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A Probabilistic Approach to Fiscal Space and Prudent Debt Level: Application to Low-Income Developing Countries

By Olumuyiwa Adedeji, Calixte Ahokposi, Claudio Battiati, and Mai Farid

I N T E R N A T I O N A L M O N E T A R Y F U N D

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Strategy, Policy, and Review Department

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Prepared by Olumuyiwa Adedeji, Calixte Ahokpossi, Claudio Battiati, and Mai Farid¹

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Abstract

What constitutes *fiscal space* or a *prudent level of debt* to conduct countercyclical policy while ensuring debt sustainability? This paper addresses the question by exploring the relationship between debt dynamics, and the probabilistic distribution of the primary balance and the effective interest rate. This proposed approach is useful in situations where the lack of relevant data makes it difficult to estimate detailed fiscal reaction functions. Applying this approach to Low-Income Developing Countries (LIDCs) and based on various debt ceiling assumptions, we find that about 60 percent of these countries presently have fiscal policy space to address adverse shocks, subject to the availability of domestic and external financing. Countries with strong institutional capacity tend to have more fiscal space, and countries with weak institutional capacity, mostly countries in conflict and fragile states, tend to lack fiscal space.

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Abbreviations and Acronyms

CEMAC	Central African Economic and Monetary Community
CPIA	Country Policy and Institutional Assessment
DC	Debt Ceiling
DSF	Debt Sustainability Framework
ECCU	Eastern Caribbean Currency Union
HIPC	Heavily Indebted Poor Countries
IMF	International Monetary Fund
LICs	Low-Income Countries
LIDCs	Low-Income Developing Countries
MDRI	Multilateral Debt Relief Initiative
VaR	Value at Risk
WAEMU	West African Economic and Monetary Union
WB	World Bank
WEO	World Economic Outlook

I. INTRODUCTION

Over the last decade, public debt ratios in Low-Income Developing Countries (LIDCs) have declined substantially, particularly following debt relief received in the context of the International Monetary Fund (IMF) and World Bank Heavily Indebted Poor Countries (HIPC) initiative.² Public debt is already on the rise in some LIDCs, as they undertake much needed infrastructure investment or countercyclical measures in the face of slowing growth.³ But how much borrowing room do these countries have? This important policy question is germane to assessing fiscal space in LIDCs.

Fiscal space can be defined as “the availability of budgetary room that allows a government to provide resources for a desired purpose without any prejudice to the sustainability of a government’s financial position” (Heller, 2005). A number of alternative definitions have been proposed to provide concrete guidance for policy analysis, with a focus on fiscal sustainability. In practical terms, fiscal space is typically approximated by the gap between a certain debt ceiling and the actual debt. Debt ceiling (or DC hereafter), which is critical for assessing fiscal space, is defined as the debt level beyond which the debt position could bring about macroeconomic risks.⁴ Given the vulnerability of LIDCs to shocks, it is desirable that the fiscal framework allows for a debt buffer (*desirable debt buffer*) such that in the event of shocks, public debt would still remain below the DC.⁵ As a result, if countries are guided by a more *prudent debt level*, i.e., the DC adjusted for the *desirable debt margin*, they can accommodate adverse shocks while containing the risk of breaching the DC in the process.

In this paper, we define a country’s *fiscal space* as the difference between a *prudent debt level* and the actual public debt to GDP ratio.⁶ It should be noted that this paper focuses on public debt level and the desirable buffer with respect to a given debt ceiling (one element of fiscal space), abstracting from liquidity/rollover risks (IMF, 2013 and 2015). In other words, low debt level does not necessarily translate into fiscal space if financing options are limited, or if the structure of the debt entails some vulnerabilities. Limited availability of financing may constrain the ability of a government to either cut taxes or increase expenditures in response to adverse shocks.

The first contribution of this paper is that it proposes a probabilistic methodology for estimating the *desirable debt margin for a given debt ceiling*, *deriving the associated prudent debt level* and *fiscal space* without explicitly estimating fiscal reaction functions and determinants of interest rates. This approach is helpful in circumstances where data

² See definition of LIDCs in: “*Proposing New Grouping in WEO Country Classifications: Low-Income Developing Countries*” (IMF 2014a).

³ See “*Macroeconomic Developments in Low-Income Developing Countries: 2014 Report*” (IMF 2014b).

⁴ At this point, debt is not necessarily unsustainable, but there is significant stress resulting in accumulation of arrears, high risk premium on external borrowing due to rising risk of default, or other signs of difficulty in servicing public debt.

⁵ Low-income countries (LICs) are subject to a wide variety of exogenous shocks—sharp swings in the terms of trade, export demand, natural disasters, and volatile financial flows. The amplitude and frequency of such shocks for low-income countries tend to be higher than in advanced and emerging market countries (see IMF (2011) and Dabla-Norris and Bal Gündüz (2014)).

⁶ This assessment is illustrative and should not be taken as Fund’s position on desirable debt margin.

limitations preclude other approaches described below. The second contribution of this paper is that it applies the methodology to LIDCs, a group with limited estimation of fiscal space in the literature.

Our proposed approach parallels Ostry and others (2010), where the authors compute the available fiscal space for a panel of 23 advanced economies as the difference between the current level of public debt and the DC implied by the country's historical record of fiscal adjustment. They determine the DC using a combination of the fiscal reaction function (the primary balance) and the effective interest rate (interest rate—output growth rate differential). However, this approach cannot be applied to LIDCs because of data limitations. On the one hand, for the effective interest rate, we do not have market interest rates or a model-implied endogenous interest rate taking into account the rising risk of default as debt approaches its DC. The model-based interest rate estimation requires various assumptions about the risk-free interest rate and the distribution of the shocks to the primary balance. In this paper, the proposed framework for ascertaining *desirable debt margin and prudent debt level* is purely probabilistic and uses the distribution of the primary balance and the effective interest rate, which is similar to the “value at risk” (VaR)⁷ and uncertainty⁸ approaches proposed by Tanner (2013) and Barnhill and Kopits (2003). To illustrate how our proposed approach would work for LIDCs, we use as a DC the public debt threshold for low-income countries (LICs) developed by the IMF and the World Bank (WB) and debt-related fiscal rules from selected LIDCs.^{9,10} The use of these thresholds as debt ceilings is for illustrative purpose. The IMF/WB thresholds are specific to the quality of policy environment in each country. The higher the quality of policy environment, the higher the debt level tolerated by the country before debt stresses emerge.¹¹ The fiscal rules used as DC are legislative DC from various countries.¹²

The results show that under such DC assumptions, about 60 percent of all LIDCs have fiscal space in the sense that their debt levels are below *prudent debt levels*. They can safely engage in countercyclical fiscal policy (subject to the availability of external and domestic financing) with a low risk of breaching their debt ceilings. It should, however, be noted that the

⁷ This approach constitutes an application of *VaR* to the debt stabilizing primary balance, where the growth adjusted interest rate is assumed to be the risk variable. We derive the standard deviation of the growth adjusted interest rate from the historical implicit values for each country.

⁸ Adverse shocks can take a country above its DC from a seemingly comfortable initial position. Conversely, a favorable shock can reestablish solvency from an initially unfavorable position. Uncertainty is thus a critical element in ascertaining *prudent debt margin*. A negative shock is defined as a bad realization of the debt stabilizing primary balance, one which is associated with a 5 percent probability (a tail event).

⁹ See *Revisiting the Debt Sustainability Framework for Low-Income Countries* (IMF and WB, 2012). The joint IMF/World Bank debt sustainability framework for LICs defines indicative thresholds of public debt and debt service indicators above which concerns of debt distress are high enough to trigger discussions on the sustainability of public debt (the thresholds are not debt ceilings in the sense of fiscal rules). This framework together with the Fund's Debt Limits Policy are tools that the Fund uses to assess borrowing capacity.

¹⁰ Note that our approach is applicable to any debt ceiling. The ones from the IMF/WB framework and the fiscal rules are only used for illustrative purpose.

¹¹ In this framework, policy-dependent thresholds are derived for each country, based on probabilities that minimize type I and type II errors for the probability that debt distress will occur.

¹² “Fiscal Rules in Response to the Crisis—Toward the “Next Generation” Rules. A New Dataset,” Schaechter and others (2012).

availability of fiscal space does not mean that a country should engage in unproductive investments. A granular look at the results indicates that countries with higher institutional capacity are more likely to have fiscal space as compared to countries with lower capacity.

The rest of the paper is organized as follows: Section II reviews the literature on “prudent debt” and “fiscal space” Section III describes our analytical approach as well as the results of its application to LIDCs. Section IV concludes the paper and draws policy implications.

II. LITERATURE REVIEW

There are different definitions of fiscal space in the literature, and they all tend to focus on fiscal sustainability. In this regard, fiscal space can be broadly defined as a country’s ability to engage in countercyclical policy in the case of a downturn, resulting in rising debt ratios or some depletion of existing financial assets, without jeopardizing debt sustainability. Fiscal space also refers to “the ability of government to make budgetary resources available for desired purposes” (Williams and Hay, 2005). The purposes include scaling up investment to close infrastructure gaps or stepping up social spending for poverty reduction. However, in order to use the concept of fiscal space to undertake analysis, a more precise definition is required.

Different authors have emphasized different aspects of the fiscal space concept by focusing on specific sectors such as health¹³ or public infrastructure (Hulbert and Vammalle, 2014) or on the broader issue of debt sustainability. Ostry and others (2010) show the existence of a nonlinear relationship between fiscal policy and debt, such that the marginal response of the primary balance to debt is significantly weaker at high levels of debt than at more moderate levels. This finding allows them to derive a public DC as the debt level above which the primary balance does not keep pace with the higher effective interest payments. However, most of the attempts to derive a ceiling for the debt-GDP ratio have focused, so far, on advanced economies.¹⁴

With regard to developing countries, fiscal space is usually referred to as the ability to undertake “growth-enhancing investment in physical and human capital that a government can finance with borrowed funds without prejudicing the long-run sustainability of its fiscal position” (Schick, 2009). For operational purposes, the IMF has used as an approach that focuses on “the gap between the actual primary balance and the debt-stabilizing primary balance” (Escolano, 2010).

Prudent debt level and fiscal space are related concepts, as the former is used to determine the latter (Ostry and others, 2010). But what constitutes a prudent debt level is very difficult to pin down precisely in practice (Ostry, Ghosh, and Espinoza, 2015). Saxegaard (2014) indicates this is because the prudent debt level depends on many country-specific circumstances as well as factors outside its control: debt stock, gross financing requirement, composition of debt, debt path, drivers of new borrowing, credibility of fiscal policy, long-term fiscal pressures, and risk appetite of market participants. Nonetheless, policymakers

¹³ Along this line of research, see for instance Williams and Hay (2005) and Novignon and Novignon (2015).

¹⁴ In this respect, see also Collard, Habib, and Rochet (2015) and Ostry, Ghosh, and Espinoza (2015).

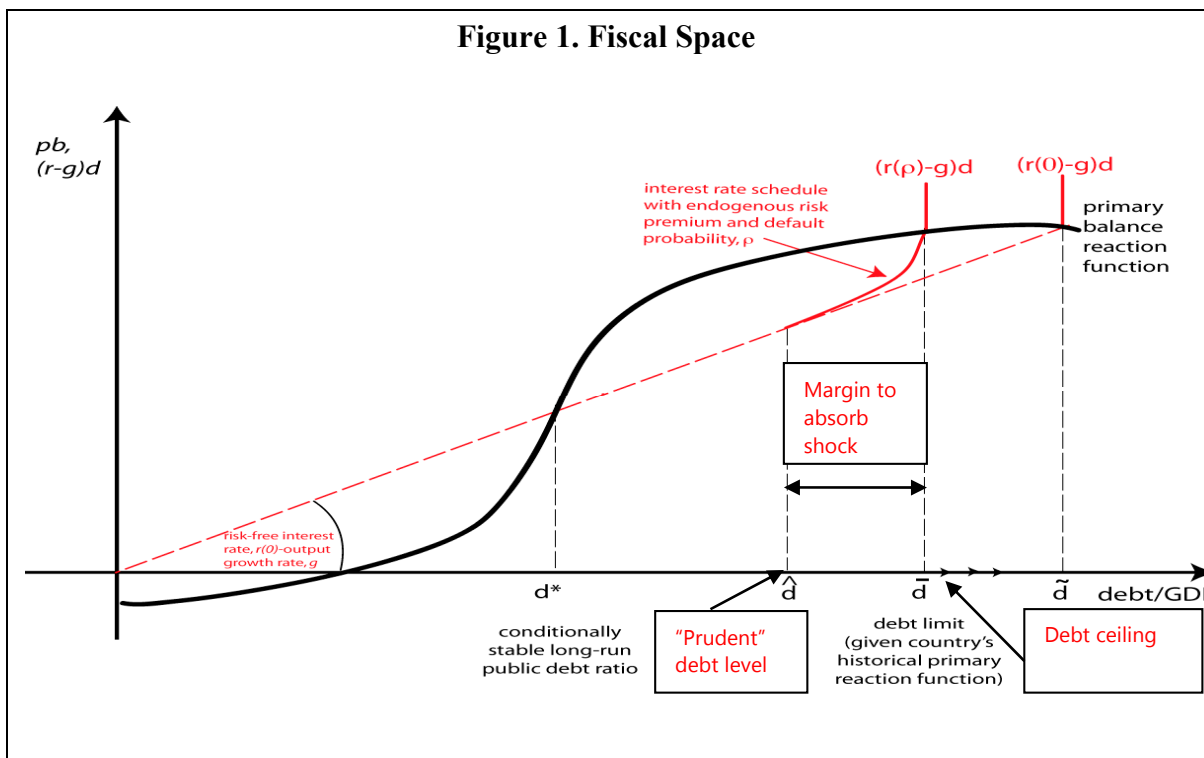
need some indicative ceiling, in particular, in situations where a rapid buildup of debt could trigger adverse market reactions.

Saxegaard (2014) proposes a probabilistic approach to determine a prudent debt level below the debt sustainability level. The prudent debt level is calculated assuming that revenue collection was two standard deviations lower than under the baseline for the next 10 years. The author also estimated the prudent debt level by simulating a VAR model to create a stochastic projection of debt for different path of the primary deficit.

III. ESTIMATING FISCAL SPACE AND PRUDENT DEBT LEVEL

A. Analytical Framework for Measuring Fiscal Space and Prudent Debt Level

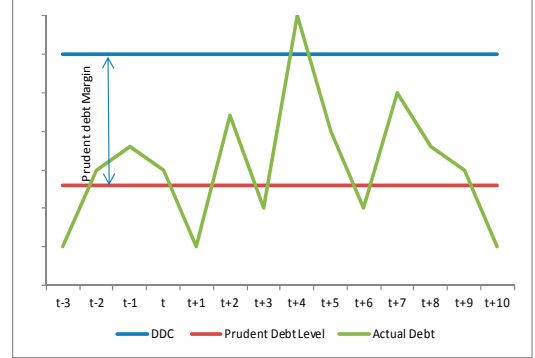
Figure 1 borrowed from Ostry and others (2010) draws a parallel between their concept of fiscal space and our approach. However, the estimation approach proposed in this paper is purely probabilistic, while the one in Ostry and others (2010) is based on the determinants of fiscal behavior and interest rates.



The point \bar{d} in the figure represents the *DC* above which, without an extraordinary fiscal effort, debt becomes unsustainable given the country's historical primary balance behavior. This *DC* also accounts for the possibility that creditors will demand an increasing risk premium as debt approaches this ceiling. Given the endogenous reaction of the interest rate to rising default risk, there is also a debt level at which markets start to question the sustainability of public finances, the point \hat{d} in the figure. The latter is equivalent to the

prudent debt level in our framework, i.e., a debt level below \bar{d} so that in the event of shock, the probability of debt rising above \bar{d} is small. It is a debt level such that questions of debt distress or debt sustainability are not acute yet.

The proposed approach determines a *prudent debt level* that would accommodate an increase in debt resulting from a shock, without jeopardizing debt sustainability. In line with the debt ceilings literature, we are focusing on debt dynamics around the *prudent debt level* (d^p). Once debt is around d^p , the goal should be to bring it down or at a minimum to stabilize it at d^p so that in the event of a shock, the probability of breaching the policy-dependent DC (d^{DC}) is small. We define *desirable debt margin* as the difference between the DC and the *prudent debt level*. The typical debt dynamic describes new debt stock as a function of the existing debt stock, the real interest rate and the new primary balance, which, if positive, would contribute to reducing the existing debt stock.



$$d_{t+1} = (1 + \lambda_{t+1})d_t - pb_{t+1}, \quad (1)$$

where $\lambda = \frac{r-g}{1+g}$, r = real interest rate and g = real GDP growth.

The *prudent debt level* and *desirable debt margin* depend on the dynamic of growth and real interest rate as capture by λ . From equation (1), the primary balance that would stabilize debt at d^p can be derived as: $pb^p = (\lambda)d^p$. A high λ would typically correspond to negative shocks to growth or/and to interest rate (high interest rate). Because λ is a random variable (real interest rate and growth outcomes are stochastic), the actual debt stabilizing primary balance would be different from the ex ante debt stabilizing primary balance, which typically assumes that λ would be at its expected value μ_λ . Over the long term, maintaining the primary balance at $pb^* = (\mu_\lambda)d^p$ will stabilize debt around d^p . However, over the short and medium terms, there may be substantial deviations of actual debt from d^p , when λ is very high and the fiscal adjustment required to bring the debt back to d^p immediately is very large and unrealistic or undesirable.

To guard against situations when the ex post debt would reach levels that trigger concerns of macroeconomic risks, it would be safe to set the *prudent debt level* d^p such that, in the event of a large shock to λ , there is only a small probability (α) that ex post debt (d^α) would exceed the debt ceiling (d^{DC}):¹⁵

$$prob(d^\alpha > d^{DC}) = \alpha \quad (2)$$

Assuming that the country sticks to its debt stabilizing primary balance, then

¹⁵ See “Revisiting the Debt Sustainability Framework for Low-Income Countries” (IMF and WB, 2012).

$$d^\alpha = (1 + \lambda^\alpha)d^p - pb^* \quad \text{or}$$

$$d^\alpha = (1 + \lambda^\alpha)d^p - (\mu_\lambda)d^p = (1 + \lambda^\alpha - \mu_\lambda)d^p \quad (3)$$

Plugging (2) into (3) results in:

$$prob[(1 + \lambda^\alpha - \mu_\lambda)d^p > d^{DC}] = \alpha \quad \text{or}$$

$$prob\left[\frac{\lambda^\alpha - \mu_\lambda}{\sigma_\lambda} > \frac{\frac{d^{DC}}{d^p} - 1}{\sigma_\lambda}\right] = \alpha \quad (4)$$

Where σ_λ is the standard deviation of λ .

Following Tanner (2013), we apply the “*VaR*” to the debt stabilizing primary balance. In order to determine the primary surplus to GDP ratio that is to stabilize debt in a future year $t+1$ and in the presence of uncertainty associated with future realizations, where the growth adjusted interest rate is assumed to be the risk variable. The growth adjusted interest rate $(r - g)/(1 + g)$ remains a random variable. Therefore, the debt stabilizing primary balance pb^* itself is a random variable (equation (3)). Assuming that the growth adjusted discount factor is normally distributed then the debt stabilizing primary balance is also normally distributed with a mean σ_λ and standard deviation μ_λ . Accordingly, we derive the standard deviation of the growth adjusted interest rate from the historical implicit values for each country.

Using this approach, we derive the debt stabilizing primary balance and hence the *prudent debt level* consistent with country-specific historical growth adjusted interest rate ratios (equation 4).

B. Estimation Approaches

From equation (4), we estimate the *prudent debt level* using two approaches: a parametric approach assuming that λ is normally distributed, and a non-parametric simulation of the distribution of λ . We apply both approaches to a set of 58 countries designated as LIDCs.¹⁶ The estimation is done using individual country data and the parametric approach is the most straightforward to implement. However, the estimation could suffer from small sample bias and the assumption that λ is normally distributed may not hold for all countries. In this regard, the non-parametric estimation approach based on bootstrapping is a credible alternative. It also serves a robustness check for the parametric approach.

¹⁶ We exclude Afghanistan and Somalia from our analysis for lack of data covering most of the period under analysis.

Parametric approach

Assuming that λ is normally distributed with mean μ_λ and variance σ_λ^2 , and that $\alpha=0.05$,¹⁷ then from (4) we can derive that:

$$1.645 = \frac{\frac{d^{DC}}{d^p} - 1}{\sigma_\lambda}$$

$$\text{Or } d^p = \frac{d^{DC}}{(1+1.645*\sigma(\lambda))} \quad (5)$$

Where 1.645 is the inverse normal distribution for the parameters defined above.

In equation (5), the prudent debt is a function of the variance of λ and the DC . For each country, we determine the prudent debt by using the country-specific DC and the standard deviation of country-specific sample. For the latter, we use a bootstrap standard deviation as an estimate for the true standard deviation.

Non-parametric approach

$$\text{Equation (4) can be written as: } \text{prob} \left[d^p > \frac{d^{DC}}{(1+\lambda^\alpha - \mu_\lambda)} \right] = \alpha$$

In this equation, d^{DC} is known for each country (as explained above). After approximating μ by the bootstrapped sample mean, we conduct a stochastic simulation by drawing with replacement λ 10,000 times from the country-specific sample and calculate the equivalent prudent debt for each draw: $d^p = \frac{d^{DC}}{(1+\lambda^\alpha - \mu_\lambda)}$. From the distribution of d^p obtained, we take the cutoff such that the right tail of the distribution represents is equal to α .

A key characteristics of the methodological approach adopted in this paper is that countries with the same level of public debt could vary in their fiscal space, depending on the distribution of their λ and their DC . Another important feature of our methodological approach is that by focusing on the distribution of λ , it only targets shocks to growth and interest rates in principle (see the formula of λ in equation 1). Explicitly modeling other shocks (exchange rate, contingent liabilities, etc.) could increase the prudent debt margins calculated below. But given that λ is derived implicitly in equation 1 (not directly through growth and interest rates data), λ will capture parts of other shocks as well.

Also, a counter-intuitive result of our approach is that, everything else equal (including interest and growth rates), countries with higher DC , i.e., countries with higher policy implementation capacity, should aim for larger *prudent debt margin* expressed as a share of GDP. The empirical analysis of public debt in LIDCs illustrates this point. For LIDCs with debt exceeding 25 percent of GDP in a given year, the top decile of the annual increase in

¹⁷ A different level of risk (α) can be specified depending on country circumstances. In particular, when financing opportunities are attractive and projects with high return are available, countries with appropriate economic policy environments may find it optimal to be less conservative in their debt management approach.

debt to GDP is at least 8.9 percent of GDP. For LIDCs with debt lower than 25 percent of GDP top decile debt increase is at least 4.8 percent of GDP. A similar pattern is observed for higher initial debt thresholds (see table below).

Year-to-Year Increase in Public Debt in LIDCs Conditional on Initial Debt Level, 2000–15

	Initial Public Debt (In percent of GDP)					
	< 25	>25	<50	>50	<75	>75
90th Percentile	4.8	8.9	5.3	11.1	7.0	11.5
95th Percentile	7.3	13.6	8.6	18.6	10.1	19.7

C. Empirical Results for LIDCs

We derive *desirable debt margins*, *prudent debt levels* and *fiscal space* for a sample of 58 LIDCs, using the IMF’s World Economic Outlook (WEO) data for general government aggregates over the period 1990–2014, where available. Data availability varies among countries, between 11 and 23 years of observations. For each country, the data consist of GDP growth rates, public debt relative to GDP and primary balances relative to GDP. For each year, the implicit λ is derived from equation (1). Then, the variance of λ and *prudent debt level* are computed.

As many LIDCs have participated in debt-relief initiatives over the sample period, establishing a causal relation between variation in the debt level and an autonomously determined interest rate and growth path (implied by λ) would be challenging. To address this issue, we dropped the years during which specific countries received debt relief in the context of the HIPC initiative and Multilateral Debt Relief Initiative (MDRI).

We note that λ is much more volatile in countries with low capacity as compared to countries with medium and high capacity. This is indicative of the relative stability of macroeconomic policy in latter countries relative to the former. The average level of λ is also sensitive to country capacity. Low capacity countries have a very negative λ , implying that the implicit interest rate on their debt is very small or their average growth rate is high, or a combination of both. The external debt of low capacity countries tends to be mostly concessional and is unlikely to vary much, even in the event of shocks. This suggests that their growth is generally higher, albeit more volatile.

Descriptive statistics of lambda by group of countries

	low capacity	medium capacity	high capacity
Average	-7.82	-2.94	-1.28
Standard Deviation	34.55	17.03	15.42

Using the Shapiro-Wilk normality test, which is appropriate for small samples, we find that for $\frac{3}{4}$ of countries in the sample the assumption of normal distribution for λ cannot be rejected with 95 percent confidence. We also find that the results under the assumption of normality and those under the non-parametric approach are broadly similar. This implies that the results under the assumption of normality are globally robust. At the same time, the non-

parametric approach provides alternative results for situations where the assumption of normality does not hold.

Illustration based on IMF/WB Debt Sustainability Framework (DSF)

The IMF/WB framework uses a number of indicators and thresholds to assess debt sustainability. We will illustrate the application of the methodology proposed in this paper by using as DCs the public debt thresholds provided by the LIC DSF framework, although it is important to note that these are not interpreted as ceilings in the LIC DSF.

The determination of *debt thresholds* in the IMF/WB framework relies on the country classification in terms of their institutional capacity as captured by the World Bank’s Country Policy and Institutional Assessment (CPIA) index. Countries are classified as “high capacity” if their CPIA is greater than 3.75, as “low capacity” if their CPIA is less than 3.25, and “medium capacity” otherwise.¹⁸ Table 5 shows the list of LIDCs and their CPIA classification based on their 2015 CPIA.

For the estimation of *fiscal space*, we classify countries based on the position of their 2015 public debt level relative to their own *prudent debt level* and to their *debt ceiling*:

- We find that close to 60 percent of LIDCs have fiscal space in 2015 in the sense that their public debt was below their prudent debt level (Table 1). In other words, they have room to increase their spending to address adverse shocks (subject to availability of financing) with low probability of exceeding their debt ceiling. For this group of countries, the amount of fiscal space available varies greatly, with some countries having ample fiscal space, and others having limited fiscal space.
- Typically, countries with medium or high quality of institutions tend to have more fiscal space (Table 1). We should note that in general, the absence of fiscal space should not be taken to mean that some form of “fiscal crisis” is imminent, or even likely, but it does underscore the need for credible adjustment plans.
- A little over 40 percent of LIDCs have no fiscal space (Table 1). For the majority of these countries (representing about 30 percent of all LIDCs), their public debt levels exceed not only their *prudent debt levels*, but also their *DC*. For the remaining countries (about 12 percent of LIDCs), their public debts exceed their *prudent debt level* but remains below their DC. Although none of these countries have fiscal space, their situations vary greatly: some of them have public debts that exceed their prudent debt levels moderately, while others exceed their prudent debt levels greatly (including exceeding their DC). On the basis of these illustrative debt ceilings, it would be prudent for these countries to bring their debt below their *prudent debt levels* so as to have space to accommodate shocks without compromising their debt situation.

¹⁸ The DSF threshold for public debt is 49 percent of GDP for low capacity countries, 62 percent of GDP for medium capacity countries and 75 percent of GDP for high capacity countries.

Table 1. Share of Countries by Debt Position—IMF/WB Debt Thresholds
(In percent)

Capacity	Parametric			Non-parametric		
	No Fiscal Space		Fiscal Space - Debt below Prudent Debt Level	No Fiscal Space		Fiscal Space - Debt below Prudent Debt Level
	Debt Exceeding Debt Ceiling	Debt NOT Exceeding Debt Ceiling		Debt Exceeding Debt Ceiling	Debt NOT Exceeding Debt Ceiling	
High	11.1	11.1	77.8	11.1	22.2	66.7
Medium	17.4	8.7	73.9	17.4	8.7	73.9
Low	46.2	15.4	38.5	46.2	15.4	38.5
All LIDCs	29.3	12.1	58.6	29.3	13.8	56.9

Turning to the analysis by country characteristics, we find that countries with low capacity lack fiscal space more frequently (Table 1). These countries are mostly fragile states. They have little tolerance for high debt levels, and more than 60 percent of them have no fiscal space. For medium and high capacity countries, there is no significant difference in the percentage of countries in terms of the classification of their debt position. About three quarters of them have fiscal space (Table 1).

The *desirable debt margin*, i.e., the margin between the *DC* and the *prudent debt level* depends on the volatility λ of and the DC: the higher they are, the higher the *prudent debt margin*. This can be derived from equation 5 above.

$$\text{prudent debt margin} = d^{DC} - d^p = d^{DC} \left(1 - \frac{1}{(1+1.645*\sigma(\lambda))}\right) \quad (6)$$

In the sample of LIDCs, the median country with high or medium capacity needs a *desirable debt margin* of about 10–11 percent of GDP (Table 2). It means that these countries need to set a *prudent debt level* that is 10–11 percent of GDP below their illustrative *debt sustainability ceiling* to ensure that the probability that the country stays under the said ceiling following a shock is 95 percent. For countries with low capacity, the equivalent debt margin is 6–8 percent of GDP. The latter is driven essentially by the volatility of λ (as shown above), which reflects the volatility of macroeconomic outcomes.

Table 2. Median and Mean Desirable Debt Margins
(In percent of GDP)

Capacity	Debt Ceiling	Median		Mean	
		Parametric	Non-parametric	Parametric	Non-parametric
High	75	11.0	11.0	11.7	14.0
Medium	62	10.2	10.5	11.6	11.6
Low	49	8.2	8.8	8.9	10.1

Source: WEO and authors' calculations.

Illustration based on debt-related fiscal rules

An alternative illustration of the proposed methodology is based on some generally used debt-related fiscal rules. The database on fiscal rules built by Schaechter and others (2012) shows that among LIDCs, two currencies unions (WAEMU and CEMAC) have a convergence criteria of public debt not exceeding 70 percent of GDP. Another currency union (ECCU) and four other LIDCs have a rule stipulating that public debt should not exceed 60 percent of GDP. The latter ceiling is also adopted by a number of emerging markets. In this section, we use this rule as the DC for all LIDCs, notwithstanding the possibility that this might be too loose for some LIDCs. This ceiling is close to the one for “medium capacity” countries in the previous section.

On aggregate, the results are similar to what is obtained using the IMF/WB DSF Thresholds in the previous section. About 60 percent of LIDCs have fiscal space based on the two types of DCs, but sets of countries in this group vary slightly (Table 3).

Table 3. Share of Countries by Debt Position—Debt Ceiling of 60 Percent of GDP
(In percent)

	Parametric			Non-parametric		
	No Fiscal Space		Fiscal Space - Debt Below Prudent Debt Level	No Fiscal Space		Fiscal Space - Debt Below Prudent Debt Level
	Debt Exceeding Debt Ceiling	Debt NOT Exceeding Debt Ceiling		Debt Exceeding Debt Ceiling	Debt NOT Exceeding Debt Ceiling	
All LIDCs	25.9	12.1	62.1	25.9	13.8	60.3

Source: WEO and authors' calculations.

The desirable debt margins are also similar to the ones obtained from the IMF/WB DSF thresholds (Table 4). On average, the margins are roughly around 10 percent of GDP, i.e., typically, most LIDCs should have their debt at least 10 percent of GDP below their DC. This is in line with the margin observed in some emerging markets, even though the motivation for the buffer could be different from that of LIDCs.

Table 4. Median/Mean Desirable Debt Margins - Fiscal Rule vs. DSF Ceilings
(In percent of GDP)

	Median		Mean	
	Parametric	Non-parametric	Parametric	Non-parametric
Fiscal Rule	9.8	10.2	10.8	11.7
IMF/WB DSF Ceilings	9.7	9.9	10.4	11.3

Source: WEO and authors' calculations.

The results discussed above (from both the IMF/WB DSF and the debt-related fiscal rules) are subject to some caveats. A key limitation of the methodology used is that it assumes that future trends can be derived from past behavior. Many LIDCs rode the commodities super

cycle of the 2000s and experienced prolonged periods of growth rates higher than the interest rates, which makes it possible to keep the debt dynamics under control without implementing fiscal adjustments. With the end of the commodities super cycle and low international interest rates, fiscal behavior may differ substantially from the one observed during the period covered by the data. Notwithstanding these observations, the results provide some order of magnitude for *prudent debt level* and *desirable debt margin* that are adequate enough to help countries reduce the likelihood of them exceeding their DC.

The interpretation of the results should take into account specific circumstances of each country and other indicators of debt vulnerability. Even if the indicators presented in this paper show that public debt is well below the *prudent debt level*, the composition of debt may still be cause of concern. In this sense, a country with low public debt and where external debt constitutes the largest share of public debt, could still face scrutiny if external debt is very high relative to some relevant thresholds. In this case, a small share of domestic debt could be symptomatic of limited domestic funding opportunity (shallow financial markets).

IV. CONCLUSION AND POLICY RECOMMENDATIONS

Over the last decade, public debt ratios in LIDCs have declined substantially due to debt relief and rapid growth. Given the vulnerability of LIDCs to shocks and the observed rise of public debt in some LIDCs to address infrastructural gaps or to undertake countercyclical measures in the face of slowing growth, it is safe to set a *prudent debt level (the debt ceiling adjustment for a desirable margin)* such that in the event of adverse shocks, public debt would still remain below the DC. The prudent debt level could then be used to assess how much fiscal space is available.

This paper uses a probabilistic approach to derive a *desirable debt margins* and thereby derive *prudent debt levels* and *fiscal space*. This paper illustrates this methodology by applying it to a group of 58 LIDCs, using as debt ceilings the thresholds from the IMF/WB DSF framework and the debt ceilings from fiscal rules generally adopted by LIDCs and some emerging markets. Using 2015 debt data, about 60 percent of LIDCs have fiscal space in the sense that their public debt levels are below *prudent debt levels*. On average, a country should aim at a public debt –to-GDP ratio that is at least 10 percent of GDP lower than the DC. However, these results vary considerably across countries. In general, countries with weaker policy implementation capacity need larger buffers to stay within the DC as compared to countries with higher capacity. As illustrated with IMF/WB DSF thresholds, which vary with country capacity, about 75 percent of countries with high and medium institutional capacity maintain debt levels below both their country-specific *prudent debt level* determined in this paper. In contrast, most countries with weak institutional capacity (essentially countries in fragile situations) do not have fiscal space. These countries without fiscal space need to undertake fiscal adjustments going forward and to step up structural and institutional reforms in order to ensure fiscal sustainability. For countries that are estimated to have fiscal space, the availability of fiscal space should not be interpreted as a license to increase spending and take on large amount of debt, as it is more difficult to rein in spending once it has been scaled up. The *desirable debt margin* and *prudent debt level* are guideposts

to keep low the probability of reaching debt levels that would trigger serious debt sustainability concerns.

The estimated country-specific prudent debt level approach adopted here provides an early warning signal of concerns about the debt position before debt would breach the DC. As a result, the approach highlights the importance of prudent fiscal management to increase the probability that public debt will remain on a sustainable path. This approach provides policymakers with a country-specific prudent debt level that is well below the estimated DC to ensure that fiscal space remains positive and fiscal sustainability is maintained.

Table 5. List and CPIA Classification of LIDCs

Country	Capacity
Afghanistan	low capacity
Bangladesh	medium capacity
Benin	medium capacity
Bhutan	high capacity
Bolivia	medium capacity
Burkina Faso	high capacity
Burundi	low capacity
Cambodia	medium capacity
Cameroon	low capacity
Central African Republic	low capacity
Chad	low capacity
Comoros	low capacity
Congo, DR	low capacity
Congo, Republic of	low capacity
Côte d'Ivoire	low capacity
Djibouti	low capacity
Eritrea	low capacity
Ethiopia	medium capacity
Gambia, The	medium capacity
Ghana	high capacity
Guinea	low capacity
Guinea-Bissau	low capacity
Haiti	low capacity
Honduras	medium capacity
Kenya	high capacity
Kiribati	low capacity
Kyrgyz Republic	medium capacity
Lao P.D.R.	medium capacity
Lesotho	medium capacity
Liberia	low capacity
Madagascar	low capacity
Malawi	low capacity
Mali	medium capacity
Mauritania	low capacity
Moldova	high capacity
Mongolia	medium capacity
Mozambique	medium capacity
Myanmar	low capacity
Nepal	medium capacity
Nicaragua	medium capacity
Niger	medium capacity
Nigeria	medium capacity
Papua New Guinea	medium capacity
Rwanda	high capacity
São Tomé and Príncipe	low capacity
Senegal	high capacity
Sierra Leone	medium capacity
Solomon Islands	low capacity
Somalia	low capacity
South Sudan	low capacity
Sudan	low capacity
Tajikistan	medium capacity
Tanzania	medium capacity
Togo	low capacity
Uganda	high capacity
Uzbekistan	medium capacity
Vietnam	high capacity
Yemen	low capacity
Zambia	medium capacity
Zimbabwe	low capacity

Source: IMF staff

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