Fiscal Stimulus under Sovereign Risk

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What is the optimal fiscal policy response to a recession when the government is subject to sovereign risk? We study this question in a model of endogenous sovereign default with nominal rigidities. Increasing spending in a recession reduces unemployment, but it exposes the government to a debt crisis. We quantitatively analyze this trade-off between stimulus and austerity and find that expanding government spending may be undesirable, even in the presence of sizable Keynesian stabilization gains and inequality concerns. Consistent with these findings, we show that sovereign risk is a key driver of the fiscal procyclicality observed worldwide.

I. Introduction

There is a long-standing view that fiscal policy should play a stabilizing role in business cycles, especially when there are constraints on monetary policy. The textbook Keynesian argument is that by spending more in a recession,
the government can prop up aggregate demand and help mitigate the rise in unemployment. Yet most countries around the world do not follow this prescription (see, e.g., Kaminsky, Reinhart, and Végh 2004). As shown in figure 1, the 2011–12 eurozone crisis provides an emblematic example in this regard. In the face of a severe recession and mounting unemployment, governments in southern Europe significantly reduced spending. This contraction in spending occurred despite their inability to use monetary policy, which left fiscal policy as the only instrument available for macroeconomic stabilization.

In this paper, we examine the optimal fiscal policy amid sovereign risk and macroeconomic stabilization concerns. We provide a framework that articulates the dilemma at the heart of the austerity-stimulus debate (e.g., Barro 2012; Krugman 2015; Alesina, Favero, and Giavazzi 2020): should the government apply a stimulus to mitigate a recession at the expense of higher sovereign spreads, or should it practice austerity to reduce the probability of a debt crisis—even if doing so induces a more severe recession?

We consider a small open economy in which the government borrows externally, subject to default risk, and nominal rigidities give rise to the possibility of involuntary unemployment. We first construct a benchmark environment under which Keynesian policies would be optimal, without the risk of sovereign default. To this end, we incorporate two key elements that have been identified in theory as providing important scope for fiscal policy as a stabilization tool. First, we consider nominal rigidities, in the form of downward nominal wage rigidity, and a fixed exchange rate regime. As in the classic Mundell-Fleming argument, an increase in government spending entails only limited crowding-out effects and is effective for reducing involuntary unemployment. Second, we consider households that are hand-to-mouth and face an uninsurable idiosyncratic risk of unemployment. These two elements generate large fiscal multipliers and substantial welfare gains from countercyclical fiscal policy. Higher spending during recessions leads to a reduction in the output gap and in inequality.

We first provide a theoretical characterization of the trade-off between stimulus and austerity in this environment. A modified Samuelson rule decomposes the effects of government spending into three objects. First, the traditional Samuelson term equates the marginal rate of substitution between private and public consumption to the marginal rate of transformation. Second, a stimulus term emerges because an increase in government spending.

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spending relaxes nominal frictions and implies that higher public consumption does not fully crowd out private consumption. Finally, an austerity term captures the costs of raising revenues for the government. An analytical example shows that when there are no costs from raising tax revenues and the fiscal multiplier is one, the government achieves full employment and follows a countercyclical fiscal policy. To the extent that raising tax revenues is costly, this implies that the government may resort to borrowing to finance spending. However, the presence of endogenous sovereign default generates a motive for austerity, since higher borrowing raises sovereign spreads for the government. The dilemma the government faces in a recession is that debt-financed spending lowers unemployment but raises sovereign spreads. Moreover, by increasing the debt burden, this limits future fiscal space and reduces the ability to mitigate a recession in the future.

A calibrated version of this model for the Spanish economy shows that when the government can commit to repaying the debt, fiscal policy is essentially Keynesian: during recessions, the government increases spending that is financed by external borrowing and stabilizes involuntary unemployment. In this setting, optimal government spending has a strongly negative correlation with economic activity and unemployment volatility is an order of magnitude smaller than that observed in the data. Incorporating default risk drastically changes the desirability of a Keynesian fiscal stimulus. Quantitatively, despite the large Keynesian benefits from fiscal stimulus, default risk can overturn the cyclicality of optimal fiscal policy. In the economy calibrated to match debt and spread levels in the data, we find that optimal policy is strongly procyclical, with a 0.7 correlation with output (vs. -0.8 for the economy without default risk). Moreover, the

Fig. 1.—Unemployment, fiscal policy, and sovereign spreads during the eurozone crisis. Unemployment rate and sovereign spreads are expressed in percentage point deviations from their 2008:Q1 values. Government consumption is set to 2008:Q1 = 100. “Average” denotes the simple average of Greece, Ireland, Italy, Portugal, and Spain. Data source: Eurostat.
volatility in unemployment increases by an order of magnitude relative to the economy without default risk and is also close to the one observed in the data.

Although the optimal fiscal policy is overall procyclical, the model displays strong state dependence, whereby the response of government spending is nonmonotonic with respect to the level of sovereign debt. When the stock of debt is relatively low, government spending expands in recessions because the Keynesian benefits outweigh concerns about sovereign risk. Similarly, when the stock of debt is very high, it is optimal for the government to default and redirect resources toward spending rather than repaying debt. It is for intermediate values of debt that the optimal response is characterized by austerity: the government reduces spending to mitigate the rise in borrowing costs and reduce the probability of a debt crisis. An important implication of this state dependence is that recessions turn out to be more severe when preceded by high levels of debt. The model’s prediction of state dependency is consistent with the dynamics of fiscal policy in Spain in the run-up to the debt crisis. State dependency also helps rationalize the evidence provided by Romer and Romer (2019) whereby countries with more “fiscal space” suffer recessions that are less severe.

Finally, we provide empirical evidence that governments’ consumption during downturns is consistent with the normative analysis from our model. Specifically, we study the dynamics of government consumption during recession episodes for countries with different sovereign risks in a panel of 70 countries for the period 1980–2016. We document that countries with high sovereign default risk—measured by credit ratings or historical default rates—exhibit more fiscal austerity during downturns than countries with low default risk. In addition, in countries with high sovereign risk, recessions associated with higher initial net foreign liability positions are characterized by more pronounced austerity. Furthermore, consistent with our model, countries with higher default risk exhibit more procyclical government consumption over the cycle than countries with low default risk.

Related literature.—Our paper is related to several strands of the literature. First, it is related to the New Keynesian literature that studies the role of government spending as a macroeconomic stabilization tool, especially in the presence of constraints on monetary policy that arise from a fixed exchange rate or a zero lower bound. Some recent influential examples in both open and closed economies include Galí and Monacelli (2008), Christiano, Eichenbaum, and Rebelo (2011), Eggertsson (2011), Werning (2011), Woodford (2011), Nakamura and Steinsson (2014), Farhi and Werning (2017), and Michaillat and Saez (2018).1 We contribute to this

1 Related to this literature, a vast body of work empirically studies the effect of changes in government spending on the economy. See Ramey (2019) for a recent survey.
literature by incorporating sovereign risk, which is a central ingredient in the debate regarding fiscal policy discussions. We characterize how sovereign risk shapes the optimal conduct of fiscal policy and show that accounting for sovereign risk is crucial for understanding the observed procyclicality of fiscal policy and how fiscal space affects the severity of recessions.

Second, our model of sovereign risk follows the literature on sovereign default in the tradition of Eaton and Gersovitz (1981), Aguiar and Gopinath (2006), and Arellano (2008). An important precursor of our paper is Cuadra, Sanchez, and Sapriza (2010), which expands the canonical model to incorporate government spending and distortionary taxation. In their model, sovereign risk can induce the procyclicality of tax rates, but it does not affect the cyclicality of government consumption, which follows the same pattern as private consumption. Because private and public goods are normal goods and the production structure is neoclassical, Cuadra, Sanchez, and Sapriza’s model features procyclical public and private consumption regardless of whether the government can commit to repay. By contrast, in our model, government spending is countercyclical without sovereign risk but procyclical with sovereign risk. Other contributions in a similar vein are Aguiar and Amador (2016), Balke and Ravn (2016), and Arellano and Bai (2017).2 These studies abstract from the Keynesian channel, and hence they cannot address the main trade-off we examine in this paper.

An earlier paper that considers nominal rigidities in a sovereign default model is Na et al. (2018). They study an optimal exchange rate policy and show that their model can account for the “twin Ds” phenomenon (i.e., the joint occurrence of large devaluations and sovereign defaults). The focus of our paper, in contrast, is on the optimal fiscal policy in the context of a fixed exchange rate. Our contribution is to provide the first analysis of the trade-off between fiscal stimulus and sovereign risk and show how this trade-off shapes the conduct of fiscal policy over the business cycle.

Our paper is also related to a literature that studies how increases in sovereign spreads can translate into higher borrowing costs for the private sector and negatively affect economic activity, an idea linked to the seminal work of Giavazzi and Pagano (1990) on expansionary fiscal contractions. Important examples include Mendoza and Yue (2009), Uhlig (2010), Corsetti et al. (2013, 2014), Broner et al. (2014), Drautzburg and Uhlig (2015), Bocola (2016), and Gourinchas, Philippon, and Vayanos (2017). We

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2 In Balke and Ravn (2016), there is unemployment due to search and matching frictions, but government spending affects employment through wealth effects on search efforts and not through aggregate demand, as in our setup. An element we share with their work is that our model also features household heterogeneity and an insurance channel from fiscal policy.
complement this literature by showing that sovereign risk considerations can cause austerity to be optimal in an environment in which fiscal stimulus is expansionary.

Finally, our paper is related to the literature on fiscal procyclicality. Several studies have documented how fiscal policies are more procyclical in emerging economies than in developed economies (see, e.g., Gavin and Perotti 1997; Kaminsky et al. 2004; Talvi and Végh 2005; Ilzetzki and Végh 2008). We complement this literature by studying differences in the procyclicality linked to default risk.

II. Model

We present a small open economy in which the government borrows externally, subject to default risk, and nominal rigidities generate the possibility of involuntary unemployment. We use the framework as a laboratory to examine the optimality of fiscal stimulus under sovereign risk.

A. Households

There is a unit mass of households indexed by $j$. Households’ preferences over private and public consumption are given by

$$E_t \sum_{j=0}^{\infty} \beta^t [U(c_j) + \psi(g^N)],$$

(1)

where $c_j$ denotes the private consumption of household $j$ in period $t$, $g^N$ denotes public spending in nontradable goods, $\beta \in (0, 1)$ is the subjective discount factor, and $E_t$ denotes the expectation operator conditional on the information set available at time $t$.

We assume constant relative risk-aversion utility functions for private and public consumption with the same risk-aversion coefficient $U(c) = (1 - \psi_g)[c^{1-\sigma} - (1 - \sigma)]$ and $\psi(g) = \psi_g[g^{1-\sigma} - (1 - \sigma)]$, with $\sigma > 0$, $\psi_g \in (0, 1)$. We assume also that the consumption good is a composite of tradable ($c^T$) and nontradable ($c^N$) goods, with a constant elasticity of substitution (CES) aggregation technology $c = C(c^T, c^N) = \omega(c^T)^{1-(1/\xi)} + (1 - \omega)(c^N)^{1-(1/\xi)}\xi^{1-(1/\xi)}$, where $\omega \in (0, 1)$ and $\xi > 0$ represents the elasticity of substitution between tradable and nontradable goods.

Households are endowed with one indivisible unit of labor. Because of the presence of downward wage rigidity and rationing (described below), each household’s actual hours worked are given by $h_j \in \{0, 1\}$, which is taken as given by the individual household. In each period, households

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3 We abstract from government spending in tradables because this represents a small share of total public spending and because spending only on nontradables has a macroeconomic stabilization role.
receive a tradable endowment $y_T^T$ and profits from the ownership of firms producing nontradable goods $\Pi_N^T$. We assume that $y_T^T$ is stochastic and follows a stationary first-order Markov process. In addition, households face a tax $T_i(h^d)$ (transfer if negative). This tax is contingent on their idiosyncratic employment status $h^d$, which reflects the availability of unemployment insurance. As is standard in the sovereign debt literature, we assume in the baseline model that households do not have direct access to financial markets. In section IV.D, we relax this assumption and allow a fraction of households to save or borrow in international capital markets.

Households’ sequential budget constraint, expressed in domestic currency, is therefore given by

$$\mathbb{E}^T_T c_t^T + \mathbb{E}^N_T c_t^N = P_T^T y_t^T + \Pi_N^T + W_t h^d - T_i(h^d) \equiv \mathcal{Y}_i(h^d),$$  

where $P_T^T$ and $P_N^T$ respectively denote the price of tradables and nontradables in units of domestic currency, $W_t$ denotes the wage in domestic currency, and $\mathcal{Y}_i(h^d)$ denotes the total household’s disposable income, which depends on aggregate variables and the idiosyncratic employment status $h^d$.

Households’ optimality yields

$$\frac{\mathbb{E}^N_T}{\mathbb{E}^T_T} = \frac{1 - \omega}{\omega} \left( \frac{\mathbb{E}^N_T}{\mathbb{E}^T_T} \right)^{1/q}. \tag{3}$$

Because of homothetic preferences, for all households the consumption of tradables relative to that of nontradables depends only on the relative prices of these two goods.

**B. Firms**

Firms are competitive and have access to a production function for nontradables $F(h) = h^\alpha$, with $0 \leq \alpha \leq 1$. Firms’ profits each period are given by

$$\Pi_i^N = P_i^N F(h) - W_i h_i. \tag{4}$$

The optimal choice of employment $h^d_i$ for a firm equates the value of the marginal product of labor and the wage rate:

$$P_i^N F'(h^d_i) = W_i. \tag{5}$$

**C. Government**

The government determines public spending, external borrowing, and default decisions, subject to a predetermined tax scheme. In terms of monetary policy, we assume that the government follows a fixed exchange
rate policy $e_t = \bar{e}$. Alternatively, one can think of the economy as being part of a currency union.\footnote{It would also be straightforward to extend our analysis to allow for an arbitrary exchange rate policy, implemented, e.g., with a Taylor rule for nominal interest rates. As long as the exchange rate policy is not able to fully eliminate the slack in the labor market, we expect our results to be similar. Notice that we abstract here from considering fiscal policies that can mimic a nominal depreciation, in the spirit of the equivalence results of Correia, Nicolini, and Teles (2008). Our calibration of the nominal rigidities will in effect target an increase in unemployment, and so implicitly we capture the fact that these policies are used to a limited extent.}

External borrowing—The government issues a long-term bond with a deterministic decay rate (Hatchondo and Martinez 2009; Chatterjee and Eyigungor 2012). In particular, a bond issued in period $t$ promises to pay $\delta(1 - \delta)^{t-1}$ units of the tradable good in period $t + j$, for all $j \geq 1$. Hence, debt dynamics are given by $b_{t+1} = (1 - \delta)b_t + \iota_t$, where $b_t$ represents the stock of bonds due at the beginning of period $t$ and $\iota_t$ represents the flow of new issuances in period $t$.

Debt contracts cannot be enforced, and each period the government may decide to default. The government’s default incurs two costs. The first cost is that the government is excluded from financial markets for a stochastic number of periods. Denote by $\zeta_t$ a variable that takes a value of one if the government can issue bonds in period $t$ and zero otherwise. Its evolution is given by $\zeta_t = (1 - \chi_t)\zeta_{t-1} + \vartheta_t(1 - \zeta_{t-1})$, where $\chi_t = 0 (1)$ if the government repays (defaults) in period $t$ and $\vartheta_t \in \{0, 1\}$ is a random variable that takes a value of one in period $t$ when the government reenters the financial market, which occurs with probability $\theta$, and it starts over with zero debt holdings. The second cost is a utility loss for households $\psi_t(y^t)$, which we assume to be increasing in tradable income. This utility loss can be seen as capturing various default costs related to reputation, sanctions, or misallocation of resources.\footnote{An alternative assumption used in the literature is the cost of default in terms of output. Under the assumption that the utility function is log over the composite consumption and output losses from default are proportional to the composite consumption in default, the losses from default would be identical for the output cost and utility cost specifications. If the fraction of output losses in the tradable and nontradable sectors is the same, the cost in terms of consumption is indeed proportional.}

The government’s budget constraint is given by

$$P_t^N g_t^N = \int_{j \in [0,1]} T(h_j) \, dj + (q_t \iota_t + \delta e_t b_t) \zeta_t,$$

where $e_t$ represents the nominal exchange rate and $q_t$ represents the price of the bond in units of foreign currency. The budget constraint (6) indicates...
that tax revenues and new debt issuance have to finance public spending and the repayment of outstanding debt obligations.

Taxes.—We assume that the government has a limited ability to raise tax revenues. The tax scheme has three components: taxes, transfers, and unemployment insurance. Tax revenues are assumed to be a fixed proportion \( \tau \in (0, 1) \) of households’ total income. As shown in Végh and Vuletin (2015), tax rates change on average about every 5 years for corporate and personal income taxes and every 8 years for value-added taxes. For simplicity, we assume that they are fixed in our baseline model. However, in section IV.D we allow for tax rates to vary subject to a cost calibrated to match the volatility of observed changes and obtain results very similar to those in our baseline with fixed tax rates.6

The government provides lump-sum transfers \( T_t \geq T \) denominated in units of tradables. We rule out lump-sum taxes by setting \( T = 0 \).

Finally, in the unemployment insurance scheme, the government taxes each employed household with \( \tau^e_t \) units of domestic currency in period \( t \) and transfers \( \tau^u_t \) units of domestic currency to each unemployed household. In the absence of labor disutility and moral hazard associated with unemployment insurance, an optimal insurance mechanism would equalize the disposable income for employed and unemployed households. In effect, this would lead to a representative-agent economy with complete markets for idiosyncratic risk. To preserve meaningful heterogeneity, we assume an imperfect insurance scheme. For simplicity, we assume that this scheme is such that the disposable income of employed households and that of unemployed households are proportional to each other:

\[
Y_t(0) = \kappa Y_t(1) \text{ for all } t, \quad (7)
\]

with \( \kappa \in [0, 1] \). A value of \( \kappa = 1 \) represents the case with complete insurance. We require that unemployment insurance be self-financed, which implies that

\[
\tau^u_t (1 - h_t) = \tau^e_t h_t \quad \text{for all } t, \quad (8)
\]

where \( h_t = \int_{j=0}^{1} h^j_t \, dj \) denotes aggregate hours worked. Equations (7) and (8) define the path of state-contingent taxes \( \{\tau^e_t, \tau^u_t\}_{t=0}^{\infty} \) for any period \( t \) under the insurance scheme.

The assumed tax scheme implies that the government budget constraint can be expressed as

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6 Note that a fixed tax rate delivers procyclical tax revenues, in line with the data (Gavin and Perotti 1997).
D. Foreign Lenders

Sovereign bonds are traded with atomistic, risk-neutral foreign lenders. In addition to investing through the defaultable bonds, lenders have access to a one-period, riskless security that pays a net interest rate $r$ (both in foreign currency). By a no-arbitrage condition, equilibrium bond prices are given by

$$q_t = \frac{1}{1 + r} \mathbb{E}_t \left[ (1 - \chi_{t+1}) (\delta + (1 - \delta) q_{t+1}) \right].$$

This equation will play a critical role when we turn to the optimal fiscal policy. If the government seeks to apply a debt-financed stimulus, lenders will anticipate that a future default is more likely and therefore demand lower bond prices to compensate for a higher default risk.

E. Wage Rigidity and Competitive Equilibrium

Let $c_t^N = \int_{\beta(0, 1)} c_{\beta}^N \, d\beta$ and $c_t^T = \int_{\beta(0, 1)} c_{\beta}^T \, d\beta$ denote aggregate consumption for tradables and nontradables, respectively. In equilibrium, the market for nontradable goods clears:

$$c_t^N + g_t^N = F(h_t^d).$$

We assume that the law of one price for tradable goods holds; that is, $P_t^T = P_t^{T,*} e$, where $P_t^{T,*}$ denotes the price of the tradable good in foreign currency, which is assumed to be constant and normalized to one.

We assume that there exists a minimum wage in nominal terms, $\bar{W}$, such that

$$W_t \geq \bar{W}.$$  \hspace{1cm} (12)

The existence of a minimum wage gives rise to a non-Walrasian labor market. We follow the notion of equilibrium in models with rationing (e.g., Barro and Grossman 1971; Benassy 1975; Dréze 1975; Schmitt-Grohé and Uribe 2016) and assume that aggregate hours worked are the minimum between labor demand and labor supply:

$$h_t = \min(1, h_t^d).$$  \hspace{1cm} (13)

If $h_t < 1$, it has to be that $W_t = \bar{W}$. If $W_t > \bar{W}$, the aggregate number of hours worked equals the aggregate endowment of labor. These conditions can be summarized as

7 Our modeling of wage rigidity is similar to that in Schmitt-Grohé and Uribe (2016). In their case, $\bar{W}$ depends on the previous period wage. To simplify numerical computations, we take $\bar{W}$ as an exogenous (constant) value.
When the economy features unemployment, we assume that there is a random allocation of hours across households every period. This means that every household has a probability $h_t$ of being employed every period.

A competitive equilibrium, for a given set of government policies, is then defined as follows.

**Definition 1 (Competitive equilibrium).** Given initial debt $b_0$ and $z_0$ and sequences of exogenous processes $\{y^N_t, q^N_t\}_{t=0}^\infty$, government policies $\{g^N_t, b_{t+1}, \chi_t, T, \varepsilon_t\}_{t=0}^\infty$, and credit market access $\{\xi_t\}_{t=0}^\infty$, a competitive equilibrium is a sequence of allocations $\{(c^T_t, c^N_t, h^d_t)_{t=0}^\infty\}$ and prices $\{P^N_t, \Pi_t, W_t, q_t\}_{t=0}^\infty$ such that (i) consumption $\{(c^T_t, c^N_t)_{t=0}^\infty\}$ solves the household’s problem, (ii) employment $\{h^d_t\}_{t=0}^\infty$ solves the firm’s problem, (iii) government policies satisfy the budget constraints and $\xi_t$ follows its law of motion, (iv) the bond-pricing equation (10) holds, (v) the market for nontradable goods clears (11), and (vi) the labor market allocations and wages satisfy conditions (12)–(14).

Notice that, using the households’ budget constraint (2), the definition of the firms’ profits, the government budget constraints, and market-clearing condition (11), we arrive at the resource constraint for tradables:

$$c^T_t = y^T_t + \xi_t[q_t - \delta b_t].$$

### F. Optimal Fiscal Policy

We now study Markov equilibria in which the government chooses policies sequentially and without commitment. We consider a benevolent and utilitarian government that chooses fiscal policies to maximize households’ welfare, subject to implementability conditions. As stated above, we focus on a fixed exchange rate regime, which leaves fiscal policy as the central instrument for macroeconomic stabilization.8

#### 1. Welfare Criterion

The objective of the government is to maximize the average expected lifetime utility of households:

$$E_0 \sum_{t=0}^{\infty} \beta^t [U_t(c^T_t, c^N_t) + v(g^N_t) - (1 - \xi_t)\psi_Y(y^T_t)],$$

8 As established by Na et al. (2018), under the optimal exchange rate policy the government would undo the nominal rigidity and allocations would coincide with flexible wages (see also Bianchi and Mondragon 2022).
where $c_T^j = \{c_T^j\}_{j \in [0,1]}$, $c_N^j = \{c_N^j\}_{j \in [0,1]}$, $U(c_T^j, c_N^j) = \int_{j \in [0,1]} u(c_T^j, c_N^j)\, dj$, and $u(c_T^j, c_N^j) = U(C(c_T^j, c_N^j))$. The following result establishes that the social period utility from private consumption admits an aggregation result, in the sense that $U(\cdot)$ can be expressed as a function of only aggregate variables.

**Lemma 1.** The social period utility from private consumption can be expressed as

$$U(c_T^j, c_N^j) = \frac{u(c_T^j, c_N^j)}{\Omega(h)} \times \Omega(h),$$

where $\Omega(h) \equiv (h + (1-h)\kappa^{1-\sigma})/(h + (1-h)\kappa)^{1-\sigma}$.

Lemma 1 indicates that the expression for welfare that would prevail in a representative-agent economy is modified to allow for inequality concerns, which can be summarized entirely in the term $\Omega(h)$. This result is useful, because it implies that welfare can be evaluated based on a minimum but critical departure from a representative-agent economy. For a given aggregate consumption bundle $\{c_T^j, c_N^j\}$, a positive unemployment rate introduces a dispersion in consumption between agents as long as there is no perfect unemployment insurance. The concavity in the utility function implies that this dispersion introduces an additional welfare loss from unemployment.

**2. Government Problem**

We cast the government problem in recursive form. In every period in which the government has access to financial markets, it chooses whether to repay or default. Given initial states $(y_T, b)$, we have that

$$V(y_T, b) = \max \{1 - \chi, V_R(y_T, b) + \chi V_D(y_T)\}, \quad (16)$$

where $V_R(y_T, b)$ and $V_D(y_T)$ denote the value of repayment and the value of default, respectively. As we show in lemma B.1, the value of repayment can be expressed as

$$V_R(y_T, b) = \max_{g^T, c^T, b \in \mathbb{R}} u(c_T^T, F(h) - g_N^T)\Omega(h) + v(g_N^T) + \beta\mathbb{E}V(y_T', b')$$

subject to

$$c_T^T + \delta b \leq y_T' + q(y_T', b')[b' - (1-\delta)b], \quad (17)$$

$$P_N(c_T^T, h, g_N^T)[c_T^T + \delta b] \leq q(y_T', b')y_T' + \tau,$$

$$P_N(c_T^T, h, g_N^T)[c_T^T + \delta b] \geq \tilde{w}.$$

The last restriction in (17) captures the implementability constraints associated with the labor market equilibrium. In this formulation, we have...
used the fact that the relative price of nontradable goods can be expressed as \( P_N(c^T_t, h, g^N_t) \equiv [(1 - \omega)/\omega](c^T_t/(F(h_t) - g^N_t))^{1/\omega} \), as obtained by combining households’ optimality condition (3) and market-clearing condition (11). In addition, \( \bar{w} = \frac{\bar{W}}{\bar{e}} \) denotes the wage rigidity parameter in terms of tradable goods and \( q(y^T, b) \) denotes the bond price schedule, taken as given by the government.

The value of default, in turn, is given by

\[
V^D(y^T) = \max_{g^N, b \in \mathbb{I}} (y^T, F(h) - g^N)\Omega(h) + v(g^N) - \psi_\lambda(y^T)
+ \beta E [(1 - \theta)V^D(y^T_t) + \theta V(y^T, 0)],
\]

subject to

\[
\mathcal{P}^N(y^T_t, h, g^N_t)g^N_t \leq [y^T_t + \mathcal{P}^N(y^T_t, h, g^N_t)F(h)]\tau,
\]

\[
\mathcal{P}^N(y^T_t, h, g^N_t)F(h) \geq \bar{w}.
\]

We can now define Markov perfect equilibrium.

**Definition 2** (Markov perfect equilibrium). A Markov perfect equilibrium is defined by policy functions \( \tilde{c}^T_t(y^T_t, b), \tilde{g}_N^N(y^T_t, b), \tilde{T}(y^T_t, b), \tilde{b}(y^T_t, b), \tilde{h}(y^T_t, b), \tilde{\chi}(y^T_t, b) \), value functions \( V(y^T_t, b), V^N(y^T_t, b), V^H(y^T_t) \), and a bond price schedule \( q(y^T_t, b) \) such that (i) given the bond price schedule, policy functions solve problems (16), (17), and (18), and (ii) the bond price schedule satisfies (10).

### III. Fiscal Policy Trade-Offs

In this section, we articulate the trade-off between stimulus and austerity that the government faces. We show how an increase in spending can help reduce unemployment and expand output in a recession, in line with the Keynesian channel, and how these benefits must be balanced with sovereign default risk concerns.

**A. Fiscal Transmission**

Before analyzing the optimality conditions of the government, it is useful to consider the transmission from fiscal policy to employment. Combining households and firms’ optimality conditions and market clearing, (3), (5), and (11), we obtain the following condition:

\[
\frac{1 - \omega}{\omega} \left( \frac{c^T_t}{F(h_t) - g^N_t} \right)^{1/\omega} F'(h_t) = w_t.
\]

The left-hand side is decreasing in \( h \) and increasing in \( g^N_t \). If wages were flexible, we would have that for any \( c^T_t, g^N_t \), wages would fall until \( h = 1 \).
However, when the wage necessary to clear the market is below $W$, the economy will suffer from unemployment. In this situation, an increase in government spending will raise equilibrium employment. Because public and private consumption goods are imperfect substitutes, the increase in spending generates an excess demand for nontradable goods, which raises the relative price of nontradables. In turn, the increase in the relative price of nontradables leads to a higher value of the marginal product of labor and to higher employment. Essentially, through an aggregate demand amplification, the increase in government spending generates an increase in nontradable output, and hence private consumption does not fall one to one with government spending.

To see this more clearly, assume that the production function is linear and wage rigidity is binding. Then (19) can be expressed as

$$h_t = g_N + \left[ \frac{1 - \omega}{\omega} \frac{1}{\phi} \right]^{1/\phi} \tilde{c}_t.$$

(20)

Equation (20) reveals that for a given $\tilde{c}_t$, the fiscal multiplier is one under linear production whenever the economy is away from full employment. We emphasize that the linearity of the production function is critical for this result. When the production function features decreasing returns, firms require a higher price to increase production. Through an expenditure-switching effect, this leads to a reduction in the private consumption of nontradables. Thus, the fiscal multiplier is below one, and there is crowding out of private consumption.  

Equation (20) also shows that employment is increasing in $\tilde{c}_t$. The higher the amount of tradable resources available, the higher the aggregate demand for nontradables, and thus this results in higher employment. In a model in which households cannot borrow externally, $\tilde{c}_t$ is determined entirely by the tradable endowment and the government’s borrowing decisions. By equation (15), a higher level of government borrowing therefore increases tradable resources and employment. Moreover, this implies that an increase in spending financed by debt will deliver larger increases in output than one financed with lump-sum taxes. By the same token, (20) underscores how a policy of transfers to households financed with government debt delivers lower output gains compared with those generated by a policy of spending directly on nontradables (also financed with debt).

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9 It should also be clear that if the government could directly manipulate the relative price of nontradables by varying the exchange rate or using specific tax instruments, the stimulus term would not arise because the government would undo the effects of the nominal rigidity.

10 The way in which $\tilde{c}_t$ goes up with debt-financed government spending operates through a general equilibrium effect. When the government raises $g_N$, there is larger demand for nontradables, which in equilibrium raises profits and labor income.
When households do have access to external financial markets, as we consider in section IV.D, they can potentially offset government borrowing choices. Of course, in a model that features Ricardian equivalence, how the government finances spending is irrelevant. However, Ricardian equivalence fails in our model because of financing frictions for the government and in particular the limits on lump-sum taxes. Therefore, while household savings may increase in response to larger borrowing by the government, they do not completely offset the increase in tradable resources from larger government borrowing. Hence, in that extension we still obtain that debt-financed stimulus is more powerful than a tax-financed stimulus.

B. Normative Analysis: An Analytical Decomposition

We now analyze the optimality conditions of the government and characterize the key trade-off it faces.

1. Modified Samuelson Rule

Let us examine the first-order condition with respect to \( g^N \) in the government problem (17). Using \( \mu \) and \( \eta \) to denote the Lagrange multipliers associated with the wage rigidity constraint and the government budget constraint, respectively, we arrive at the following modified Samuelson rule (MSR):

\[
\left( \frac{\partial P^N}{\partial g^N} \right) - \eta \left( \frac{\partial P^N}{\partial g^N} (g^N - F(h) \tau) \right) = 0,
\]

where \( u_S(c^T, c^N) \equiv \partial u(c^T, c^N) / \partial c^N \) and all variables correspond to time \( t \). This condition equates the marginal benefits from spending with the marginal costs. We next examine the three terms in this condition—which we label “Samuelson,” “stimulus,” and “austerity”—and how the key elements of the model shape these terms.

2. Frictionless Case (Samuelson)

Let us first focus on a frictionless version of the model (i.e., one in which there are no financing frictions for the government and no nominal rigidities). In this case, the net marginal benefits are given by the first term in (MSR): the government would equate the marginal benefits of higher government spending, \( v'(g^N) \), to the marginal costs of less private consumption, \( u_S(c^T, c^N) \)—or, put differently, the government equates the
marginal rate of substitution between private and public consumption to the marginal rate of transformation, which is equal to one in the model. This is the classic Samuelson rule for the efficient provision of public goods (Samuelson 1954). Assuming that the utility from tradables and that from nontradables are separable, and given the assumption of homothetic preferences, this would imply that government spending would be a constant fraction of nontradable output. The logic behind this principle is that movements in output get translated into absolute movements in government spending while keeping constant the share of public consumption.

3. Stimulus Benefits

In the presence of nominal rigidities, a second term in (MSR) emerges because private consumption is not completely crowded out by public consumption when there is slack in the labor market. As explained above, an increase in \( g^N \) raises \( P^N \) and increases employment. At the margin, one unit of increase in \( g^N \) relaxes the wage rigidity constraint by \( F(h)\frac{\partial P^N}{\partial g^N} \), which in turn has a shadow value of \( \mu_t \).

To shed light on the marginal utility benefits from the stimulus term, we can turn to the first-order condition with respect to \( h_t \). Assuming that \( h < h^* \), we have that the marginal benefit from raising employment at the optimum must be such that

\[
-\mu \left( \frac{\partial P^N}{\partial h} F'(h) + \hat{p}^N F''(h) \right) = u_N(c^T, c^N)\Omega(h)F'(h) + \left( u(c^T, c^N)\Omega'(h) + \eta \left[ \left( \frac{\partial P^N}{\partial h} F(h) + \hat{p}^N F'(h) \right) \tau - \frac{\partial P^N}{\partial h} g^N \right] \right).
\]

The right-hand side of equation (21) captures the marginal benefit from relaxing the wage rigidity constraint. The first term is given by the shadow value of the higher amount of output available for consumption. The second term represents the reduction in inequality. The third term arises whenever the government budget constraint binds, \( \eta_t > 0 \): a change in employment alters the tax revenues (which are proportional to output) and also the price at which the government makes purchases.

A simple example.—To more clearly illustrate the stimulus benefit, consider a simple case in which the government has access to lump-sum taxes \( T = \infty \) and the production function is linear. The following proposition provides a sharp result on the desirability of government stimulus; namely, full employment is optimal at all times if either there is a utility from public spending or there are inequality concerns.
Proposition 1 (Benefits of fiscal stimulus). Assume that $\alpha = 1$ and $T = -\infty$. Then, if either $v' > 0$ or $\kappa < 1$, we have that $h_t = 1 \; \forall \; t$ is strictly optimal.

To understand this result, consider a version of the model with (i) a representative agent, $\kappa = 1$; (ii) no value from public spending, $v(g) = 0$; and (iii) strictly decreasing returns to scale, $\alpha < 1$. In this situation, an increase in government spending crowds out private consumption and provides no benefits (i.e., it is optimal to set $g^N = 0$).

Now consider the case with $\alpha = 1$ so that we have a unit fiscal multiplier, and assume that $\kappa < 1$. In this version of the model, there are no crowding-out effects from government spending as long as $h < 1$ (due to linearity), and a higher level of employment helps to reduce inequality. In this situation, an economy with unemployment is suboptimal because raising spending (financed with taxes) provides, in effect, full insurance against idiosyncratic risk without reducing the aggregate level of private consumption.

Finally, consider an economy with a representative agent, $\kappa = 1$, linear production, and $v'(g) > 0$. In this case, it is again optimal to ensure full employment. This is because raising spending provides utility to households without reducing their private consumption. Notice that whereas stimulus is able to implement full employment, there is still a loss relative to the flexible wage economy because the level of spending exceeds the one prescribed by the Samuelson rule.\footnote{In terms of the complementary slackness condition (14), the government is at a point with $h = 1$ and $v_0 = \tilde{v}$.}

A natural question that follows is how the government should adjust spending through the business cycle to ensure that the economy is at full employment. The next corollary shows that if tradable consumption co-moves positively with the endowment of tradables (as would typically be the case in incomplete market models), the government follows a countercyclical fiscal policy as long as the wage rigidity is binding.

**Corollary 1 (Countercyclical fiscal policy).** Consider the same assumptions as in proposition 1. Given states $\{b, \tilde{y}^T\}$ and $\{\tilde{b}, \tilde{y}^T\}$, such that $c^T(b, y^T) > c^T(\tilde{b}, \tilde{y}^T)$, and a binding wage rigidity, we have that $g^N(\tilde{b}, \tilde{y}^T) > g^N(b, y^T)$.

The intuition is that a low tradable endowment generates a contraction in aggregate demand and requires a higher amount of spending to reduce the slack in the labor market.

4. Financing Costs

When the government faces financing frictions, there are additional costs from spending that go beyond the potential crowding-out effects...
of private consumption. The austerity term in equation (MSR) captures the marginal utility cost of how an increase in spending tightens the government budget constraint. If the government spends one additional unit, it directly tightens the budget constraint by $p^N$, which is the cost for the government to provide the extra unit of public goods. In addition, two general equilibrium effects arise from the increase in $p^N$ that results from the increase in spending. First, the increase in the price raises the inframarginal units of spending, and this tightens the budget constraint by $(\partial P^N / \partial g^N) g^N$. At the same time, an offsetting general equilibrium effect occurs because the increase in $g^N$ also raises tax revenues (because revenues represent a fraction of total income). The overall marginal utility cost of tightening the government budget constraint is given by the product of the sum of these three terms and $\eta$, the Lagrange multiplier on the government budget constraint. Notice in particular that if the government had access to lump-sum taxes, the Lagrange multiplier on the government budget $\eta$ would be zero and the austerity term would vanish.\(^{12}\)

We argue next that the austerity term depends critically on the degree of default risk. The Euler equation for government borrowing is as follows:

$$\left(\lambda_t + \eta_t\right) \left(q_t + \frac{\partial q_t}{\partial h_{t+1}} i\right) = \beta \mathbb{E}_{t} \left[ (\lambda_{t+1} + \eta_{t+1}) (1 - \chi_{t+1}) (\delta + q_{t+1} (1 - \delta)) \right], \quad (22)$$

where $\lambda_t$ denotes the Lagrange multiplier on the resource constraint on tradables in period $t$.\(^{13}\) This condition says that the marginal benefit from borrowing today is equal to the marginal cost of repaying the debt tomorrow. Borrowing one additional unit today helps relax today’s government budget constraint as well as today’s resource constraint for tradables, with a total marginal utility benefit of $\lambda_t + \eta_t$. By the same token, repaying the debt tomorrow has the opposite effects, as captured by the term $\lambda_{t+1} + \eta_{t+1}$ on the right-hand side.

How the government trades off these two effects is shaped critically by how the bond price changes in response to higher debt $\partial q_t / \partial b_{t+1}$. When an increase in borrowing raises default risk significantly, this implies lower

\(^{12}\) That $\eta$ would be zero is apparent from the fact that $\tau$ appears only in the second constraint in (17).

\(^{13}\) The multiplier $\lambda_t$ is in turn equal to $\lambda_t = u_T + \xi, \partial P^N / \partial c_T$. The second term arises because the government internalizes the fact that higher borrowing raises tradable resources and helps mitigate the wage rigidity through the general equilibrium effect. When we analyze household borrowing in sec. IV.D, the increase in government borrowing can be partly offset by household borrowing. Formally, as we show below, this translates into an additional term in (22), which is the Lagrange multiplier on households’ Euler equation—the additional implementability constraint in the government’s problem.
revenues from bond issuances, and in effect this leads to higher cost from stimulus since more borrowing is needed to finance the same level of stimulus.\footnote{Notice that while a lower bond price reflects that the government will pay in fewer states of nature tomorrow, it still faces higher default costs, which represent a deadweight loss for the economy.}

\section*{C. Stimulus versus Austerity: A Counterfactual Experiment}

To shed light on how the government chooses the actual optimal level of spending, we conduct a perturbation exercise in which we allow the government to choose a level of spending that differs from the optimal one. The idea is to trace how output and sovereign spreads would differ if the government were to choose a different level of spending.

Let us describe the experiment in more detail. We study how a change in spending today, taking as given all future policies and value functions as defined in the Markov equilibrium, affects current allocations and prices. To balance the changes in spending, we assume that the government adjusts the debt level and transfers to satisfy the budget constraint. Formally, in terms of the government’s problem (17), rather than maximizing with respect to the entire set of allocations, we fix an arbitrary level of government spending and solve optimally for the remaining allocations conditional on that level of spending. Our model simulations will be based on the optimal level of spending chosen by the government, but to understand the optimal choice it is instructive to consider alternative values of spending.

The results of this experiment are shown in figure 2, using the parameter values of the calibrated economy we describe in section IV. As initial values for the states, we assume that tradable endowment income is 1 standard deviation below its unconditional mean and current debt is 10\% above its average (results are qualitatively similar for other states). In each panel, the filled circle indicates the level of the variable of interest at the optimal level of government spending, which, as figure 2a shows, achieves the maximum welfare. The lines trace the values of all variables if the government were to choose the alternative value of spending.

As figure 2 shows, an increase in government spending stimulates economic activity. The increase in spending raises the price of nontradables (fig. 2d) and lowers unemployment (fig. 2b). As explained above, the increase in demand for nontradable goods leads firms to produce more in equilibrium. This is part of the standard channel from fiscal policy in open economies and is consistent with a large empirical literature (see,
We can also see that since nontradable consumption increases together with government consumption (fig. 2c), the fiscal multiplier is larger than one. As discussed in section III.A, the fiscal multiplier is larger than one because spending is debt financed and raises $c^T$.

Figure 2e also shows that the increase in government spending leads to an increase in spreads. Such an increase reflects the higher risk of future default associated with higher debt levels. This increase in spreads raises the debt burden, limits fiscal space in the future, and is a key factor that deters the government from providing a sufficient stimulus to attain full employment. In the next section, we quantitatively study the austerity-stimulus trade-off faced by the government and show how this shapes the conduct of fiscal policy over the business cycle.

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15 For advanced economies, the results are somewhat more mixed. For example, Miyamoto, Nguyen, and Sheremirov (2019) find that whereas in emerging economies the real exchange rate appreciates in response to government spending, it depreciates in advanced economies (see also Monacelli and Perotti 2010).
IV. Quantitative Analysis

A. Calibration

We calibrate the model to match key moments of the Spanish economy and use a year as the model period. We calibrate the model to Spain because, as stated in the introduction, the recent eurozone crisis provides a prototypical example of the main mechanisms featured in our model: a sharp increase in unemployment and sovereign default risk and a currency peg that leaves fiscal policy as the only instrument for macroeconomic stabilization. The model is solved numerically using value function iteration. For details on the solution method, see appendix D.

We assume the following functional form for the default cost: \( \psi_d(y_T) = \max\{0, \psi_1 + \psi_2 \log(y_T)\} \), with \( \psi_2 > 0 \), which has been used in related literature to match the bond spread dynamics observed in the data (for related functional forms on default costs, see Chatterjee and Eyigungor 2012; Bianchi, Hatchondo, and Martinez 2018).

All selected parameter values used in the baseline calibration are shown in table 1. We choose a subset of parameters according to predetermined values and choose the rest of the parameters to match key moments in the data. Data used for moments targeted in the calibration are detailed in appendix section F.3.

In the group of predetermined parameters, we set the coefficient of relative risk aversion to \( \sigma = 2 \) and the elasticity of substitution between tradable and nontradable goods to \( \xi = 0.5 \), which is in the range of values considered in the literature;\(^{16}\) the share of tradables in the consumption aggregator to \( \omega = 0.3 \), which implies a ratio of tradable output to total output of around 20%, in line with the data for Spain in the period of analysis; and the labor share from the nontradable sector to \( \alpha = 0.75 \), as in Schmitt-Grohë and Uribe (2016). For unemployment insurance, we set the ratio of the consumption of unemployed households to that of employed households to \( \kappa = 0.7 \), which is in line with the average expenditure on nondurable goods and services during unemployment estimated by Chodorow-Reich and Karabarbounis (2016) for the United States. In Spain, the monthly benefit amount is 70% of the monthly base over the first 6 months and 50% thereafter, until the unemployment spell reaches 2 years, according to the Servicio Público de Empleo Estatal regulations.

The tradable endowment \( y_T \) follows a log-normal first-order autoregressive (AR(1)) process, \( \log y_{t+1} = \rho \log y_T + \sigma \varepsilon_{t+1} \), with \( |\rho| < 1 \) with \( \varepsilon_{t+1} \sim \text{i.i.d. } N(0, 1) \). We estimate the parameters \( \rho \) and \( \sigma \) for the stochastic process

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\(^{16}\) This parameterization implies that the inter- and intratemporal elasticity of substitution are the same, and hence the marginal utility of tradables and that of nontradables are separable. Another useful implication is that the amount of public spending, according to the Samuelson rule, does not depend on \( b \) or \( y_t \).
of $y_T^T$ using Spanish national accounts data for the agriculture and manufacturing sectors, log-quadratically detrended. This estimation yields $\rho = 0.78$ and $\sigma_\epsilon = 0.029$.

For the parameters related to the debt market, we set the international risk-free rate $r$ equal to 2%, which is roughly the average annual gross yield on German 5-year government bonds; the maturity parameter $\delta$ equal to 0.184 to generate an average Macaulay bond duration of 5 years, in line with Organization for Economic Cooperation and Development (OECD) data for Spain over the period 2000–2010; and the reentry probability $\theta$ equal to 0.18 to generate an average autarky spell of 6 years, which is close to the average resumption of financial access reported by Gelos, Sahay, and Sandleris (2011) over the period 1980–2000 for 150 developing countries.

| Parameter | Value | Description | Target Statistic/Source |
|-----------|-------|-------------|-------------------------|
| $\alpha$  | 0.75  | Labor share in nontradable sector | Schmitt-Grohé and Uribe 2016 |
| $\beta$   | 0.91  | Discount factor | External debt/GDP (22.8%) |
| $\delta$  | 0.184 | Coupon decaying rate | Average bond duration (5 years) |
| $\theta$  | 0.18  | Reentry probability | Average autarky spell (5.5 years) |
| $\kappa$  | 0.7   | Relative consumption unemployed | Chodorow-Reich and Karabarbounis 2016 |
| $\rho$    | 0.777 | AR(1) coefficient of $y_T^T$ | Spanish tradable GDP process |
| $\sigma_\epsilon$ | 0.029 | Standard deviation of $\epsilon$ | Spanish tradable GDP process |
| $\beta^\phi$ | 0.33 | Utility loss from default (intercept) | Average bond spread (1.05%) |
| $\phi^\psi_\epsilon$ | 2.42 | Utility loss from default (slope) | Volatility of bond spreads (1.4%) |
| $\psi_\epsilon$ | 0.02 | Weight of $g$ in utility | Relative standard deviation of government spending to GDP (2) |
| $\tau$    | 0.19  | Income tax rate | Average government spending/GDP (18.1%) |
| $\bar{w}$ | 3.1   | Minimum wage | Unemployment increase in crisis |
The six remaining parameters are calibrated to match six moments from the data.\footnote{Computation of simulation statistics is conducted in the standard way (see app. sec. D.2).} Targeted moments are detailed in table 1. The first three moments speak to the amount of default risk in the economy: the average Spanish public external debt-to-GDP ratio of 22.8% and the average and volatility of Spanish bond spreads of 1.05% and 1.4%, respectively.\footnote{We note that our calibration target excludes domestically held debt. We follow this approach to more precisely capture the contractionary effects of austerity on aggregate demand. That is, in our model, when the government cuts borrowing, it depresses aggregate demand by transferring resources abroad. If we were to include domestic debt, this would to some extent understate the costs of austerity because households would increase their consumption of nontradable goods.} Although all parameters affect all moments in our calibration, these three moments are governed mostly by the discount factor $\beta$ and the parameters on the default cost function $\psi^0_x$ and $\psi^y_x$.\footnote{The calibrated value of the discount factor is $\beta = 0.91$. As is standard in the literature, a relatively low discount factor is needed to rationalize the observed levels of debt. This could capture households’ impatience or political economy frictions.}

The second group of moments is linked to government spending and taxes. We target the ratio of the volatility of government spending to the volatility of output of two and the mean Spanish government spending over GDP of 18%. These moments are influenced mainly by the weight of the government good in the utility function, $\psi_g$, and the income tax rate, $\tau$. Finally, we calibrate $\bar{w}$ to be consistent with the surge in unemployment during the episode of high sovereign spreads. In the data, unemployment in Spain went from 11.3% in 2008 to 21.4% in 2011. Accordingly, we set $\bar{w}$ so that the average increase in unemployment in the 2 years before a default is 10%. This yields $\bar{w} = 3.1$. Table F.1 shows that our calibrated model approximates the targeted moments fairly well.\footnote{An exception is the volatility of spreads; the model falls short in replicating the volatility observed in the data. As discussed by Aguiar et al. (2016), this is a common challenge faced by the canonical sovereign debt model.}

\subsection*{B. Fiscal Policies over the Business Cycle}

In this section, we study how default risk shapes optimal fiscal policy over the business cycle. To do so, we first consider an economy in which we shut down default risk and then show how incorporating default risk changes the nature of the optimal fiscal policy response. We calibrate the two economies to match the same data targets, with the exception of spreads, and which are, of course, zero for the risk-free economy.\footnote{Essentially, we choose the same parameter values as in our baseline economy (detailed in table 1), except for the discount factor and utility of government spending—which we set to match the same average debt-to-GDP and government-spending-to-GDP ratios as in our baseline economy—and the parameters governing the default costs, which are set to large enough values to ensure that the economy never defaults for the targeted debt levels.}
Table 2 reports key business-cycle moments from the risk-free economy, the baseline model, and compares them with their data counterparts. A first takeaway is that in the absence of default risk, optimal fiscal policy is countercyclical, with a correlation of $0.81$ between government spending and GDP. This model prediction is in sharp contrast to the procyclical behavior of government spending observed for Spain ($0.46$ in our sample).

Table 2 also shows that, thanks to the effective stabilizing role of fiscal policy, the fluctuations in unemployment are small—one order of magnitude smaller than those observed in the data for Spain.

Column 3 of table 2 shows the business-cycle statistics for our baseline economy with default risk. The main result is that government spending is procyclical, with a correlation of $0.72$ with output. This table shows that the resulting fluctuations in unemployment are also more aligned with the data.

The sharp contrast between the conduct of fiscal policy in the risk-free economy and in the economy with default risk can be illustrated by comparing the policy functions for government spending. As figure 3 shows, optimal government spending with risk-free debt (depicted by the solid line) is monotonically decreasing with income. In contrast, optimal government spending with defaultable debt (depicted by the dashed line) is nonmonotonic within the repayment region. In particular, spending

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**TABLE 2**

**Business-Cycle Statistics: Data and Models**

| Statistic                        | Data | Risk-Free | Default |
|----------------------------------|------|-----------|---------|
| Averages (%):                   |      |           |         |
| Mean(spreads)                   | 1.05 | .00       | 1.09    |
| Mean(debt/$y$)                  | 22.8 | 22.4      | 22.6    |
| Mean($p^{NG}/y$)                | 18.1 | 18.6      | 18.2    |
| Correlations with GDP:          |      |           |         |
| corr(GDP, $g^N$)                | .46  | −.81      | .72     |
| corr(GDP, $c$)                  | .98  | 1.00      | .98     |
| corr(GDP, spreads)              | −.38 | .00       | −.95    |
| corr(GDP, unemployment)         | −.34 | −.37      | −.97    |
| Volatilities (%)                |      |           |         |
| $\sigma(GDP)$                   | 3.5  | 1.2       | 4.3     |
| $\sigma(p^{NG}/y) / \sigma(GDP)$| 2.0  | 1.6       | 2.0     |
| $\sigma(c) / \sigma(GDP)$      | 1.1  | 1.1       | 1.1     |
| $\sigma($spreads$)$            | 1.4  | .0        | .7      |
| $\sigma($unemployment$)$       | 4.1  | .6        | 5.6     |

**Note.**—This table reports business-cycle statistics for the data and the models with risk-free and risky debt. Bond spreads are computed as the differential between the annual sovereign bond return and the annual risk-free rate. The variables GDP and $y$ denote total output at constant and current prices, respectively.

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22 Time series for public and private consumption and GDP are log-quadratic detrended.
is increasing in $y^T$ for low levels of $y^T$ and is decreasing in $y^T$ for high levels of $y^T$.

To understand these results, figure 4 depicts two important objects that we discuss in the context of the optimal policy trade-offs in section III. Figure 4a shows the fiscal multiplier, defined as the increase in output from a marginal increase in government spending, as a function of tradable endowment. As the figure shows, the fiscal multiplier is positive when income is low and becomes zero once the economy is at full employment. Figure 4b shows the increase in spreads that results from the increase in external debt to finance of one unit of government spending. A crucial property illustrated in the figure is that the marginal financial cost is larger when income is low. Overall, this figure shows that although in bad times

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23 Notice also that the amount of spending increases to the left of the default threshold. The reason is that when the government repays and is close to the default threshold, it runs a fiscal surplus and defaulting frees up resources for stimulus.

24 For empirical evidence on the asymmetry of the fiscal multiplier, see, e.g., Born et al. (2019).
the fiscal multiplier is larger, the fact that the financial cost is also larger implies that the government chooses to cut spending and follow a procyclical fiscal policy.

It is important to highlight that departing from the optimal fiscal policy under default risk can entail large welfare costs. To show this, we replace the optimal countercyclical spending with a benchmark Samuelson rule that specifies a constant $g^N$ over the business cycle and evaluate the welfare costs from following this rule as opposed to the optimal one. We find that the average welfare cost is 3.5% of permanent consumption.\textsuperscript{25}

Following a Samuelson rule instead of the optimal state-contingent policy generates several welfare consequences—it may have adverse effects on the borrowing terms at which the government borrows, which in turn affects the ability to front-load consumption and smooth income shocks over time and, in addition, affects the ability to achieve macroeconomic stabilization. We argue that the latter accounts for the bulk of the welfare losses. Evaluating the value function under the assumption that $c^N$ and $g^N$ are the same (and equal to their optimal values) for both classes of policies, we find that welfare losses become negligible in that case. In addition, the welfare implications associated with the utility loss from default penalties are also quite small. When we abstract from the default penalties when computing the value function, the welfare gains are reduced by about 0.1 percentage points. In contrast to Lucas (1987), macroeconomic stabilization entails significant welfare consequences.

\textsuperscript{25} Welfare is computed in total consumption equivalence terms (for details, see app. D).
C. The Debt Dependence of Optimal Fiscal Policy

In this section, we show that default risk considerations lead to an important state dependency in the optimal fiscal policy. In particular, the government’s optimal response to shocks depends crucially on the country’s level of debt. To illustrate this debt state dependence, we consider a 1 standard deviation drop in tradable endowment and simulate the model forward under the expected path of income, starting from two initial levels of debt—one that is 25% below the steady-state level (“low debt”) and another that is 25% above the steady-state level (“high debt”).

Figure 5 shows the results of this exercise. The figure compares macroeconomic variables and spreads under the negative shock with those in the economy without the shock. The dashed line corresponds to the economy that starts with low debt. In this case, the government chooses an expansionary path for government spending and borrowing (fig. 5b and 5c, respectively). Facing low default risk, the government resorts to a fiscal stimulus that prevents virtually any increase in unemployment (fig. 5f).

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26 For this quantitative exercise, we simulate from $t = 2$ onward along 10,000 tradable income paths. Naturally, along some paths, default occurs during some periods. To compute the impulse responses, we consider all of the simulations in each period and calculate the cross-sectional median of the variables.
In sharp contrast, the solid line in figure 5 shows that when initial debt levels are high, the government chooses to contract government spending and reduce debt levels. Because the negative shock triggers an increase in sovereign risk, the government finds it too costly to engage in an expansionary fiscal policy. The increase in spreads that would result from the increase in borrowing renders the stimulus too costly. This scenario is characterized by a large increase in unemployment (around 8 percentage points) resulting from the contraction in both public and private consumption.27

Spain’s simulations.—The state dependency of our model is also useful in interpreting the recent dynamics of government spending observed in Spain—our calibrated economy—in the run-up to the debt crisis. Figure 6 shows the evolution of Spain’s government spending, real GDP, debt/GDP, and bond spreads over the period 2007–13, in both the model and the data. For the model dynamics, we start from the debt level in 2007 and feed the observed path of tradable income. To capture the emergency lending received by Spain, we assume that the government receives a lump-sum transfer of 1.5% of the GDP in 2012 and 2013, which corresponds to the funds provided by the European Stability Mechanism (ESM).28

In line with our data, the government responded to the Great Recession with a fairly aggressive fiscal stimulus (fig. 6b). At that time, borrowing costs remained quite modest and government spending kept rising (see figs. 1, 6d). In 2012–13, there was a new slump in economic activity, but the situation at that time was quite different. Facing mounting spreads, the Spanish government decided to cut spending sharply; this in turn deepened the recession.

D. Extension with Household Borrowing

In the baseline model, we consider a setup in which only the government can access international financial markets. This is the standard assumption in the sovereign debt literature. In this section, we extend the model to allow a fraction $\gamma$ of “unconstrained” households to save and borrow abroad. We also assume that these households pool their unemployment risk. We index unconstrained households by $u$. Given these assumptions, we now have to track the aggregate bond position of unconstrained households ($a_u$) as a state variable, in addition to the government bonds and tradable endowment shock.

27 In app. H, we provide a systematic analysis of the state dependence in which we consider the full range of debt and income.

28 The promised amount by the ESM was €100 billion, but only half of it was actually used.
When households can save internationally, the government problem \((17)\) features an additional implementability constraint—namely, the government needs to respect the unconstrained households’ Euler equation for bonds. Let \(C^T, u, C^N, u\) denote the continuation policy for tradable and nontradable consumption for unconstrained households. The government problem is then subject to

\[
u_T(c^T, c^N) \geq \beta R \mathbb{E} u_T[C^T(y^T, b', a'_0), C^N(y^T, b', a'_0)], \quad (23)
\]

with equality whenever the borrowing constraint on households does not bind.

Under the assumption that preferences are separable in tradables and nontradables, we obtain the same optimality condition for \(g^N\) as in the baseline model. That is, (MSR) still characterizes the trade-off between stimulus and austerity (see details in app. C). The government’s borrowing choices, however, do affect the amount of households’ borrowing and therefore the level of aggregate demand. Because of the presence of aggregate demand externalities (see, e.g., Schmitt-Grohé and Uribe 2016), constraint \((23)\) will in general bind for the government. That is, households and the government “disagree” about the intertemporal allocation of consumption. In particular, in a recession, households fail to internalize that if they were to increase borrowing and consumption, employment would increase. Similarly, under full employment, households fail to internalize that if they were to reduce borrowing, this would increase aggregate demand.

**Fig. 6.**—Data and model: Spain 2007–13. This figure shows the time series of macro variables for Spain in the run-up to the 2012–13 crisis. Model simulation starts with the initial external debt in 2007 and fits the observed path of tradable output. For 2012–13, we assume that Spain receives a total bailout of 3% of GDP. GDP, spending, and consumption are expressed in percentage deviations from the trend in the data and percentage deviations from the mean in the model.
demand in the future and mitigate recessions. In addition, to the extent that households are not borrowing constrained, they are able to partly offset borrowing choices by the government and potentially offset government stimulus. However, Ricardian equivalence does not hold, given the frictions in taxes and borrowing by the government. Moreover, because public and private goods are imperfect substitutes, government consumption will affect relative prices and firms’ labor demand, similar to our baseline model.

The effects of household borrowing on the transmission mechanism of fiscal policy can be analyzed through equation (20), which shows that the fiscal multiplier is higher when households respond to an increase in $g^N$ by raising $c^T$. Conversely, if households respond by lowering $c^T$, the fiscal multiplier becomes smaller. Overall, the effects of higher $g^N$ on $c^T$ are complex and depend on various forces—in particular, intra- and inter-temporal substitution effects and aggregate income effects. Higher spending raises $p^N$, which leads households to substitute consumption toward tradables. At the same time, higher prices today relative to the future lead to an intertemporal substitution toward the future. Finally, the increase in spending raises current household income (through higher labor income and profits) but the accumulation of debt implies a reduction in future income and government transfers.

To examine the effects on the transmission mechanism, we conduct the same numerical counterfactual analysis as in section III. We assume that 40% of the agents can borrow externally and use the same parameters as in the baseline. The analysis is presented in figure 7. The figure displays the savings of unconstrained agents and nontradable output (the appendix includes other relevant variables—in particular, spreads on unemployment that show the same trade-off as in the baseline model). As can be seen in figure 7a, households increase their savings in response to a debt-financed stimulus. Figure 7b shows that we still obtain an increase in the aggregate amount of nontradable consumption, which implies a multiplier that is still above one (although lower than the baseline).

Overall, this extension suggests that the main trade-off remains very similar in a version with household borrowing. Figure C.1 shows that optimal spending is still characterized by a nonmonotonic policy function. In addition, we obtain a correlation between output and spending, which is roughly the same as in the baseline model.

29 As we show in app. C, eq. (20) continues to characterize the effects of fiscal stimulus with the difference that aggregate tradable consumption corresponds to the average of constrained and unconstrained agents (see eq. [C.8]).

30 It is well understood that a fraction of hand-to-mouth agents may raise fiscal multipliers above one (Gali, López-Salido, and Vallés 2007).
E. Other Extensions and Sensitivity

Fiscal rules.—The critical friction that inhibits the government from following a countercyclical fiscal policy is the lack of commitment, which has two dimensions in our model: the inability to commit to repayment decisions and the inability to commit to spending decisions. We now argue that allowing for a limited degree of commitment—namely, a commitment to the next period’s government spending during repayment—can be quite effective in rendering a stimulus more desirable. In appendix I, we show how, in the midst of a recession, a policy of “fiscal forward guidance” that promises lower government spending once the economy is back to normal can help reduce spreads today and render a stimulus more desirable.31

Appendix E also quantitatively explores the role of simple fiscal rules that the government follows at all times (see table E.1). Unlike the effectiveness of fiscal programs discussed above, we find that fiscal rules that specify a constant level of spending reduce welfare. The possible gains from committing to low spending turn out to be dwarfed by the costs of the lack of flexibility. Moreover, even though spreads may turn out to be lower in the economy with a constant-spending rule, this occurs primarily

31 Like other contributions to the large literature on fiscal rules (see, e.g., Chatterjee and Eyigungor 2015; Hatchondo, Martínez, and Sosa-Padilla 2016; Hatchondo, Roch, and Martínez 2019; Hatchondo, Martínez, and Roch 2022), we assume that these rules are enforced by either some legal mandate or a supranational institution. Halac and Yared (2017) and Dovis and Kirpalani (2020) study reputation mechanisms. The appendix also presents a case in which ill-designed austerity programs can have unintended effects on raising spreads; an empirically relevant case is argued by Born, Müller, and Pfeiffer (2020). In recent work, Anzoategui (2020) investigates the effects of austerity on spreads using a similar model that incorporates estimated fiscal rules.
because the lack of flexibility creates a form of debt intolerance that causes the government to borrow very little in equilibrium. Overall, our findings suggest that desirable rules are likely to be highly nonlinear and must be carefully designed to be effective.\textsuperscript{32}

Costly tax adjustment.—Our baseline analysis features a constant tax rate. A fiscal constraint is indeed critical to inducing a binding government budget constraint—which, together with default risk, gives rise to the austerity channel. However, it is possible to extend our analysis to allow for a variable tax rate. For tractability, we do not model the primitive reasons why it is costly to adjust taxes and instead consider a loss from taxation given by \( \Phi(t - \bar{\tau}) \), where \( \bar{\tau} \) represents a reference tax rate and \( \Phi \) is a convex function that achieves a minimum at zero.\textsuperscript{33} As we show in appendix section B.2, the characterization provided in section III is preserved. The only difference now is that optimality must also satisfy a condition that equates the marginal costs from changing taxes to the marginal value of the tax revenues obtained:

\[
\Psi'(t - \bar{\tau}) = \eta[y^T + \rho F(h_i)].
\]

(24)

An implication of this condition is that in periods in which default risk and the government budget constraint are tighter, it is optimal to raise \( \tau_s \), as doing so allows for more space to increase spending. Our quantitative explorations show that the overall austerity results are preserved for realistic parameterizations of \( \Psi \).\textsuperscript{34}

In table G.1, we also consider an extreme case in which the government has access to lump-sum taxes, which corresponds to \( \Psi = 0 \). In line with our corollary 1, the government chooses a countercyclical fiscal policy, because a simultaneous increase in taxes and spending helps raise aggregate demand without increasing the exposure to the debt crisis. However, once we calibrate the cost of taxation to match the volatility obtained in the data, the results we obtain are very close to the baseline with a fixed tax rate.

\textsuperscript{32} We have also explored alternative simple rules in which spending reacts linearly to income and also found little improvements. One promising avenue for future research is to explore fiscal rules based on debt and spread limits, following the work of Hatchondo, Martínez, and Roch (2022).

\textsuperscript{33} What is crucial for our analysis is that taxes are costly to raise for the government. One can interpret the costs of increasing taxes as originating from deadweight losses or political economy costs. Although including such detailed frictions goes beyond the scope of our paper, they constitute an interesting analysis for future research.

\textsuperscript{34} We specify a quadratic cost \( \Psi = \Psi_0(\tau - \bar{\tau})^2 \) and calibrate \( \bar{\tau} \) to match the average spending-to-GDP ratio and \( \Psi_0 \) to match a mean absolute deviation of 3% in tax rates, as obtained by Végh and Vuletin (2015).
**Robustness of results.**—Table G.1 shows that the main results from the normative analysis are robust to alternative parameterizations of the model. In particular, the optimal fiscal policy is procyclical for alternative discount factors, default costs, debt maturity, degree of unemployment insurance, and tax levels. Economies with a higher discount factor exhibit fiscal policies that are less procyclical. This result suggests that political economy frictions, interpreted as a lower discount factor, drive up the procyclicality of fiscal policy. However, even when raising the discount factor from 0.91 to 0.95, we obtain a correlation between output and spending of 0.65 (vs. 0.75 in the baseline). Governments with lower default costs carry less debt and also exhibit less procyclical fiscal policy.35 Similarly, economies with longer maturities need to roll over a smaller fraction of the debt and choose less procyclical policies. Inequality considerations also play an important role in determining the optimal policy: economies with less unemployment insurance put a higher weight on unemployment stabilization and choose less procyclical policies. Economies with higher tax rates have to resort to risky external finance to a lesser extent and follow less procyclical fiscal policies. Finally, when income shocks are less persistent, procyclicality is reduced. Intuitively, a less persistent shock implies that a recession today is less likely to be followed by a recession in the future. Therefore, the government has less need for fiscal space in the future and may find it optimal to spend more.36

V. Fiscal Responses by Sovereign Risk in the Data

We document that, consistent with the normative predictions of the model, countries with higher sovereign default risk exhibit more fiscal austerity during downturns. In addition, we show that within risky economies, higher initial foreign liabilities are associated with more austerity during recessions. We highlight the fact that the evidence we provide is descriptive and not aimed at being causal. The key takeaway is that the patterns of fiscal policy observed in the data are consistent with how the government resolves the trade-off between stimulus and austerity in our model.

---

35 Table G.1 also reports the comparison of economies with different default costs when we recalibrate their discount factors so that they have similar debt levels. In this case, the economy with lower default costs faces a higher probability of default for any level of borrowing, which raises austerity considerations and renders the optimal policy more procyclical. Table G.2 also reports similar results in a calibration for Brazil and Greece.

36 In fig. G.1, we compare the policy function for spending in the baseline model with the policy in the case of a one-time unanticipated shock. In contrast to the baseline model, for the case of the fully temporary shock, the government responds to a fall in $y'$ by spending more.
Our empirical analysis includes data on national accounts and sovereign risk indicators for a panel of countries around the world for the period 1980–2016. We obtain national accounts data from World Development Indicators (WDI), a dataset that reports information from official sources for a large set of countries. We measure economic activity with GDP and government consumption with the variable “general government final consumption expenditure”; we focus our empirical analysis on government consumption because this is the variable for which we conduct our normative analysis in the model. We measure both variables at constant prices and in per capita terms using data on population from Penn World Tables. Table J.1 lists 108 countries with at least 15 years of data for these variables. Table J.2 presents summary statistics of the cyclical behavior of government consumption and GDP around the world. Most countries are characterized by a government consumption that is more volatile than GDP and procyclical. This cyclicality displays a large dispersion across countries, ranging from 0.2 to 0.8, which we exploit in our empirical analysis.

For sovereign risk, we use two measures: historical default rates from Reinhart and Rogoff (2009) and credit ratings from S&P. Table J.3 lists the countries with available data in our sample; it also reports average default rates by country before World War II and the minimum and mode ratings for countries with more than 15 years of available data for the period 1980–2016. As reported in the table, historical default rates exhibit a strong positive relationship with credit ratings. We complement the measures of sovereign risk with data on net foreign liabilities from Lane and Milesi-Ferretti (2007).37

We are interested in characterizing the behavior of government consumption during recessions for countries with different default risks. For this, we identify recession episodes following the algorithm of Calvo, Coricelli, and Ottonello (2014), which defines recessions as time windows that contain annual contractions of real per capita GDP (app. sec. J.2 provides the details of this algorithm). Following this procedure, we identify a sample of 239 recession episodes in the countries with credit ratings data in our sample, which are listed in tables J.4 and J.5. Recessions exhibit a median contraction of economic activity of 1.6% in the first year and a median contraction of 2.7% from peak to trough.

37 As shown in sec. IV.D, in our model the key variable that determines fiscal policy is the government’s debt. In the empirical analysis, we focus on total net foreign liabilities (including both public and private net foreign liabilities) because of data availability in our sample of countries and the period of analysis. In the model-simulated data in sec. IV.D, these variables exhibit a strong positive correlation.
We include in our analysis additional variables that the literature has shown to be important determinants of fiscal policy over the business cycle and capable of being correlated with sovereign default risk. First, we examine countries’ income levels (e.g., Gavin and Perotti 1997; Kaminsky et al. 2004; Ilzetzki and Végh 2008), which we measure with the average GDP per capita purchasing power parity adjusted, obtained from WDI.\textsuperscript{38} Second, we include political polarization, studied in Ilzetzki (2011) and measured (as in this work) with the index of ethnic fractionalization of Alesina et al. (2003). Third, we consider political agency problems, studied by Alesina, Campante, and Tabellini (2008), which we measure (as in their work) with the degree-of-corruption index of Kaufmann, Kraay, and Mastruzzi’s (2006) aggregate governance indicators.

B. Specification

We provide descriptive evidence to characterize the dynamics of government consumption during recessions for countries with different sovereign risk and foreign liabilities by estimating Jordà (2005)-style local projections:

\[
\log g_{jt+s} - \log g_{jt-1} = \alpha_j + \beta_{\text{recession}_t} \sigma_{jt} + \gamma_j (\text{recession}_t \times \text{risk}_j) \\
+ \delta_j (\text{recession}_t \times \text{risk}_j \times \ell_{jt-1}) \tag{25}
+ \rho_1 \Delta \log g_{jt-1} + \rho_2 \ell_{jt-1} + \Gamma_j \text{recession}_t X_{jt-1} + \epsilon_{jt},
\]

where \(s \geq 1\) indexes the forecast horizon, \(g_j\) represents real government consumption per capita of country \(j\) in period \(t\), \(\alpha_j\) is a country fixed effect, \(\text{recession}_t\) is a dummy variable that takes a value of one if country \(j\) has a recession starting in period \(t\) and zero otherwise, \(\text{risk}_j\) denotes a dummy variable that takes a value of one if country \(j\) has sovereign default risk and zero otherwise, \(\ell_{jt}\) denotes the ratio of net foreign liabilities to GDP of country \(j\) in period \(t\) de-meaned at the country level,\textsuperscript{39} \(X_{jt-1}\) is a vector of controls, and \(\epsilon_{jt}\) is a residual. In our baseline specification, we measure the variable risk, as either a dummy variable that takes a value of one if country \(j\) has a historical default rate above 1% or a dummy variable that takes a value of one if country \(j\) ever had an S&P sovereign credit rating below AA, which denotes a very strong capacity to meet its financial commitments and is the minimum rating observed in the

\textsuperscript{38} Although we include this variable in the analysis to absorb differences in fiscal policies driven by differences in income levels, Ilzetzki (2011) shows that the cyclicity of government consumption—which is the main focus of our analysis—is not significantly different for high-income countries and developing countries.

\textsuperscript{39} We de-mean the variable \(\ell_{jt}\) at the country level to abstract from permanent differences in foreign-liability positions across countries. See Ottonello and Winberry (2020) for a similar procedure for firms’ leverage.
United States; we consider alternative thresholds in the robustness analysis. For the control vector $X_{jt-1}$ in the baseline model, we include the log of the country’s GDP per capita and the interaction of this variable with $\ell_{jt-1}$ to absorb differences in fiscal policies during recessions driven by different income levels; we also consider additional variables below. Our main coefficients of interest are $\beta_s$ and $\gamma_s$, which measure the cumulative growth in government consumption $s$ years after a recession for riskless and risky economies, and $\delta_s$, which measures how the cumulative growth of government consumption $s$ years after a recession varies for recessions with different initial net foreign liabilities. We cluster standard errors in two ways to account for correlation within countries and within years. We also estimate (25) with real GDP instead of real government consumption.

C. Results

Table 3 reports the results from estimating (25) for $s = 0$, which corresponds to estimating the growth in government consumption and GDP relative to their mean in the initial year of a recession episode for countries with different sovereign risk and foreign liabilities. The first row shows the estimate for $\beta_0$, which indicates that riskless economies tend to display growth in government consumption close to its mean, while GDP grows 3–4 percentage points below its mean. The second row shows the estimate for $\gamma_0$, which indicates that risky governments exhibit more austerity in terms of their government consumption than riskless economies, with a 2 percentage point growth below that of riskless economies; these economies also experience a more severe output contraction. The third row shows the estimate of $\delta_0$, which indicates that for risky economies, recessions with high initial foreign-liability positions tend to exhibit more fiscal austerity in terms of their government consumption than recessions with low initial foreign liabilities. When measuring default risk with credit ratings, this coefficient is statistically significant and indicates that having 1 standard deviation higher initial net foreign liabilities over GDP above the mean is associated with a growth of government consumption 2 percentage points below that of a risky economy with the average level of foreign liabilities in the initial period of a recession episode.\footnote{The units of $\ell_s$ are standardized over the entire sample; thus, the units of the estimated coefficient are standard deviations of the ratio of external liabilities over GDP from the sample, which is 0.41.}

Figures 8 and J.1 show the dynamics of government consumption and GDP in the years following the initial contraction from recession episodes, obtained by estimating (25) for different horizons $s$ for both measures of
sovereign risk. The left and middle panels depict the estimates of $b$ and $g$ as a function of $s$, which indicate that, after its initial response documented in table 3, cumulative government consumption growth tends to contract, with more persistence for risky economies. The right panels of figure 8 show that fiscal austerity following recession episodes is particularly persistent and acute for risky economies with initial foreign liabilities.

### D. Robustness and Additional Analysis

Appendix section J.3.2 shows that the results that characterize recession episodes are robust to expanding the vector of country-level controls

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**TABLE 3**

| Dependent Variable | $\Delta g_{jt}$ | $\Delta g_{jt}$ | $\Delta y_{jt}$ | $\Delta y_{jt}$ |
|--------------------|----------------|----------------|----------------|----------------|
|                     | (1)            | (2)            | (3)            | (4)            |
| Recession          | -.002          | -.003          | -.038***       | -.036          |
|                    | (.005)         | (.006)         | (.005)         | (.005)         |
| Recession $\times$ risk | -.022***      | -.019***       | -.016**        | -.024***       |
|                    | (.008)         | (.007)         | (.007)         | (.007)         |
| Recession $\times$ risk $\times \ell$ | -.008        | -.017***       | -.002          | -.014***       |
|                    | (.019)         | (.006)         | (.010)         | (.003)         |
| Observations       | 1,633          | 2,368          | 1,662          | 2,434          |
| $R^2$              | .18            | .13            | .45            | .41            |

Notes:—Results from estimating

$$
\Delta \log z_{jt} = \alpha_j + \beta_{\text{recession}_j} \gamma_{(\text{recession}_j \times \text{risk}_j)} + \delta_{(\text{recession}_j \times \text{risk}_j \times \ell_{j-1})} + \rho_1 \Delta \log z_{j-1} + \rho_2 \ell_{j-1} + \Gamma \text{recession}_j X_{j-1} + \epsilon_{jt},
$$

where $z_{jt} \in \{g_{jt}, y_{jt}\}$ is either real government consumption per capita or real GDP per capita of country $j$ in period $t$; $\alpha_j$ is a country fixed effect; recession$_j$ is a dummy variable that takes a value of one if country $j$ has a recession starting in period $t$ and zero otherwise; risk$_j$ denotes a dummy variable that takes a value of one if country $j$ has sovereign default risk and zero otherwise; $\ell_j$ denotes the ratio of net foreign liabilities to GDP of country $j$ in period $t$ demeaned at the country level, standardized over the entire sample; and $X_{j-1}$ is a vector of controls that includes the log GDP per capita of country $j$ and the interaction of this variable with $\ell_{j-1}$. In cols. 1 and 3, sovereign risk is measured with a dummy variable that takes a value of one if the historical default rate of country $j$ is above 1% and zero otherwise (for details, see sec. V); in cols. 2 and 4, sovereign risk is measured with a dummy variable that takes a value of one if the country ever had a rating below AA. Standard errors are two-way clustered by country and by year.

** Significant at the 5% level.
*** Significant at the 1% level.

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41 To render these results more tangible, app. sec. J.3.1 presents country-level patterns for these dynamics during recession episodes and compares them with their reference risk group.
which at the baseline is aimed at absorbing differences in income across countries and the interaction of this variable with net foreign liabilities. In particular, figures J.6 and J.7 show that the differences in sovereign risk from our baseline specification do not capture differences in fiscal cyclicalities for countries with different ethnic fragmentation or corruption, which, as discussed above, have been identified in the literature as important drivers of fiscal procyclicality. Appendix section J.3.3 investigates how the results vary with alternative thresholds of credit ratings. Figure J.9 shows that the differential responses between riskless and risky sovereigns weaken as we lower the bar that defines a riskless economy.

Finally, appendix section J.4 complements the results for recession episodes by documenting the cyclicality of government consumption for countries with different default risk. The main result is that, consistent with our model, countries with higher default risk tend to exhibit a higher sensitivity of government consumption to changes in GDP.

VI. Conclusion

We provide a framework that combines Keynesian features with sovereign risk concerns to articulate the fundamental dilemma faced by policy
makers in a severe downturn: should the government increase spending to ease the recession at the expense of higher spreads or cut spending to reduce exposure to a debt crisis—even if that deepens the recession? Our analysis suggests that a fiscal stimulus may be undesirable, even in the presence of sizable Keynesian stabilization gains and inequality concerns.

As the global economy emerges from the COVID-19 crisis with record-high sovereign debt levels, the issues we tackle here are likely to inform upcoming policy debates. However, we believe that there are several important areas in which the analysis presented here should be extended. First, we have focused on the role of government spending as a potential countercyclical policy tool while positing a tax rate that is either fixed or subject to an exogenous deadweight loss, calibrated to match the variability in the data. Future research could allow for a richer fiscal constellation and shed further light on, for example, whether austerity should be loaded relatively more on spending or taxes. Second, we have assumed that fiscal policy is conducted by a benevolent government, which shares in particular the same discount factor as households. An interesting area for future research is to incorporate political economy frictions. Extending the analysis in this dimension would help inform policy discussions on the desirability of fiscal rules and the extent to which they can help manage the fiscal austerity-stimulus trade-off in the presence of sovereign risk.

Data and Code Availability

Code replicating the empirical and computational analysis in this article can be found in the Harvard Dataverse, https://doi.org/10.7910/DVN/X3OEI2 (Bianchi, Ottonello, and Presno 2023).

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