



# Fiscal limits in developing countries: A DSGE Approach



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## ABSTRACT

This paper studies fiscal limits in developing countries using a dynamic stochastic general equilibrium (DSGE) approach. Distributions of fiscal limits, which measure a government's capacity to service its debt, are simulated based on macroeconomic uncertainty and fiscal policy. The analysis shows that expected future revenue plays an important role in explaining the low fiscal limits of developing countries, relative to those of developed countries. Large devaluation of real exchange rates can significantly reduce a government's capacity to service its debt and lower the fiscal limits. Temporary disturbances, therefore, can shift the distribution of fiscal limits and suddenly change perceptions about fiscal sustainability.

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## 1. Introduction

Sovereign debt of developing countries generally perceived as riskier than that of developed countries with the exception of the recent European debt crisis. Developing countries with low debt-to-GDP ratios can have much lower credit ratings than developed countries with high debt-to-GDP ratios, as documented in Alvarado et al. (2004), Hausmann (2004), and Reinhart et al. (2003). For example, Belgium, the United Kingdom, and the United States all had government debt-to-GDP ratios over 0.85 in 2012 while maintaining sovereign ratings at or above AA. At the same time, Argentina and Ecuador had much lower debt-to-GDP ratios at 0.38 and 0.22 in 2012, but with ratings of only B and B– (Standard & Poor's (2013)).<sup>1</sup> Fiscal limits, defined as the maximum debt level a government is able to service, are generally lower in developing than developed countries.

Using a dynamic stochastic general equilibrium (DSGE) model, this paper studies several factors that shape fiscal limit distributions in developing countries. Fiscal limits are computed as the expected discounted sum of maximum primary surplus that can be generated in the future. The model, incorporating important economic and fiscal policy shocks, is used

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<sup>1</sup> The debt ratios reported here are computed from general government gross debt, taken from the database of the World Economic Outlook (International Monetary Fund (2016)). The data of general government net debt are not available for Argentina and Ecuador. The net government gross debt-to-GDP ratios for Belgium, the U.K., and the U.S. were 0.62, 0.77, and 0.79 in 2012.

to simulate a distribution of fiscal limits, conditional on an initial state. The fiscal limits simulated are state-dependent and uncertain, depending on the underlying macroeconomic fundamentals and shock processes. To demonstrate how our approach can be applied, we fit the model to the Argentina's post-default data since 2004 and estimate several structural and shock parameters. A simulated fiscal limit distribution can then be used to assess sovereign default probability for a given debt level of a country.

In our framework, whether a government defaults each period depends on if the current debt exceeds a realized effective fiscal limit, drawn from the simulated distribution. This means that fiscal limits or debt thresholds to trigger a default decision are uncertain. In reality, sovereign default is a political decision that may or may not be grounded in economics.<sup>2</sup> In our modeling, while sovereign default is a stochastic event, its probability rises as a government becomes more indebted as observed in reality. Different from the strategic sovereign default approach of [Eaton and Gersovitz \(1981\)](#), in which a utilitarian government accounts for some economic costs in making default decisions (e.g., [Aguiar and Gopinath \(2006\)](#), [Arellano \(2008\)](#), [Yue \(2010\)](#)), the DSGE framework adopted here is convenient for incorporating economic shocks and conducting policy analysis.

Our analysis highlights two factors important for explaining the relatively low fiscal limits in developing countries. Revenue collection, characterized by the maximum effective tax rates that can be implemented, plays an important role in determining fiscal limits. Due to inefficient tax collection systems, tax evasion, and large informal sectors, developing countries on average have much lower effective tax rates than developed countries ([International Monetary Fund \(2011\)](#)). [Callen et al. \(2003\)](#) estimate that the effective tax rate for emerging markets outside eastern Europe is only 10%, much lower than the average of industrial countries, which exceeds 30%. A smaller tax base has been recognized to contribute to higher sovereign default risks in developing countries (e.g., see [Hausmann \(2004\)](#)). Our analysis quantifies the impact revenue collection has on fiscal limits: a one-percentage point increase in the maximum effective tax rate can raise the mean of the distribution of fiscal limits by almost 12% of GDP for Argentina.

Another factor is real exchange rate fluctuations for developing countries that rely heavily on external borrowing. The literature emphasizes the balance-sheet effect, where a substantial devaluation increases government liabilities in terms of domestic goods prices and therefore sovereign default risks. We show that a large devaluation not only changes the state of the economy at the current period, but also spills over into future periods, both of which lower the fiscal limits and constrain a government's capacity to service its debt. Temporary disturbances in the exchange rate can move the distribution of fiscal limits and suddenly change perceptions about fiscal sustainability. This is consistent with the argument made in [Calvo et al. \(2004b\)](#) in explaining Argentina's 2001 default: a steep real depreciation led by sudden stops turned an otherwise sustainable fiscal position into an unsustainable one in an economy with heavily dollarized liabilities.<sup>3</sup> We also show that higher volatility of real exchange rates leads to a more dispersed distribution of fiscal limits, making sovereign default a more likely event.

Our analysis is related to a growing literature on fiscal limits or debt sustainability assessment, accounting for interactions between macroeconomic conditions and fiscal policy. [Celasun et al. \(2007\)](#) propose a "fan-chart" algorithm to simulate debt distributions using an empirical framework that captures debt interactions with macroeconomic shocks. Motivated by [Bohn \(1998\)](#); [2008](#), [Ghosh et al. \(2013\)](#) estimate fiscal limits by imposing the debt sustainability condition that government debt should be expected to converge to some finite share of GDP under historical fiscal reaction functions. Also, in response to the recent European debt crisis, several recent papers estimate fiscal limits and assess fiscal crisis probabilities in the context of monetary union (e.g., [Daniel and Shiamptanis \(2012\)](#); [2013](#) and [Polito and Wickens \(2015\)](#)). Lastly, similar to our general equilibrium approach, [Buffie et al. \(2012\)](#) assess fiscal sustainability for developing countries with external debt, but they assume exogenous risk premia and do not allow for sovereign default risks as modeled here.

## 2. Model

The model is a small open, real economy with two production sectors for nontradables and tradables (denoted by  $N$  and  $T$ ). The two-sector structure is necessary to have the endogenous real exchange rate. To enhance the empirical relevance of simulated fiscal limits, later we resort to Bayesian estimation for some parameter calibration. Thus, certain rigidities, shown to be important in the DSGE literature to match data, are incorporated, including capital adjustment costs and labor mobility friction. Also, four policy and structure shocks—total factor productivity (TFP), spending and tax policy, and terms of trade—are added as they are important in driving economic fluctuations. [Appendix A](#) lists the equilibrium conditions of the model.

<sup>2</sup> For example, the gross general debt-to-GDP ratio was only 0.22 in 2008 when Ecuador defaulted in 2008. Ecuador's President Correa called foreign debt immoral and decided to default on its \$3.9 billion external sovereign debt while holding \$5.7 billion of international cash reserve from oil receipts. This default was generally perceived as driven more by a political motivation and less by an economic one.

<sup>3</sup> Another important factor explains the relatively high risk of sovereign debt in developing countries is "debt intolerance" resulting from poor credibility and a default history, as emphasized in [Reinhart et al. \(2003\)](#). Our analysis does not explore this factor.

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