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Sustainable Fiscal Policy with Rising Public Debt-to-GDP Ratios *

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Abstract

In financial and economic policy circles concerned with public debt in developing countries, a rising debt-GDP ratio is interpreted as a signal of overborrowing, warning of debt defaults if strong fiscal corrections are not adopted in time. This paper shows why this interpretation is incorrect by building a simple model of fiscal policy in which upward-sloping debt paths are observed even though the probability of default is "almost surely" equal to zero.

JEL classification codes: E62, F34, F37, H63

Key words: public debt, fiscal policy, debt sustainability, debt limits

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1 Motivation

The literature on public debt sustainability is largely silent about when an indebtedness level becomes unsustainable. The empirical evidence seems not to be helpful either: the median public debt-GDP ratio among countries that defaulted on their public debt during the last 30 years is about 50 percent; 35 (30) percent of the defaults happened at debt ratios of less (more) than 40 (80) percent (IMF, 2003a, Ch.III). The lack of sustainability benchmarks leads policymakers and debt analysts to focus on other aspects of public debt to assess its sustainability.

Following the tradition started with Blanchard (1990) and Blanchard et al. (1990), one of the most common practices points out that upward-sloping time paths of public debt signal fiscal policy unsustainability. For instance, the slope of the debt path is a key component of a framework elaborated by the IMF and the World Bank for assessing debt sustainability (see IMF, 2003b), and as documented by IMF (2003b), investment houses and risk-rating agencies also based their fiscal sustainability analyses on the short-term dynamics of public debt.[1] By building a model in which rising debt paths are consistent with an almost surely nil probability of default, this paper shows why it is misleading to assess fiscal sustainability by focusing on the slopes of debt-paths.

2 The Basics

Debt sustainability analyses focus on the government budget constraint, which takes the following form in a non-monetary economy:

$$b_t = b_{t-1}\mathcal{R}_t + g_t - \tau_t \tag{1}$$

where all variables except the growth-adjusted interest rate $\mathcal{R}_t \equiv R_t/\Gamma_t$ are measured as GDP ratios; here, R_t and Γ_t are the gross rates of interest and GDP growth; τ_t and g_t represent fiscal revenues and non-interest fiscal outlays; and b_t the public debt issued at the

[1] For recent applications of this approach, see Celasun et al. (2006) and the references therein.

end of period t. Hereafter, R_t, Γ_t, and τ_t are assumed to be exogenous and stochastic with their dynamics governed by a Markov chain $\mathcal{Q}(q_{t+1}; q_t)$, where $q_t \equiv [\tau_t, R_t, \Gamma_t]'$.

Seeking to identify unsustainable debt ratios, Mendoza and Oviedo (2006a, 2006b) adopt the notion of the natural debt limit (NDL) of the precautionary-savings literature (Aiyagari, 1994; see also Aiyagari, et al. 2002) to pinpoint the maximum sustainable level of public debt that a country can support. Levels of debt that exceed the NDL are inconsistent with solvency (i.e. debt repayment) in all states of nature. In Mendoza and Oviedo (2006a) the NDL on public debt, ϕ, depends on the "worst" state of the Markov chain $\mathcal{Q}$, as well as the minimum level of g_t, say $g^{\min}$, considered as socially or politically tolerable:

$$\phi \equiv \min \left\{ \mathcal{R}_t^{-1} (\tau_t - g^{\min}) \right\} ; \tag{2}$$

By never borrowing more than ϕ a country guarantees its ability to pay even under the most adverse scenario. If borrowing more than ϕ is allowed, there are feasible scenarios in which the country is unable to repay even setting $g_t = g^{\min}$ forever.

3 A Model of Sustainable Fiscal Policy

Consider a government that seeks to provide a smooth path of fiscal outlays without incurring too large a debt or primary fiscal deficits $d_t \equiv g_t - \tau_t$, while ensuring the provision of the minimum level of expenditures $g^{\min}$. This can be the goal of a government interested in meeting policy goals like those of the Maastricht fiscal convergence criteria, which require the primary deficit and the debt ratio to not exceed 3 and 60 percent of GDP, respectively.

Assume that the policy goals are summarized by the following infinite-horizon loss function:

$$\mathfrak{L}_0 = \sum_{t=0}^{\infty} \beta^t \mathrm{E}_0 \left\{ - \log(g_t) + \omega \left[\iota(d_t \geq \bar{d}) + \iota(b_t \geq \bar{b}) \right] \right\} , \tag{3}$$

subject to: (i) the budget constraint (1); (ii) $b_t \leq \phi$, according to the definition of ϕ given in (2) and a given $g^{\min}$; (iii) the Markov chain $\mathcal{Q}(q_{t+1}; q_t)$; and (iv) b_{-1} given . In (3), E_0 is the conditional expectation operator and $\beta \in (0, 1)$ a discount factor; ι is an indicator function equal to 1 if the condition stated in its argument occurs, and equal to 0 otherwise. The parameters $\bar{d}$ and $\bar{b}$ are "upper desirable limits" on d_t and b_t, externally imposed to the fiscal authority, and $\omega \geq 0$ is a penalty parameter capturing the adverse political consequences of exceeding those limits.

The term $-\log(g_t)$ captures the perceived benefits from government outlays and induces an outlay-smoothing effect similar to the one that helps Mendoza and Oviedo (2006a) to explain the procyclicality of fiscal policy in developing countries. As in social choice theory, concave preferences over g_t reflect either that opportunistic policymakers benefit from rents that are proportional to fiscal expenditures or that benevolent policymakers internalize the welfare derived by residents from the consumption of public goods.

Calibration

The foregoing model is calibrated to the 1985-2006, Costa Rican fiscal variables of the central government. The starting point is $\hat{q}_t$, the empirical counterpart of $[\tau_t, R_t, \Gamma_t]'$. By resorting to Tauchen and Hussey's (1991) algorithm, a Markov chain of twelve states $\mathcal{Q}(q_{t+1}; q_t)$ approximates the statistical properties of the exogenous state variables in actual data, i.e., $\{\hat{q}_t\}_{t=1985}^{2006}$. Table 1 shows the implied statistical moments of τ_t and $\mathcal{R}_t$.[2]

To guarantee that the unconditional mean values of b_t and g_t match their empirical counterparts, β is set equal to 0.981 and the mean value of R_t is set to 1.065. Following the Maastritch fiscal criteria and considering that the size of the central government is about 2/3 of the total size of the Costarrican government, $\bar{d} = 0.02$ and $\bar{b} = 0.40$. $g^{\min}$ is set equal to two-and-a-half standard deviations below the mean in the data: the observed mean value of g_t is equal to 0.130 and $g^{\min} = 0.086$. This value of $g^{\min}$, along with the states of the Markov chain, imply that $\phi = 0.502$. Finally, $\omega = 0.01199$ is the minimum value of the penalty parameter that reduces to zero the probabilities $\Pr[d_t > \bar{d}]$ and $\Pr[b_t > \bar{b}]$, so $b_t \ll \bar{b}$ and $d_t \ll \bar{d}$ almost surely $\forall t$. As $\bar{b} < \phi$, the economy is always able to honor its public debt and consequently, the fiscal policy is sustainable.

[2]The Costa Rican data, along with the used Markov chain are available from the author upon request.

4 Rising Debt Ratios with Sustainable Fiscal Policy

The constrained loss-minimization problem is solved by formulating a discrete-state dynamic programming problem. The state space are 500 equidistant values of $b_t \in [0.1, \phi]$, along with the 12 triples of q_t of the Markov chain. The controls are g_t and b_t; the pay-off function is the negative of the instantaneous loss function in (3); last, the budget constraint (1) and the transition probability matrix of the Markov chain $\mathcal{Q}$ are the states' laws of motions.

Let π^∞ represent the limiting distribution of the states (b_t, q_t). Table 1 shows the moment statistics implied by π^∞ and Figure 1a shows the induced marginal limiting distribution of b_t. The figure shows that $\Pr[b_t > \bar{b}]$=0, and therefore $\Pr[b_t > \phi]$=0. Thus, by the the definition of the NDL, the fiscal policy represented by $g_t = \tilde{g}(b_{t-1}, q_t)$ and $b_t = \tilde{b}(b_{t-1}, q_t)$ poses no fiscal risk: the government is always able to repay its debt!

Can this policy generate short- to midterm increasing public debt paths? Two computable objects can answer this question: (a) the "forecasting functions" of b_t, which represent the model implied conditional mean of the debt ratio given an initial state (b_{-1}, q_0); and (b) a fan chart, which was recently introduced in the literature by Celasun et al. (2006) to represent the results of a large number of simulations of equation (1). Typically, the simulations consider a distribution of shocks affecting the debt ratio and a reaction function of the primary balance to the debt level, the latter being the empirical counterpart of $\tilde{g}(b_{t-1}, q_t)$ and $\tilde{b}(b_{t-1}, q_t)$ in the model.

Starting with the first exogenous state and five initial debt ratios ranging between 0.2 and 0.4 (=$\bar{b}$), Figure 1b shows the corresponding forecasting functions. When $b_{-1} = 0.2$ ($b_{-1} = 0.4$), the model predicts a time-increasing (time-decreasing) debt ratio. More generally, as the forecasting functions represent conditional means, all these functions converge to the unconditional mean of b_t, $\mu(b)$, shown in Table 1. Therefore, any initial debt ratio such that $b_{-1} < \mu(b)$ generates time-increasing debt ratios. Increasing or decreasing ratios, however, cannot be interpreted as signals of fiscal policy unsoundness for it has been shown that debt default is is an impossible event in the modelled economy.

The uninformativeness of the slope of the time-path of public debt to signal unsustainability is not a result particular to the loss function specified in (3). Any fiscal policy that generates a unique unimodal distribution of b_t with a support included in $(-\infty, \phi]$ can lead to the same conclusion.

The fan chart in Figure 1c arises from 1000 simulations of $\mathcal{Q}$ and the use of the optimal policy functions to describe the dynamics of the endogenous state variables. The initial debt ratio is $b_{-1} = \bar{b}/2 = 0.20$. From lighter to darker, the colored areas show deciles at 20, 40, 60 and 80 percent confidence intervals around the median projection; it can be inferred from the chart, for instance, that the probability of observing a rising debt ratio is approximately equal to 90%.

The results depicted in Figures 1a to 1c lead to the conclusion of this paper. Public debt ratios are expected to rise if the actual debt ratio is below its unconditional mean. Increasing debt ratios are perfectly consistent with a sound fiscal policy that, by construction, rules out debt default.

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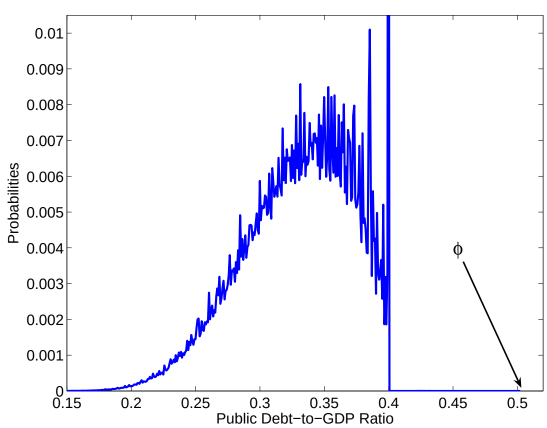
Table 1: Unconditional Moments Implied by the Limiting Distribution of the State Variables

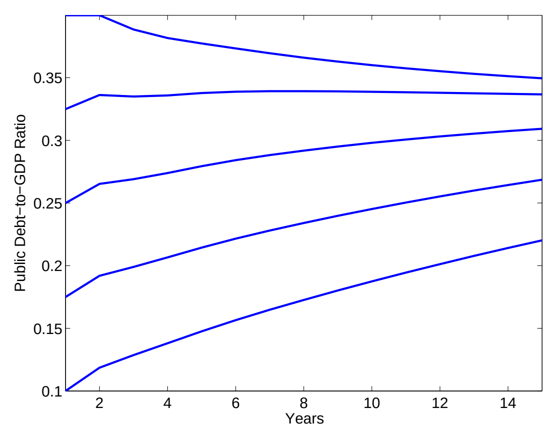
Variable (x) (GDP ratios, except $\mathcal{R}_t$)	$\mu(x)$ $\times 100$	$\sigma(x)$ $\times 100$	$\rho(x)$	$\rho(x,y)$	
				$y = \tau$	$y = \mathcal{R}$
Fiscal revenue (τ_t)	13.2	5.7	0.62	1.00	-0.19
Growth adjusted int. rate ($\mathcal{R}_t - 1$)	1.7	3.5	0.21	-0.19	1.00
Public debt (b_t)	33.1	13.0	0.96	-0.24	0.02
Non-interest outlays (g_t)	12.6	5.1	0.75	0.52	-0.42
Primary balance ($-d_t$)	0.6	125.3	0.54	0.61	0.18

Notes: $\mu(x)$, $\sigma(x)$, and $\rho(x)$, stand for the mean, standard deviation, and autocorrelation of x. $\rho(y,x)$ is the contemporaneous cross correlation between y and x.

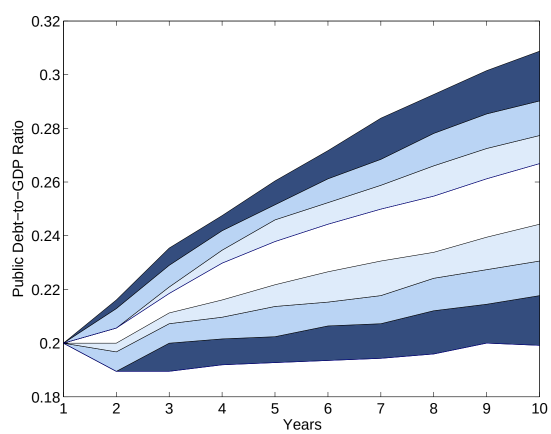
Figure 1: Public Debt-GDP Ratio: Limiting Marginal Distribution, Forecasting Functions, and a Fan Chart



(a) Marginal Distribution of b_t



(b) Forecasting Functions of b_t



(c) Fan-Chart of b_t