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Macroeconomic volatility, debt dynamics, and sovereign interest rate spreads

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Abstract

While the relationship between volatility and risk is central to much of the financial literature it has not been incorporated systematically into assessment of sovereign debt sustainability. This paper attempts to fill this gap by studying how the probability distribution of sovereign debt to GDP ratios depends on the stochastic properties of underlying macroeconomic variables. Using right-hand tail of the distribution as a measure of the risk we are able to show how the volatility of the underlying variables as well as potential interactions between them influence country risk.

JEL classification: C15; F34

Keywords: Macroeconomic volatility; Debt dynamics; Sovereign spreads

1. Introduction

The value of bonds issued by emerging markets has grown rapidly during the course of the last 20 years, reaching 3.7 trillion USD in 2004 and becoming one of the primary devices for satisfying emerging market financing needs.[1] With improving economic conditions and increased globalization of financial markets, many emerging markets have better access to capital

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[1] Moody's estimate.

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markets and consequently have accumulated more debt to finance their economic activities. Despite this increased importance of sovereign debt, there are relatively few studies that have tried to determine the pricing behavior of investors for this asset class.

The existing literature has examined emerging bond market spreads empirically as a function of different fundamentals.[2] Standard macroeconomic variables, such as real GDP growth, various debt ratios, international reserves, and international interest rates, have been found to be significant. Although the theoretical reasons for including these variables are not always spelled out, the underlying notion is that they are all related to the probability of default.

In this paper we argue that second moments of macroeconomic variables underlying the evolution of sovereign debt play a fundamental role in explaining bond spreads. Although the finance literature regularly emphasizes variances and covariances as crucial variable for pricing of financial assets, to our knowledge there are no studies that have introduced these aspects of macroeconomic variables as explanations of sovereign bond spreads.[3]

In theory there are two possible influences of macroeconomic volatility on bond spreads.[4] One says higher volatility increases the demand for international borrowing to help smooth consumption (Eaton and Gersovitz, 1981), whereas another argues that volatility induces higher default risk, reduces the debt/GDP threshold (Catao and Kapur, 2004), and thereby increases the interest rate. Our empirical work supports the latter view that second moments of macroeconomic variables help explain a significant portion of sovereign spreads.

The link between macroeconomic indicators such as real growth rates, debt ratios, etc. and sovereign bond spreads is often rationalized with reference to the literature on debt sustainability. This literature can be divided into two strands. The first, which looks at the asymptotic properties of the evolution of debt, and the second, which is often policy focused, and typically investigates the implications of alternative macroeconomic scenarios for the expected path of internal or external debt.[5,6]

Particularly interesting in this context is the stress-testing approach in IMF (2002), which comes close to what we propose in this paper. Our basic hypothesis is that the riskiness of a sovereign bond depends not only on the expected future path of the debt ratio, but also on its entire probability distribution, particularly its right-hand tail.[7] Even if the expected (*i.e.* the most probable) time path of a country's debt looks sustainable, it is possible that some realizations of the underlying variables will bring it to levels that are considered by creditors to be 'too high'. The likelihood of such realizations depends on the variances and covariances of the underlying

[2] Edwards (1986), Eichengreen and Mody (1998), and Cline and Barnes (1997).

[3] Volatility parameters have been introduced in models estimating the probability of default. See, for example, Catao and Kapur (2004), Eaton and Gersovitz (1981), and Peter (2002).

[4] See Catao and Kapur (2004) for an analysis of the theoretical link between volatility of macroeconomic variables and the probability of default.

[5] See Hamilton and Flavin (1986), Trehan and Walsh (1991), Kremers (1989), Hakkio and Rush (1991), Wilcox (1989) and Ahmed and Rogers (1995) among others.

[6] See IMF (2002), Goldstein (2003), and Goldfajn (2002) among others.

[7] IMF (2003) has mentioned the approach we are suggesting for assessing sustainability, but they do not use it as mainstay in their sustainability analysis and they do not develop the idea in detail. Barnhill and Kopits (2003) use the balance sheet approach test about fiscal sustainability under uncertainty through producing density distribution. Garcia and Rigobon (2004) follow a similar approach as ours but calculate a risk indicator based on probabilities that the debt to GDP ratio exceeds certain threshold values. For further discussion of the approach of Garcia and Rigobon see Sections 2.3.3 and 3.1.3.