresponding rule immediately after the crisis. By comparing both economies, we can learn how valuable it is to have flexibility during large crises.

5 Assessing policy flexibility and policy rules

This section explores the implications of monetary, fiscal, and debt flexibility and the role of policy rules. For each case, we consider two scenarios. First, the restriction is imposed before, during, and after the COVID-19 shock. In the second scenario, we consider that the restriction is abandoned during the COVID-19 shock period but re-implemented immediately after. We measure welfare costs considering a one-period increment in non-tradable consumption to keep utility constant in both scenarios (see Appendix D).

5.1 The value of policy flexibility

This section assesses the benefits of allowing policies to react to shocks, or what we call “the value of policy flexibility”. To do that, we compare an economy that completely responds to a significant crisis with alternative economies in which one of the policy instruments (taxes, debt, and money growth) is kept constant.

There are six columns with results in Table 4. A feature of the crisis to highlight is that the columns with flexible policies in the period of the large crisis (columns 2, 4, and 6) are similar to the benchmark results in Table 3 with policy flexibility. This result means that the restrictions before or after the crisis are irrelevant for a large but short crisis like COVID-19.

The first interesting result comes from analyzing flexibility in taxes. As we show in the following subsection, inflexibility in taxes could come from rigid fiscal rules. Note, however, that as changing taxes regularly requires legislative approval, lack of flexibility could also come from the weakness of the political party in charge of the government. The comparison between columns (1) and (2) shows that having flexibility in taxes is
Table 4: The value of policy flexibility

<table>
<thead>
<tr>
<th>Constant policy in normal times</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant policy in the large crisis</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>τ = 0.24</strong></td>
<td><strong>B = 0.53</strong></td>
<td><strong>μ = 0.04</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Δ Tax rate, pp</td>
<td>0.0</td>
<td>-6.3</td>
<td>-6.0</td>
<td>-6.7</td>
<td>3.6</td>
<td>-6.3</td>
</tr>
<tr>
<td>Δ Expenditure / GDP, pp</td>
<td>5.2</td>
<td>4.6</td>
<td>4.4</td>
<td>4.7</td>
<td>5.0</td>
<td>4.6</td>
</tr>
<tr>
<td>Δ μ, pp</td>
<td>5.4</td>
<td>13.2</td>
<td>14.1</td>
<td>11.9</td>
<td>0.0</td>
<td>13.3</td>
</tr>
<tr>
<td>Δ Primary deficit / GDP, pp</td>
<td>5.2</td>
<td>10.9</td>
<td>10.4</td>
<td>11.4</td>
<td>1.4</td>
<td>10.9</td>
</tr>
<tr>
<td>Δ Real GDP, %</td>
<td>-10.7</td>
<td>-9.5</td>
<td>-9.4</td>
<td>-9.6</td>
<td>-11.5</td>
<td>-9.5</td>
</tr>
<tr>
<td>Δ GDP USD, %</td>
<td>-19.7</td>
<td>-20.9</td>
<td>-21.6</td>
<td>-20.0</td>
<td>-18.9</td>
<td>-20.9</td>
</tr>
<tr>
<td>Δ Employment, pp</td>
<td>-3.8</td>
<td>-3.2</td>
<td>-3.2</td>
<td>-3.2</td>
<td>-4.2</td>
<td>-3.2</td>
</tr>
<tr>
<td>Δ Debt / GDP, pp</td>
<td>10.4</td>
<td>11.2</td>
<td>10.0</td>
<td>12.0</td>
<td>10.4</td>
<td>11.2</td>
</tr>
<tr>
<td>Δ Credit spreads, bps</td>
<td>94.5</td>
<td>92.6</td>
<td>24.6</td>
<td>46.1</td>
<td>123.2</td>
<td>100.4</td>
</tr>
<tr>
<td>Δ Inflation , pp</td>
<td>-1.2</td>
<td>-0.2</td>
<td>0.7</td>
<td>-1.3</td>
<td>-2.7</td>
<td>-0.2</td>
</tr>
<tr>
<td>Δ Inflation 2021, pp</td>
<td>7.6</td>
<td>14.5</td>
<td>13.4</td>
<td>15.9</td>
<td>3.7</td>
<td>14.2</td>
</tr>
<tr>
<td>Δ Depreciation, pp</td>
<td>8.1</td>
<td>12.2</td>
<td>14.3</td>
<td>9.6</td>
<td>4.4</td>
<td>12.3</td>
</tr>
<tr>
<td>Δ Depreciation 2021, pp</td>
<td>-0.7</td>
<td>2.9</td>
<td>-0.2</td>
<td>7.1</td>
<td>-2.6</td>
<td>2.3</td>
</tr>
<tr>
<td>Δ Imports, %</td>
<td>-21.0</td>
<td>-15.5</td>
<td>-17.9</td>
<td>-12.7</td>
<td>-23.6</td>
<td>-15.7</td>
</tr>
<tr>
<td>Δ Exports, %</td>
<td>-16.1</td>
<td>-10.7</td>
<td>-9.0</td>
<td>-12.8</td>
<td>-19.7</td>
<td>-10.6</td>
</tr>
<tr>
<td>Δ Welfare after shock, %</td>
<td>-12.9</td>
<td>-12.8</td>
<td>-12.8</td>
<td>-12.5</td>
<td>-13.1</td>
<td>-12.8</td>
</tr>
<tr>
<td>Δ Welfare due to restriction, %</td>
<td>-0.1</td>
<td>-0.3</td>
<td>-0.3</td>
<td>-0.3</td>
<td>-0.3</td>
<td>-0.3</td>
</tr>
</tbody>
</table>

Note: Δ stands for change in that variable.

quite helpful. While in column (1), taxes are constant by construction, if flexibility is allowed during the period of the shock, as in column (2), the tax rate would drop by 6.3%.

This fundamental difference stems from the extra constraint imposed by the rule that implies more significant tax distortions and, consequently, a more considerable decline in real GDP and employment. Note that the other policy instruments are also affected when taxes are not allowed to change. In particular, expenditures are higher, and the money growth rate is lower as more resources are available from taxes. Note that the lower money growth rate in 2020 implies that inflation and depreciation are lower both in 2020 and 2021. There is a positive value of flexibility as welfare increases 0.1%.

The second exciting comparison is between columns (3) and (4), showing the value of flexibility in the amount of external debt. Again, this lack of flexibility could result from fiscal policy rules, as analyzed in the following subsection. Or it could be due to other factors that restrict the supply of external funds to the government (e.g., distress in global sovereign debt markets). If the level of debt is kept constant, the net impact on taxes and the money growth rate is similar to the case with flexibility. However, if
external debt must be kept constant, the debt-to-GDP ratio is forced to increase less.

Consequently, the domestic currency depreciates more, and the trade balance adjusts more abruptly—with imports falling more and exports falling less. Although this restriction has less impact on real GDP, it has a more considerable impact on welfare—the welfare loss is equivalent to a 0.3% one-period reduction in the consumption of the non-tradable good. The difference between the real GDP and welfare results is that the economy produces more exports and consumes less of the imported good, pushing the real GDP up. Still, it has negative consequences from the welfare perspective.

The last comparison is in terms of flexibility of the monetary policy. While in the economy displayed in column (5), $\mu$ is restricted to be constant at the steady state level of 4%, in the economy in column (6), the money growth rate is allowed to respond to the crisis. A restriction in the case of monetary policy could be a consequence of policy design, such as an exchange rate regime, inflation targeting, a monetary union, or dollarization. The results show that real GDP and employment fall significantly more in the case of the policy restriction. The critical difference is that in the flexible policy environment, $\mu$ increases by 13 percentage points compared to being kept constant. In the last case, taxes must increase since there are fewer resources from seigniorage. This change generates more significant tax distortions compared to the case with flexible policy—in which taxes decline. The restriction on money growth also implies that GDP measured in dollars falls less due to a less severe depreciation. This lower depreciation severely impacts exports, which declined by 9 percentage points more. Therefore, this constraint on monetary policy is very restrictive as it generates a more severe recession and significant welfare losses. These losses are equivalent to a 0.3% one-period reduction in the consumption of the non-tradable good.

Overall, flexibility in policy instruments has a significant value in terms of welfare and is essential to alleviate the impact of shocks on real GDP, employment, and international trade.

5.2 The value of temporary suspension of rules

What are the implications of policy flexibility in the context of standard policy rules? This section answers that question by looking at (i) fiscal policy rules such as limits on debt-to-GDP and deficit-to-GDP ratios and (ii) restrictions on monetary policy imposed
by mandates to target nominal variables, such as inflation targeting or exchange rate regimes.

5.2.1 Fiscal rules

Table 5 quantifies the effects of imposing the following standard class of fiscal rules: a limit on the primary deficit-to-GDP ratio and a limit on the debt-to-GDP ratio. We set the limits based on the level of the respective variable in the steady state of the unconstrained economy, which are 1% for the primary deficit-to-GDP ratio and 37% for the debt-to-GDP ratio.

The primary deficit constraint has substantial implications, as shown in the comparison of columns (1) and (2). The main reason is that in an unconstrained economy, the deficit increases significantly as the tax rate drops and expenditures increase. With the rule, the tax rate must increase to fulfill the deficit rule. Thus, compared to the case in which the rule is relaxed, GDP and employment fall an extra 2.3 percentage points and 1.2 percentage points, respectively. There is also an abrupt trade disruption in which both imports and exports fall 10 percentage points more. Keeping this rule does not only affect macroeconomic variables. It also implies a high welfare cost, equal to a one-period reduction of 0.4% of non-tradable consumption.

The analysis of the debt-to-GDP rule in columns (3) and (4) shows that keeping this rule during large crises has significant negative implications. Compared to a temporary suspension of the rule, the welfare cost of not repaying are relatively much lower and so default becomes more attractive. This result is evident in the more considerable increase in sovereign debt spreads: they rise abruptly from 80 to 357 basis points once the debt-to-GDP rule is not relaxed. The reduction in welfare due to keeping this rule is severe, equivalent to a 5.1% one-period reduction in non-tradable consumption.

Note that this rule means that debt must decline during the period of the crisis as long as the debt-to-GDP ratio is required not increase. On the one hand, this means that taxes do not decrease as much, a similar mechanism to the deficit rule case. On the other hand, and more importantly, repaying part of the debt to the rest of the world requires the country to generate a more significant trade balance surplus. Thus, the money growth rate increases 10 percentage points more. So the local currency depreciates more than 30 percentage points more, generating a sizeable real depreciation. Consequently,
Table 5: The value of suspending fiscal rules

<table>
<thead>
<tr>
<th></th>
<th>deficit / $Y \leq 0.01$</th>
<th>$B / Y \leq 0.37$</th>
</tr>
</thead>
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<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td></td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>Rule in normal times</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Rule in the large crisis</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>$\Delta$ Tax rate, pp</td>
<td>5.0</td>
<td>-6.4</td>
</tr>
<tr>
<td>$\Delta$ Expenditure / GDP, pp</td>
<td>5.0</td>
<td>4.6</td>
</tr>
<tr>
<td>$\Delta$ $\mu$, pp</td>
<td>-1.4</td>
<td>13.2</td>
</tr>
<tr>
<td>$\Delta$ Primary deficit / GDP, pp</td>
<td>0.0</td>
<td>11.0</td>
</tr>
<tr>
<td>$\Delta$ Real GDP, %</td>
<td>-11.8</td>
<td>-9.5</td>
</tr>
<tr>
<td>$\Delta$ GDP USD, %</td>
<td>-18.9</td>
<td>-20.8</td>
</tr>
<tr>
<td>$\Delta$ Employment, pp</td>
<td>-4.4</td>
<td>-3.2</td>
</tr>
<tr>
<td>$\Delta$ Debt GDP, pp</td>
<td>9.9</td>
<td>11.2</td>
</tr>
<tr>
<td>$\Delta$ Credit spreads, bps</td>
<td>101.5</td>
<td>93.5</td>
</tr>
<tr>
<td>$\Delta$ Inflation , pp</td>
<td>-2.7</td>
<td>-0.3</td>
</tr>
<tr>
<td>$\Delta$ Inflation 2021, pp</td>
<td>2.1</td>
<td>14.5</td>
</tr>
<tr>
<td>$\Delta$ Depreciation, pp</td>
<td>4.1</td>
<td>12.1</td>
</tr>
<tr>
<td>$\Delta$ Depreciation 2021, pp</td>
<td>-3.9</td>
<td>2.8</td>
</tr>
<tr>
<td>$\Delta$ Imports, %</td>
<td>-25.3</td>
<td>-15.3</td>
</tr>
<tr>
<td>$\Delta$ Exports, %</td>
<td>-20.3</td>
<td>-10.8</td>
</tr>
<tr>
<td>$\Delta$ Welfare after shock, %</td>
<td>-13.1</td>
<td>-12.8</td>
</tr>
<tr>
<td>$\Delta$ Welfare due to the rule, %</td>
<td>-0.4</td>
<td>-5.1</td>
</tr>
</tbody>
</table>

Note: $\Delta$ stands for change in that variable.

exports increase (9.6%) instead of decreasing (10%), and imports decrease by more than 25 percentage points. Note that although this massive reallocation of resources is very costly in terms of welfare, in real terms (constant prices), GDP declines by almost 1 percentage point less. Thus, the analysis of this debt-to-GDP rule presents an interesting case in which real GDP and welfare provide different answers to the desirability of the rule’s suspension.

Overall, we can conclude that sustaining fiscal rules may be very costly during a large crisis, particularly those involving a debt-to-GDP ratio limit.

5.2.2 Nominal targets

Monetary policy in many emerging markets is in charge of keeping inflation close to some target. Similarly, in some countries, especially those with a history of high inflation, monetary authorities accommodate the monetary policy to target a predetermined currency depreciation rate. This section analyzes the impact of these monetary rules on the policy response to a large crisis. As in the previous case, we set the targets based on
the level of the respective variable in the steady state of the unconstrained economy.

Columns (1) and (2) of Table 6 show the results of relaxing, during the crisis, an inflation target of 4%. Similarly, the comparison of columns (3) and (4) displays the impact of relaxing a target depreciation rate during the crisis. Relaxing monetary policy during COVID-19 makes all these rules replicate the perfectly flexible benchmark. However, there are multiple implications whenever these targets are pursued during the COVID-19 period. First, real GDP and employment fall more sharply. This negative impact is increasing from the inflation target to the depreciation target. Intuitively, we can map the severity of the target with the required adjustment on the money growth rate $\mu$. Note that in the target suspension case, the money growth rate increases by 13 percentage points. In contrast, it is held constant in the inflation target case. In the depreciation target case, it must actually fall by 4 percentage point.

Table 6: The value of suspending nominal targets

<table>
<thead>
<tr>
<th></th>
<th>inflation= 4%</th>
<th></th>
<th>depreciation= 4%</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>Target in Normal times</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Target in the large crisis</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>$\Delta$ tax rate, pp</td>
<td>6.4</td>
<td>-6.3</td>
<td>5.3</td>
<td>-6.3</td>
</tr>
<tr>
<td>$\Delta$ expenditure to gdp, pp</td>
<td>6.6</td>
<td>4.6</td>
<td>4.4</td>
<td>4.6</td>
</tr>
<tr>
<td>$\Delta \mu$, pp</td>
<td>-0.2</td>
<td>13.2</td>
<td>-4.3</td>
<td>13.2</td>
</tr>
<tr>
<td>$\Delta$ Primary deficit / GDP, pp</td>
<td>0.2</td>
<td>10.9</td>
<td>-0.9</td>
<td>10.9</td>
</tr>
<tr>
<td>$\Delta$ Real GDP, %</td>
<td>-11.9</td>
<td>-9.5</td>
<td>-12.1</td>
<td>-9.5</td>
</tr>
<tr>
<td>$\Delta$ GDP USD, %</td>
<td>-19.2</td>
<td>-20.8</td>
<td>-17.9</td>
<td>-20.8</td>
</tr>
<tr>
<td>$\Delta$ Employment, pp</td>
<td>-4.5</td>
<td>-3.2</td>
<td>-4.5</td>
<td>-3.2</td>
</tr>
<tr>
<td>$\Delta$ Debt GDP, pp</td>
<td>9.0</td>
<td>11.2</td>
<td>11.3</td>
<td>11.1</td>
</tr>
<tr>
<td>$\Delta$ Credit spreads, bps</td>
<td>92.1</td>
<td>96.2</td>
<td>179.9</td>
<td>88.4</td>
</tr>
<tr>
<td>$\Delta$ Inflation, pp</td>
<td>0.0</td>
<td>-0.2</td>
<td>-5.1</td>
<td>-0.2</td>
</tr>
<tr>
<td>$\Delta$ Inflation 2021, pp</td>
<td>0.0</td>
<td>14.4</td>
<td>2.8</td>
<td>14.4</td>
</tr>
<tr>
<td>$\Delta$ Depreciation, pp</td>
<td>7.2</td>
<td>12.3</td>
<td>0.0</td>
<td>12.2</td>
</tr>
<tr>
<td>$\Delta$ Depreciation 2021, pp</td>
<td>-6.5</td>
<td>2.6</td>
<td>0.0</td>
<td>2.8</td>
</tr>
<tr>
<td>$\Delta$ Imports, %</td>
<td>-28.0</td>
<td>-15.6</td>
<td>-22.9</td>
<td>-15.6</td>
</tr>
<tr>
<td>$\Delta$ Exports, %</td>
<td>-20.3</td>
<td>-10.7</td>
<td>-23.0</td>
<td>-10.7</td>
</tr>
<tr>
<td>$\Delta$ Welfare after shock, %</td>
<td>-13.3</td>
<td>-12.8</td>
<td>-13.4</td>
<td>-12.8</td>
</tr>
<tr>
<td>$\Delta$ Welfare due to target, %</td>
<td>-0.6</td>
<td></td>
<td>-0.7</td>
<td></td>
</tr>
</tbody>
</table>

Note: $\Delta$ stands for change in that variable.

The impact on real GDP is primarily because the tax rate must increase when the money growth rate is forced to decline to meet the nominal target. Note here that these policy restrictions are harder than keeping policy constant as they imply that the money growth rate is forced to decline, which can have significant economic implications.
growth rate must move in the other direction that the government would like.

Interestingly, GDP measured in dollars falls between 1.5 and 3 percentage points less when the rules are imposed. This finding results from a less severe depreciation implied by these restrictions on monetary policy. This lower depreciation, in turn, severely impacts trade: exports fall between 9 and 12 percentage points, implying that imports must also fall more. In addition, the restriction on the depreciation rate makes debt repayment more costly, implying that sovereign debt spreads increase by almost 100 basis points more.

The welfare costs of these restrictions range between 0.6% and 0.7% one-period decline in non-tradable consumption and increase from inflation target to depreciation target. In general, the welfare costs of monetary restrictions are high.

6 Conclusions

This paper incorporates fiscal and monetary rules to a prototype model of sovereign default that includes distortionary domestic policies as in Espino et al. (2022) to evaluate the value of policy flexibility during large crises.

We find sizable welfare gains of policy flexibility; i.e. the ability of government to react changing taxes, debt, and the money growth rate during the crisis. In general, flexibility also improves the performance of the economy. However, we also find that looking at macroeconomic aggregates alone might provide a misleading evaluation of the value of flexibility.

Our results also shed light on fiscal policy rules and nominal targets for monetary policy. The main conclusion is that the inability of abandon these restrictions during the crisis may be even more costly than inflexible policies. In the case of fiscal rules, if government do not renounce to the rule during the crisis period, taxes must increase while flexibility would actually dictate to decrease. Similarly, if government do not renounce to nominal targets during the crisis period, the money growth rate is forced to decline while flexibility would ask for to increase monetary financing by means of a higher the money growth rate.

Finally, the analysis provides new insight into the interplay between fiscal and monetary rules and default risk. Restricting a currency devaluation during a crisis, for example,
with an exchange rate regime, limit the real devaluation and so it increases the risk of default as it restricts the reallocation of resources toward the exports producing sector while limits the disincentives to demand of imported consumption goods.

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Appendix

A   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.

B Government budget constraint: the primal approach

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 \((y^N, y^T, p^N, p^T)\),

\[
w = \frac{p^N}{A(I)F_N'},
\]

(23)

\[
e = \frac{p^N}{(1 - \phi)p^T F_N'},
\]

(24)

Using (23) and (24), necessary first order conditions for the agent’s problem imply that

\[
p^N = \frac{\theta}{c_N},
\]

(25)

\[
\tau = 1 - \frac{(1 + \phi)}{(1 - \phi)p^T u^T},
\]

(26)

\[
(1 + \mu) = \beta \theta \frac{(1 + \phi)}{(1 - \phi)p^T c_N F_N u^T} \mathbb{E} \left[ \frac{u_N'}{p^{NI}} \right| B, I, s],
\]

(27)

\[
u_N - \frac{(1 - \phi)p^T u^T F_N}{(1 + \phi) F_T} \geq 0.
\]

(28)

where the last constraint (28) implies that the Lagrange multiplier for the CIA constraint (2) is non-negative.\(^\text{11}\) Without loss of generality, we consider the case in which (28) does not bind and so the cash-in-advance constraint (2) is satisfied with equality and in equilibrium it becomes (25).

Combining the government budget constraint, (3), and the balance of payments, (7),

\(^{11}\)Condition (28) reflects an inefficiency wedge, as the marginal rate of substitution between tradable and non-tradable goods is lower than their relative price (i.e., agents would like to consume relatively more non-tradable goods).
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):

$$\tau w h - p^N (g + \gamma) + \mu - e((1 - \phi)p^T y^T - (1 + \phi)c^T) \geq 0. \quad (29)$$

Using the equations (23)-(27), the government budget constraint (29) in terms of allocations reduces to

$$A(I)F(c^N + g, y^T) \left[1 - \frac{(1 + \phi)}{(1 - \phi)p^T} u_t A(I)F_T \right]$$

$$- \left[ A(I)F_N(g + \gamma) + A(I)F_Ty^T - \frac{(1 + \phi)}{(1 - \phi)p^T} A(I)F_Tc^T \right]$$

$$- \frac{1}{\theta} c^N A(I)F_N + \beta \frac{A(I)F_T}{u_T} \frac{(1 + \phi)}{(1 - \phi)p^T} \mathbb{E} [u^N c^N | B, I] \geq 0$$

(30)

Using the fact the $F$ is HOD1 (i.e. $F(c^N + g, y^T) = F_N(c^N + g) + F_T y^T$), we can rearrange to obtain (8).

### C 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

<table>
<thead>
<tr>
<th>Country</th>
<th>Actual</th>
<th>WEO forecast</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>-9.9</td>
<td>-1.3</td>
<td>-8.6</td>
</tr>
<tr>
<td>Brazil</td>
<td>-4.1</td>
<td>2.0</td>
<td>-6.1</td>
</tr>
<tr>
<td>Chile</td>
<td>-5.8</td>
<td>3.0</td>
<td>-8.9</td>
</tr>
<tr>
<td>Colombia</td>
<td>-6.8</td>
<td>3.6</td>
<td>-10.4</td>
</tr>
<tr>
<td>Mexico</td>
<td>-8.3</td>
<td>1.3</td>
<td>-9.6</td>
</tr>
<tr>
<td>Peru</td>
<td>-11.0</td>
<td>3.6</td>
<td>-14.6</td>
</tr>
<tr>
<td>Uruguay</td>
<td>-5.9</td>
<td>2.3</td>
<td>-8.2</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>-7.4</strong></td>
<td><strong>2.1</strong></td>
<td><strong>-9.5</strong></td>
</tr>
</tbody>
</table>

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

D Welfare Computation

Welfare: Let $V^{pol}(b, s)$ be the value function of repaying debt under a policy (e.g. fixed exchange rate) and $V^{ben}(b, s)$ the value function of repaying debt in the benchmark. Next, we omit the dependence on $(b, s)$ to simplify the notation but the evaluation will be at $b = b^{SS}$ and $s = s^{Covid}$ as the economy just received the Covid shock.

Define the value function with the benchmark policies but increasing $c_N$ by $\lambda$ only in the current period as

$$
\hat{V}^{ben}(\lambda) = u^N((1 + \lambda)c_N^{ben}) + u^T(c_T^{ben}) + u^H(h^{ben}) + \beta V^{ben}
$$

where $V^{ben}$ is the continuation value associated with $s$ of steady state (after the Covid shock) and $b = B(b^{SS}, s^{Covid})$. Notice that

$$
\hat{V}^{ben}(\lambda) = V^{ben} + u^N((1 + \lambda)c_N) - u^N(c_N).
$$

Then, if following the policy is costly (beneficial), we would find a negative (positive) value of $\lambda$ such that $\hat{V}^{ben}(\lambda) = V^{pol}$. Since $u^N(x) = \alpha_N \frac{x^{1-\sigma}}{1-\sigma}$, we can rewrite $\hat{V}^{ben}(\lambda) = V^{pol}$ as

$$
V^{ben} + \alpha_N \frac{((1 + \lambda)c_N^{ben})^{1-\sigma}}{1-\sigma} - \alpha_N \frac{c_N^{ben1-\sigma}}{1-\sigma} = V^{pol},
$$

so

$$
\alpha_N \frac{((1 + \lambda)c_N^{ben})^{1-\sigma}}{1-\sigma} = V^{pol} - V^{ben} + \alpha_N \frac{c_N^{ben1-\sigma}}{1-\sigma},
$$

$$
(1 + \lambda)^{1-\sigma} \alpha_N \frac{(c_N^{ben})^{1-\sigma}}{1-\sigma} = V^{pol} - V^{ben} + \alpha_N \frac{c_N^{ben1-\sigma}}{1-\sigma},
$$
\[(1 + \lambda)^{1-\sigma} = \frac{V_{pol} - V_{ben}}{\alpha N (c_{ben}^N)^{1-\sigma}} + 1,\]

and

\[\lambda = \left( \frac{V_{pol} - V_{ben}}{\alpha N (c_{ben}^N)^{1-\sigma}} + 1 \right)^{1/(1-\sigma)}.\]