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Safe Debt and Uncertainty in Emerging
Markets: An Application to South Africa

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Safe Debt and Uncertainty in Emerging Markets: An Application to South Africa[*]

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Abstract

This paper develops a methodology for estimating a safe public debt level that would allow countries to remain below a maximum sustainable debt limit, taking into account the impact of uncertainty. Our analysis implies that fiscal policy should target a debt level well below the debt ceiling to allow space to absorb shocks that are likely to hit the economy. To illustrate our findings we apply the methodology to estimate a safe debt level for South Africa. Our results suggest that South Africa's debt ceiling is around 60 percent of GDP, although uncertainty is high. Simulations suggest targeting a debt-to-GDP ratio of 40 percent of GDP would allow South Africa to remain below this debt ceiling over the medium-term with a high degree of confidence.

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I. INTRODUCTION

The buildup of public debt in many countries since the global financial crisis has rekindled concerns about fiscal sustainability and renewed calls for fiscal consolidation to bring down and stabilize public debt at safe levels. However, while it is easy to operationalize a policy strategy that stabilizes debt, it is far more difficult to conceptualize what constitutes a safe level of debt. It is broadly accepted that high levels of debt are typically associated with high interest rates and poor economic outcomes.[1] However, at the same time many emerging market economies face demands for increased borrowing to finance public investment projects to ease supply constraints and sustain economic growth. The aim of this paper, which was produced using information up to end-2013, is to suggest a method to estimate the level of debt a country should target.

This paper proposes a simple methodology for determining a safe debt level that takes into account the impact of shocks to the economy. In particular, our main contribution is to combine existing methods for estimating debt ceilings (e.g., Reinart et al., 2003 and IMF, 2003) and stochastic debt forecasting (e.g., Celasun et al., 2006) to estimate the gap between the sustainable debt ceiling and the safe level of debt that fiscal policy should target (the debt benchmark). As argued by Mendoza and Oviedo (2009), a sustainable fiscal position is one in which government can commit to servicing its debt even when the economy is buffeted by shocks, or when fiscal risks materialize. This implies that fiscal policy should target a debt level well below the debt ceiling to allow space to absorb shocks that increase the fiscal borrowing requirement. In countries where volatility is high—e.g., due to the composition and level of debt or because of elevated macroeconomic volatility that affects a countries' repayment capacity—the distinction a debt ceiling and a debt benchmark is especially important. In particular, higher volatility argues for a fiscal policy that allows for more space under the debt ceiling to maintain repayment capacity even when the economy is subjected to shocks.

To illustrate our findings this paper explores the question of a debt benchmark for South Africa. South Africa has a strong fiscal record, but its debt-to-GDP ratio has risen sharply in the past six years—from 27 percent of GDP in 2008 to 43.1 percent of GDP in 2013—due both to falling revenue and rising expenditure-to-GDP ratios. The fiscal space built up in the mid-2000s has been eroded as a result of countercyclical fiscal policies in response to the global financial crisis, and the budget deficit remains high by historical standards. Moreover, a volatile macroeconomic environment—due in part to South Africa's reliance on the mining sector and unstable industrial relations—exposes the government to significant fiscal risks. At the same time, South Africa's debt burden is not out of line with that in other emerging

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[1] As the recent debate surrounding the findings of Reinhart and Rogoff (2010) shows, the claim that debt beyond a common threshold level results in lower growth is much more contentious (see e.g., Herndon, Ash, and Pollin, 2013; and Eberhardt and Presbitero, 2013).

markets, financing has so far been easily available in its liquid bond market, and the debt maturity and currency composition suggest a relatively high debt tolerance. This combination of a moderate debt level and high macroeconomic volatility makes South Africa a good candidate for this analysis. Using a wide range of methodologies, we estimate that a debt ceiling around 60

Figure 1. South Africa: Rising Government Deficits and Debt
(percent of GDP)

Source: National Treasury

percent of GDP is consistent with debt sustainability in South Africa. A simple stochastic Vector Auto-Regression (VAR) model suggests a benchmark of around 40 percent of GDP would be sufficient to keep debt below the ceiling with a high degree of confidence till 2020, even if the economy were to be buffeted by large shocks. Simulations suggest reaching this benchmark would require a significant fiscal effort and that could—in the absence of growth-enhancing structural reforms—put further pressure on the already-weak economy.

The rest of this paper is organized as follows: Section II discusses the complexities involved in estimating a country's debt tolerance, and the distinction between debt ceilings and debt benchmark; Section III considers various methods for estimating maximum sustainable debt ceilings, and associated debt benchmarks. Section IV applies these methodologies to South Africa, in order to estimate a debt ceiling, debt benchmark, and possible consolidation path. Section V concludes.

II. DEBT SUSTAINABILITY AND DEBT TOLERANCE

To frame the discussion it may be useful to start with a definition of debt sustainability. The IMF defines debt sustainability "as a situation in which a borrower is expected to be able to continue servicing its debts without an unrealistically large correction to the balance of income and expenditure" (IMF, 2002, p. 5). While seemingly straightforward, this definition leaves a number of questions unanswered. How large is an unrealistically large correction to the balance of income and expenditure, and what factors determine whether a borrower is likely to be able to service its debt or not? More generally, the level at which a country's debt is deemed to be sustainable may be influenced by many factors:

- Debt stock: A high government debt-to-GDP ratio can raise concerns about a country's ability to sustain the primary balances necessary to repay that debt, and can push up the cost of borrowing. Moreover, higher debt is often associated with lower growth and higher interest rates, thus requiring an even larger primary balance to service it.
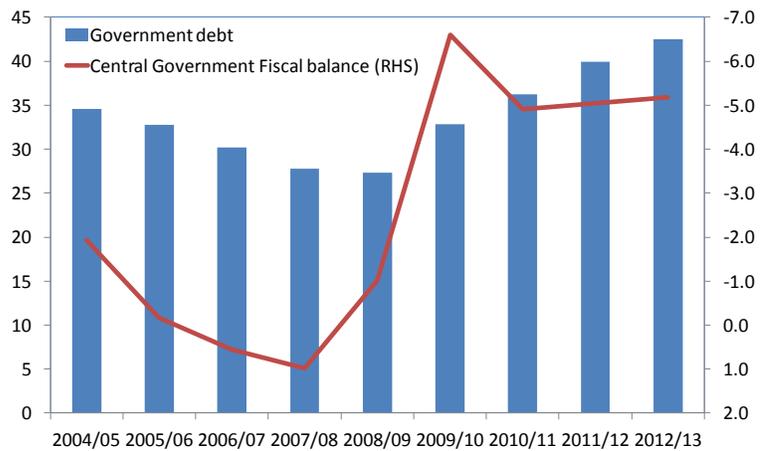
- Gross financing requirement: Large fiscal deficits and high rollover requirements may call into question the sovereign's ability to borrow sufficient amounts to meet its debt obligations into question, even though the overall debt-to-GDP ratio may be low.

- Composition of debt: A high share of foreign-currency or short-term debt, or debt at floating interest rates, exposes the sovereign to adverse exchange rate and interest rate movements, as well as rollover risk, that can increase the cost of meeting its debt obligations and the risk of debt distress.

- The debt path: A country with a moderate, but rapidly-increasing, debt-to-GDP ratio may be more likely to have the sustainability of its fiscal position called into question than a country with a high, but stable or declining debt level.

- Drivers of new borrowing: Government borrowing that improves physical and human capital—e.g., investment projects with a high rate of return or recurrent spending on education and health—is less likely to undermine debt sustainability given its likely impact on future economic growth.

- Credibility of fiscal policy: A government that can credibly commit to future primary surpluses consistent with full repayments of its debt obligations is likely to have a higher degree of debt tolerance. However, the more these surpluses are pushed into the future the more likely it is that the credibility of the government's fiscal policy will be called into question by market participants.

- Long-term fiscal pressures: Non-discretionary spending commitments, or the anticipation of lower revenues from non-renewable resources, can call into question the solvency of the sovereign and undermine debt sustainability, especially if accompanied by doubts about the government's ability to push through contentious spending and tax measures.

- Risk appetite: A level of debt or financing need initially deemed sustainable by market participants can quickly become unsustainable if global risk appetite and the availability of financing changes. In this sense, taking on debt introduces a vulnerability that can produce self-fulfilling crises (Wyplosz, 2010).

The number of factors that drive perceptions about debt sustainability complicates the calculation of a country's debt tolerance and helps explain the lack of consensus across studies and methodologies (see e.g., IMF, 2013a). It also helps explain some of the recent furor surrounding Reinhart and Rogoff's claim that when government debt exceeds 90 percent of GDP, government borrowing crowds out private investment and slows growth (Reinhart and Rogoff, 2010). Herndon, Ash, and Pollin (2013) have pointed to methodological issues with Reinhart and Rogoff's study and cast doubt on the finding of a common non-linearity in the relationship between debt and growth at the 90 percent of GDP

level. Moreover, research suggests that the relationship between growth and debt is likely to be highly country-specific (Eberhardt and Presbitero, 2013) and non-linear, with the impact larger at higher levels of indebtedness (Kumar and Woo, 2010).

Ultimately a country's debt position is no longer sustainable when markets deem it so. It may therefore be tempting to reject as futile any attempt to estimate a country's debt tolerance. However, policymakers in many countries do not have this luxury given the rapid buildup of debt in recent years and the need to keep debt below a level which triggers an adverse market reaction (at which point it may be too late to avoid a crisis). We therefore argue that providing some practical tools for estimating a country's debt tolerance is important to provide some guidance for policy makers, but at the same time caution against attaching too much confidence to any particular estimate given what Wyplosz calls the "mission impossible nature of the exercise" (Wyplosz, 2011, p. 2).

It is also worth noting that several regional country groupings and individual countries have found it useful to establish debt ceilings as an anchor for fiscal policy (see Table 1). Many of these debt ceilings are clustered around 60 percent. At first this may seem surprising given the empirical finding in Eberhardt and Presbitero (2013) of significant cross-country heterogeneity. However, as Topalova and Nyberg (2010) point out this could simply reflect the inherent difficulty in estimating a country's debt tolerance.

III. ESTIMATING DEBT CEILINGS AND DEBT BENCHMARKS

Numerous methods have been suggested for determining the maximum level of—external or public—debt that a country can safely hold before experiencing distress. These methods vary according to; (i) the indicator used to determine the prudent level of debt, e.g., the risk of a debt crisis or solvency of the public sector; (ii) whether they are cross-country or country-specific approaches; (iii) whether they are parametric or non-parametric; and (iv) whether they are econometric or model based.

For the purpose of this study we do not consider the cross-country methodologies proposed in the literature (see e.g., the non-parametric signaling approaches employed in IMF, 2002; Baldacci et al., 2011; and Manasse et al., 2013) as they make it difficult to incorporate county-specific information in the determination of the debt ceiling. A related literature not discussed here uses parametric approaches to examine the link between debt and the likelihood of a crisis, but without identifying a particular debt ceiling (see e.g., Detragiache and Spilimbergo, 2001). Another strand of the literature examines the impact of higher indebtedness on a broader set of macro-financial variables including growth (Reinhart and Rogoff, 2010; and Patillo et al., 2002), investment (Borensztein, 1990), and the effectiveness of countercyclical fiscal policy (IMF, 2008), but without specifying a particular debt ceiling. Similarly, Naraidoo and Raputsoane (2013) employ non-linear threshold methods to investigate the level of debt in South Africa beyond which fiscal consolidation has taken

place in the past, but do not assess whether this level of debt is optimal. Finally, work by Bi (2011), Bi et al. (2014), and Ghosh et al. (2013) differs from our econometric analysis by employing theory-based models to calculate public debt limits and to study their interaction with sovereign risk premia and fiscal policy.

Table 1. Examples of Debt Ceilings		
Supranational	**Year**	**Ceiling**
Eastern Caribbean Currency Union (ECCU)	1998	60
European Union (EU)	1995	60
West African Economic and Monetary Union (WAEMU)	2000	70
Central African Economic and Monetary Community (CEMAC)	2002	70
National		
Armenia	2008	60
Bulgaria	2003	60
Cape Verde	1998	60
Indonesia	2004	60
Jamaica	2010	100
Kenya	1997	45
Kosovo	2010	40
Mauritius	2008	60
Namibia	2001	30
Pakistan	2005	60
Panama	2002	40
Poland	1999	60
Serbia	2011	45
Slovak Republic	2011	60
Sri Lanka	2003	85
United Kingdom 1/	2010	40
1/ Net Debt		
Source: IMF fiscal rules data set available at http://www.imf.org/external/datamapper/FiscalRules/other/char.htm		

One strand of the literature attempts to estimate econometrically the level of indebtedness beyond which a country is perceived to have a greater default risk. This literature follows Reinhart et al. (2003) in classifying countries into clubs based on their Institutional Investor Rating (IIR).[2] Club A includes the countries with the highest IIR that enjoy continuous access to capital markets given their perceived low default risk. Club B, on the other hand, includes countries with only intermittent access to credit markets, while countries in club C are unable to access capital markets and are forced to rely mainly on bilateral and multilateral

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[2] The IIR, which is published biannually by the Institution Investor magazine, is based on economists and sovereign risk analysts' perception of a country's default risk. The IIR grades each country on a scale from 0 to 100, with a rating a 100 given to countries perceived as having the lowest default risk.

financing. The link between a country's default risk and its history of default and macroeconomic stability as well as public debt is then estimated econometrically, with the coefficient on public debt allowed to vary across clubs, using a specification of the form:

$$IIR_i = \alpha + \sum_{j=A}^{C} \beta_j I(CLUB_i = j)\, Debt_i + \gamma X_i + \varepsilon_i \qquad (1)$$

where I is an index of countries and j is an index of clubs, I is an indicator variable equal to one if $CLUB_i = j$ and zero otherwise, X is a vector of controls, and ε is a vector of normally distributed shocks. Using this methodology DiBella (2008) estimates that, in the case of the Dominican Republic, a debt level of 30 percent of GDP marks the boundary between being in club B or C., Topalova and Nyberg (2010) use the same approach to estimate a debt ceiling of 45-75 percent of GDP for India.

A second approach uses a simple accounting identity to calculate the debt stock consistent with the present discounted value of a country's expected future primary surpluses, i.e. the primary surpluses consistent with full repayment of the initial level of debt. In mathematical terms we can write:

$$d^* = \sum_{t=0}^{\infty} \frac{(T_t - G_t)}{(1 + i)^t} \qquad (2)$$

where d^* is the maximum value of the debt-to-GDP ratio consistent with public sector solvency, T_t and G_t are the government revenue-to-GDP ratio and non-interest expenditure-to-GDP ratio in period t, and i is the discount rate defined as $r - g$ where r is the real interest rate, and g is the real growth rate of GDP. Using this approach, and the assumption that past primary surpluses are a good guide to the future, IMF (2003) calculates a median debt ceiling of 75 percent of GDP for industrial economies and 25 percent of GDP for emerging markets.

A variant of this approach proposed by Mendoza and Oviedo (2009) calculates the maximum level of debt a country can service, taking into account uncertainty around future revenues as well as the government's ability to adjust fiscal policy in response to shocks. In particular, Mendoza and Oviedo (ibid.) propose:

$$d^* = \frac{T_{min} - G_{min}}{r - g} \qquad (3)$$

where d^* is the maximum level of debt a country can service, and T_{min} and G_{min} are the minimum government revenue-to-GDP and non-interest expenditure-to-GDP ratios. Mendoza and Oviedo (ibid.) argue that d^* is the maximum level of debt at which the

government can credibly commit to repay its creditors at all times (including during periods of crisis).

The Mendoza-Oviedo model highlights the importance of factoring in uncertainty about future revenues in the calculation of an appropriate debt benchmark. In particular, a shock that lowers economic growth and revenue collection may lead to a cyclical deterioration in the primary balance and a buildup in debt that may be difficult to counter fully using the tools at the government's disposal. A series of negative shocks could exacerbate the situation, pushing the government toward a level of indebtedness it would find difficult to service. An unexpected increase in the real interest rate would have a similar impact.

To factor in the impact of uncertainty on debt, a number of studies have moved toward a "fan-chart" approach to debt forecasting (see e.g., Celasun et al., 2006; Kawakami and Romeu, 2011; and Burger et al., 2011). In this methodology, which also forms part of the IMF's revised public debt sustainability analysis (IMF, 2013b), a country-specific Vector Auto-Regression (VAR) comprising the non-fiscal determinants of public debt dynamics is estimated on historical data. A fiscal reaction function can either be estimated as part of the VAR or as separate block. Formally we have:

$$Y_t = A(L)Y_{t-1} + \xi_t \tag{4}$$

where Y is a vector of variables, A is a vector of parameters and L the lag operator, and ξ is a vector of normally distributed shocks with covariance-variance matrix Ω. A large number of forecasts of Y are then generated using a sequence of random vectors $\xi_t = W\eta_t$ where $\eta_t \sim N(0,1)$ and $\Omega = W'W$ and the estimated parameter vector A. The debt projection corresponding to each realization of Y can then be calculated using the standard debt accumulation equation:

$$d_{t+1} = d_t \frac{(1 + r_t)}{(1 + g_t)} - s_t \tag{5}$$

where s_t is the primary surplus in percent of GDP.

An implication of factoring in the impact of uncertainty is the fact that a country's debt tolerance is distinct from the level of debt that fiscal policy should target. As argued by Mendoza and Oviedo (2009), a sustainable debt position is one in which the sovereign can credibly commit to servicing its debt even when the economy is buffeted by adverse shocks or when fiscal risks materialize. This implies that fiscal policy should target a debt level sufficiently below the debt ceiling to allow space for absorbing unanticipated shocks that worsen the primary balance or result in deteriorating debt dynamics. This distinction is particularly important in countries that are often buffeted by large external shocks (e.g., commodity exporters or countries heavily reliant on favorable weather conditions), that have

an unstable domestic environment (e.g., countries with contentious labor relations or domestic strife), or that have a volatile fiscal position (e.g., due to the composition of debt or a narrow revenue base).

The main contribution of this paper is to combine the probabilistic approach to debt forecasting described above with the various methodologies proposed in the literature for estimating a debt ceiling, in order to calculate a debt benchmark that leaves enough space under the debt ceiling to absorb shocks that may adversely affect debt dynamics. Our approach involves three steps: First we employ the techniques described above—notably Reinhart's IIR approach and the public sector solvency approach—to determine an appropriate debt ceiling. We then use the Mendoza-Oviedo framework and a stochastic VAR to calculate a debt benchmark consistent with this ceiling. In particular, for the stochastic VAR we manipulate the path of the primary balance to ensure that the resulting stochastic debt projection—the "fan chart"—remains below the debt ceiling over the medium term with a high degree of confidence, i.e. even if the economy is hit by a series of adverse shocks similar to what it has experienced in the past. The final step then involves calculating the tax or expenditure measures to achieve the adjustment in the primary balance necessary to achieve this debt benchmark.

IV. AN APPLICATION TO SOUTH AFRICA

South Africa has been able to maintain a relatively sustainable debt position—the debt-to-GDP ratio has not exceeded 50 percent since 1995—since the political transition in 1994 (Calitz et al., 2011). Burger et al. (2011) argue that this strong track record reflects to large extent a fiscal policy centered on improving the primary balance in response to rising debt.[3]

South Africa's fiscal position strengthened significantly in the mid-2000s as the introduction of inflation targeting in 2001 ushered in a period of macroeconomic stability, a boom in commodities and robust economic boosted revenue collection, and reforms to broaden and deepen the public debt market lowered interest

Figure 2. South Africa: Government Debt-to-GDP Ratio
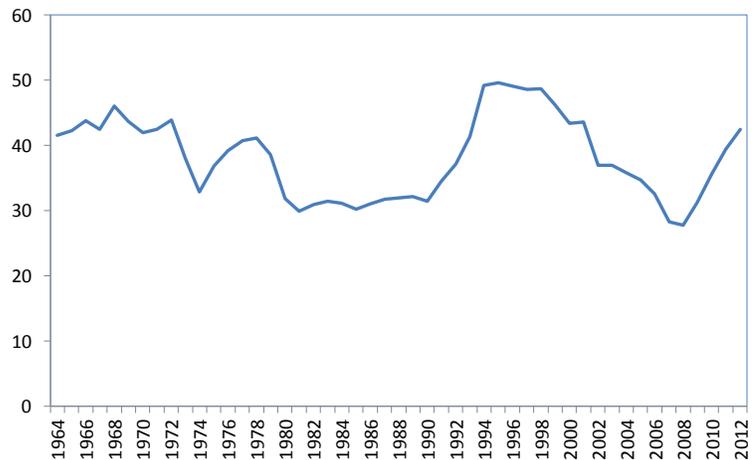
Source: South Afrcan National Treasury

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[3] See Burger et al. (2011) for a historical overview of South Africa's fiscal position and public debt, as well as the policies underlying those developments.

rates. Central government primary surpluses averaging close to 3 percent in 2006-2008 and a positive interest-growth differential brought gross government debt down to a low of 27 percent of GDP in 2008.

The global financial crisis ushered in a period of countercyclical fiscal policy, as the government appropriately took advantage of available fiscal space to support the economy. Between 2009-2012 the central government deficit averaged close to 5 percent of GDP as the weakening economy reduced revenue collection and a rising wage bill increased government spending. As a result, the government debt-to-GDP has increased by 15 percent of GDP since the start of the crisis, reaching 42 percent of GDP at end-2012. Absent additional policy measures, IMF projections suggest debt will exceed 50 percent of GDP by the end of this decade.[4]

While fiscal stimulus during the great financial crisis likely averted an even greater economic slowdown, persistent budget deficits financed increasingly by non-resident investors and rapid buildup of debt in recent years have increased vulnerabilities. In particular, South Africa's relative fiscal position among emerging markets has been deteriorating since 2008 and its debt-to-GDP ratio—which pre-crisis was relatively low—is now slightly above the median in peer emerging market countries, while the government's gross domestic financing requirement has more than doubled since 2008 to 11½ percent of GDP in

Figure 3. South Africa: Deteriorating Public Debt Levels Relative to Peer Countries

Legend:
- South Africa rank (percent)
- South Africa gross public debt (percent of GDP, RHS)
- Peer country median debt ratio (percent of GDP, RHS)

28.5 ... 52.6
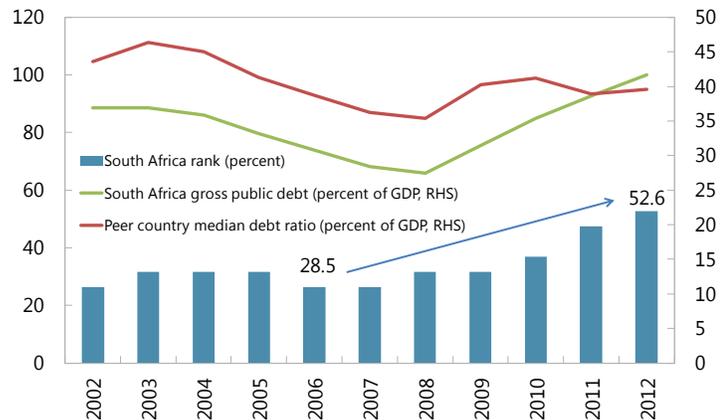
Sources: IMF World Economic Outlook and author's calculations.

2012.[5,6] At the same time, foreign ownership of domestic government bonds has nearly tripled since 2008, reaching 36 percent at end-2012. This deterioration, combined with lackluster growth and growing structural problems, prompted sovereign credit rating downgrades in 2012 and 2013.

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[4] It is worth emphasizing that recent budget documents have repeatedly stated that revenue and expenditure plans would be reassessed if the fiscal or economic outlook continued to deteriorate.

[5] In this paper, the peer emerging market group of countries consists of Argentina, Brazil, Chile, China, Colombia, Hungary, India, Indonesia, Korea, Malaysia, Peru, the Philippines, Poland, Romania, Russia, Thailand, Turkey, and Ukraine.

[6] The gross financing requirement is defined as the sum of the budget deficit plus debt amortization.

While it is clear that fiscal vulnerabilities have increased in recent years, there are several factors that suggest South Africa has a relatively high debt tolerance. A long history of sustainable fiscal policies and a deep and liquid debt market have contributed to historically low interest rates. In addition, the composition of debt is very favorable: strategic benchmarks limit foreign-currency denominated debt to 20 percent of the total, while domestic debt is split 70-30 percent between fixed rate bonds, and inflation-linked bonds and short-term Treasury Bills. In practice, foreign currency debt is around 10 percent of the total, well below the benchmark. A smooth maturity profile, together with average term-to-maturity of around 10 years, also contributes to greater debt tolerance.

A. A Debt Ceiling for South Africa

As noted previously, the sustainable debt ceiling consistent with South Africa's repayment capacity can be calculated as the discounted sum of future primary surpluses. Doing so requires specifying the future path of primary surpluses and the appropriate discount rate. Neither of these are straightforward and small changes to assumptions have a significant bearing on the resulting debt ceiling.

For the purpose of this study we assume a path for the primary balance consistent with the projections in IMF (2013c), with gradual convergence from -2.4 percent of GDP in 2012/13 to a long-run equilibrium of 0.6 percent of GDP in 2024/25.[7] This equates to a 2 percent of GDP improvement over the IMF's projection period (2012/13-2018/19) and an improvement in the primary balance of 0.25 percent of GDP per annum from 2018/19 onwards. While ambitious, experience from other countries (see e.g., IMF, 2013b) suggests this magnitude of adjustment is feasible.

Calculation of the appropriate discount rate—the difference between the real interest rate and real GDP growth—builds on the methodology outlined in IMF (2003) and Abiad and Ostry (2005). We proxy the real interest rate by the average yield on US 10-year inflation-linked bonds between 2003-2008 plus South Africa's average sovereign spread from JP Morgan's Emerging Market Bond Index Global (EMBIG) over the same period. We exclude more recent data from the calculation of the real interest rate given the sharp movements in US interest rates and EMBIG spreads during the global financial crisis. The resulting real interest rate—3.8 percent—plus the IMF's current estimate of long-term growth in South Africa—3 percent—yields a discount rate of 0.8, close to the discount rate of 0.9 found by Topalova and Nyberg (2010) for South Africa.

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[7] South Africa's primary balance has averaged close to 0.6 percent since 1980.

Box 1. Data Coverage

An appropriate coverage of the public sector is critical for an overall determination of debt sustainability. In general, the measure of debt should be as broad as possible, while both gross and net debt measures should be considered (IMF, 2013b).

Coverage of the Public Sector

In South Africa, public sector debt is largely driven by the borrowing decisions of the central

government. In 2012/13, central government debt accounted for around 73 percent of total public sector debt. Although state-owned enterprise debt has increased significantly in recent years, their borrowing has mainly been undertaken by a handful of large commercially-viable companies on the strength of their own balance sheets. Moreover, provincial governments cannot accumulate debt, and local government debt is low and concentrated in a few large metropolitan areas with their own revenue-raising capabilities. For these reasons—as well as the absence of reliable data on the indebtedness of the consolidated

South Africa: Public Debt
(percent of GDP)

Source: South African National Treasury and South African Reserve Bank

public sector—central government debt in South Africa is a reasonable proxy for overall public debt and the measure we employ in this paper. To be comprehensive, however, the analysis in this paper should be complemented by an analysis of the potential contingent liabilities posed by state-owned enterprise and sub-national borrowing. Doing so is beyond the scope of this paper.

Gross vs. Net Debt

In the mid-2000s, the South African government decided to increase cash holdings in order to create a buffer for future debt repayments, and for the sterilization of capital inflows. Between 2004/05 and

2012/13, cash balances increased from 2.1 to 5.7 percent of GDP, largely funded by increased borrowing. As a result, the gap between gross and net debt has increased considerably. However, only around 65 percent of these cash reserves are readily available for government operations, with the remainder being used by the South African Reserve Bank (SARB) to sterilize past foreign exchange purchases and thus only available as bridge finance on the understanding that they be replenished. As a result, we argue that net debt underestimates the fiscal risks posed by government borrowing and therefore employ a

South Africa: Central Government Debt
(percent of GDP)

Source: South African National Treasury
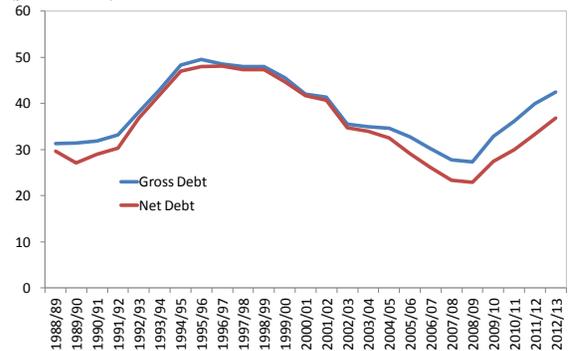
measure of gross debt in our analysis. Moreover, any "bias" resulting from the use of gross rather than net debt likely offsets the use of central government debt to assess the fiscal risks posed by the indebtedness of the entire public sector. We do recognize, however, that if cash buffers increase further incorporating these balances will have a material impact on the assessment of debt sustainability.

Applying this discount rate to the government's intertemporal budget constraint in equation (2) yields a sustainable debt ceiling of 59 percent of GDP. However, as shown in Figure 4 the sustainable debt ceiling is very sensitive to the assumptions made regarding the future path of the primary balance as well as the discount factor: a long-run average primary balance of 0.8 percent

Figure 4. South Africa: Sustainable Debt Ceiling
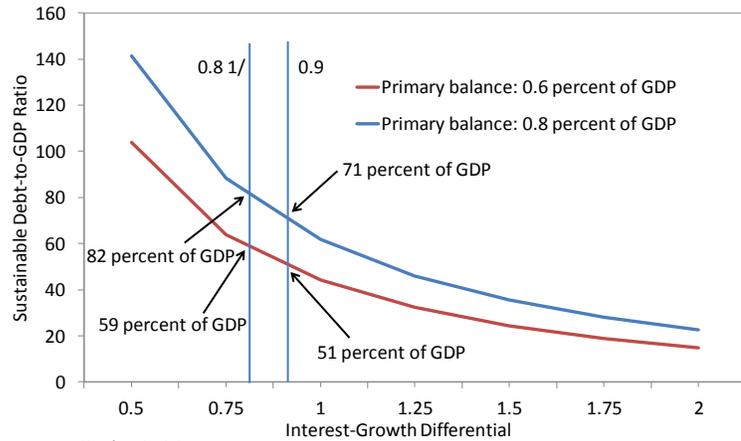
Source: Author's calculations
1/ Interest-growth differential consistent pre-GFC EMBIG and average yield on US 10-year inflation linked bonds, and IMF estimate of potential growth.

of GDP—equivalent to the average primary balance over 1990/01-2000/11—would increase the sustainable debt ceiling to 82 percent of GDP, while an increase in the discount rate to 0.9—equivalent to a decline in potential growth to around 2 percent or an increase in the real interest rate by 100 bps—would reduce the sustainable debt ratio to 51 percent.

The second approach to calculating the debt ceiling that we consider in this paper follows Reinhart et al. (2003) in classifying countries into clubs based on their debt intolerance (proxied by the Institutional Investor Rating-IIR). Using the sample of 117 countries included in the IMF's market-access debt sustainability analysis (MAC DSA) we identify four clubs, where the cutoff for the clubs are based on the mean IIR over the entire sample and the standard deviation of the IIR. As we can see from Figure 5, South Africa's IIR has increased over time and the country graduated from club BII to club BI in

Figure 5. South Africa: Institutional Investor Rating (IIR) 1/
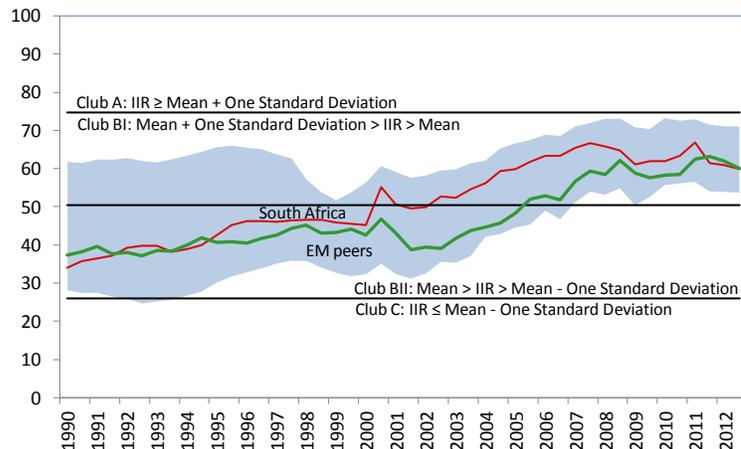
Source: Institutional Investor, Inc.
1/ Error bands show the 10th and 90th percentile of rankings.

2000, around the time multi-year budgeting and inflation targeting was introduced. South Africa's IIR has tended to exceed the median IIR in peer emerging markets, but the decline in South Africa's IIR since 2010 means this is no longer true.

Following Reinhart et al. (2003) we estimate the relation between countries' average IIR and average debt-to-GDP ratio between 2000 and 2010 using the simple cross-sectional OLS

regression in equation (1). To control for a country's track record of macroeconomic stability we include a variable to capture the percent of years with inflation above 20 percent. As in Reinhart et al. (ibid), we also experiment with controlling for a country's default history using either the number of years since the last public or external debt default episode, or the percent of years (since 1950 or 1800) in which a country has been in default.

Figure 6. Institutional Investor Rating and Government Debt
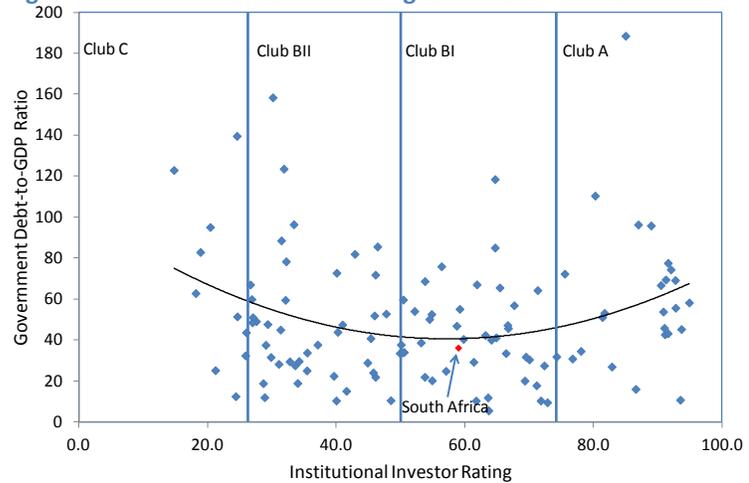
Source: IMF World Economic Outlook, Institutional Investor, Inc., and author's calculations

As can be seen from Figure 6, it is likely that the relationship between a country's IIR and debt-to-GDP ratio is non-linear. In particular, it appears at first glance that countries with a lower IIR are less debt tolerant than those with a higher IIR. In fact the relationship between IIR and debt may even be slightly positive for countries in club A. To allow for this potential non-linearity we allow the coefficient on the debt-to-GDP ratio to vary across clubs.

Table 2 presents the results of four different specifications of the cross-sectional regressions. As expected, a track record of high inflation or a poor repayment history is associated with a lower IIR. As in previous studies, the coefficient on debt enters with a negative (and significant) sign for countries in clubs B and C, but has a positive (although not significant coefficient) for club A countries. In other words, club a countries' attractiveness to

Table 2: Debt Intolerance and Debt 1/				
	Model 1	Model 2	Model 3	Model 4
Debt x Club A	0.331***	-0.027	0.087	0.086
	[0.053]	[0.064]	[0.070]	[0.074]
Debt x Club B	-0.183***	-0.15**	-0.118*	-0.134*
	[0.053]	[0.057]	[0.067]	[0.070]
Debt x Club C	-0.329***	-0.357**	-0.282	-0.403**
	[0.070]	[0.144]	0.175	[0.179]
Inflation	-59.220***	-40.419*	-40.351	29.491*
	[17.115]	[24.020]	28.169	[-1.750]
Crisis years		0.165***		
		[0.026]		
Crisis 1950			-0.619***	
			[0.154]	
Crisis 1800				-0.872***
				[0.304]
Constant	60.023***	57.21653***	74.710***	74.544***
	[2.719]	[3.547]	[3.889]	[4.332]
R^2	0.582	0.618	0.488	0.426
Adjusted R^2	0.568	0.583	0.443	0.374
N	117	62	62	62
Club B1 cut-off	50	60	160	165

1/ Numbers in square brackets are standard errors. *** indicates significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.

Table 3: Institutional Investor Rating and Government Debt				
	Model 1		Model 2	
Debt ratio	IIR	Club	IIR	Club
30	54.5	Club BI	55.5	Club BI
35	53.6	Club BI	54.8	Club BI
40	52.7	Club BI	54.0	Club BI
45	51.8	Club BI	53.3	Club BI
50	50.9	Club BI	52.5	Club BI
55	49.9	ClubBII	51.7	Club BI
60	49.0	ClubBII	51.0	Club BI
65	48.1	ClubBII	50.2	ClubBII
70	47.2	ClubBII	49.5	ClubBII
75	46.3	ClubBII	48.7	ClubBII
80	45.4	ClubBII	48.0	ClubBII
85	44.5	ClubBII	47.2	ClubBII
90	43.5	ClubBII	46.5	ClubBII
95	42.6	ClubBII	45.7	ClubBII
100	41.7	ClubBII	45.0	ClubBII

investors appears to be unrelated—and possibly slightly positively related—to their level of indebtedness, underscoring their high debt tolerance. On the other hand, the results for clubs B and C confirm the impression from Figure 5 that countries with a lower IIR (in a "worse" club) tend to be more debt intolerant. The different specifications differ in terms of their explanatory power though, with the model including the amount of years since the last default episode (Model 1) performing significantly better than the specifications including the percent of years (since 1950 or 1800) that a country has been in default (Models 3 and 4), and somewhat better than a specification excluding any measure of a country's default history (Model 1).[8] Using the two best-performing specifications (Models 1 and 2) we calculate that the debt level at which South Africa would move from club BI to BII—and thus be considered less debt tolerant—is around 50-60 percent (see Table 3).

The final approach we employ to gauge South Africa's debt ceiling is based on a simple comparison of debt levels across emerging markets with similar sovereign ratings. The public debt level is one of several determinants of a country's sovereign rating, and as Figure 7 suggests a lower debt-to-GDP ratio is typically associated with a higher rating. In 2008 South Africa's debt level was relatively low compared to its debt rating, but following rating downgrades in 2012-13 and a rapid increase in debt, its debt level is now closer that of similarly rated emerging market countries. However, error bands are high and suggest that a debt level as high as 60 percent of GDP could be consistent with South Africa's current sovereign debt rating.

Figure 7. Debt-to-GDP ratios and sovereign ratings 1/
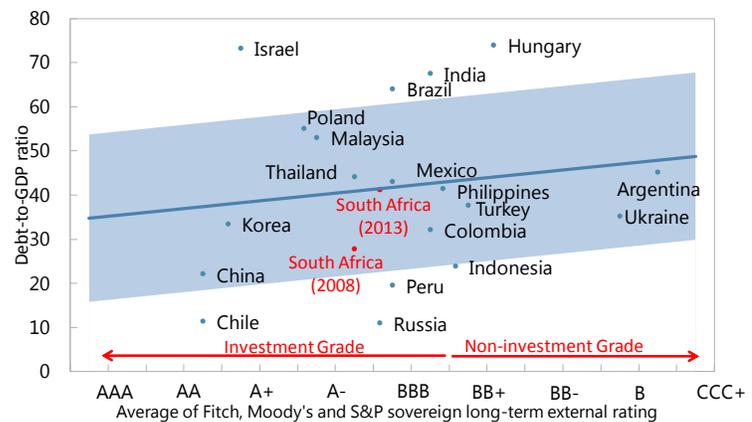
Sources: Fitch, Moody's, S&P; and WEO.
1/ The shaded area shows the one-standard error bands around the fitted values of a linear regression.

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[8] The sample size in the three specifications that include a measure of a country's default history is limited to the number of MAC DSA countries including in Reinhart's debt history database.

In summary, the different models suggest a debt ceiling for South Africa in the range of 50-80 percent. While this range is large, there is a clustering of results around the 60 percent of GDP mark, and this is the debt ceiling employed for the remainder of this paper. In particular, this debt ceiling is consistent with both the IMF's projections of the discounted sum of future primary surpluses, the Reinhart et al. (2003) model of debt intolerance, and a simple comparison with similarly-rated emerging market countries. The large uncertainty does, however, warrant a certain amount of caution. In particular, small changes in assumptions regarding the future path of the primary balance or the interest-growth differential could lead to large changes in the estimated debt ceiling. Policymakers need to weigh these risks carefully when deciding on fiscal policy to ensure that public debt remains sustainable.

B. A Debt Benchmark for South Africa

As noted previously, uncertainty surrounding economic outcomes suggests South Africa should target a debt-to-GDP level below the 60 percent of GDP debt ceiling. Shocks to the economy and to the primary balance would likely result in sustained breaches of the debt ceiling that could undermine investor confidence. An appropriate debt benchmark is therefore a debt-to-GDP ratio that leaves enough spaces to absorb shocks that can increase the deficit and the debt level.

Figure 8 provides a first pass at assessing the impact of unanticipated shocks on the uncertainty surrounding South Africa's primary balance and debt forecasts.[9] The chart plots the average coefficient of variation of the National Treasury's primary balance and debt projections for three separate three-year periods. Twice a year—in the budget review and the medium-term budget policy statement (MTBPS)—the National Treasury produces three-year-ahead fiscal forecasts. The coefficient of variation is calculated using the six sets of projections—three budget reviews and three MTBPSs—that the National Treasury produces for any given year.

Figure 8. South Africa: Volatility of Fiscal Forecasts
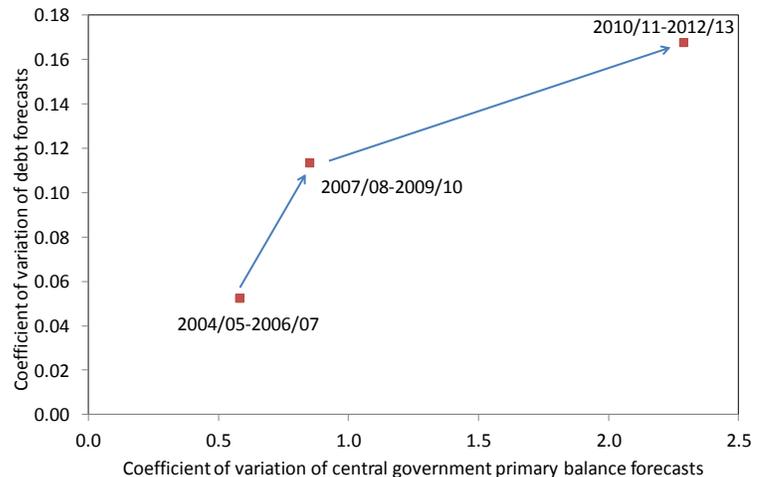
Source: South African National Treasury

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[9] The chart does not control for any discretionary change in the fiscal stance that could introduce additional volatility into the projections.

The chart suggests that uncertainty surrounding South Africa's primary balance and debt projections has increased over time. This finding is consistent with research by Calitz et al. (2013) that finds an upward trend in forecast errors of the budget balance over time. This increased uncertainty may also be a reflection of the extraordinary volatility observed during and in the aftermath of the global financial crisis. However, since 2010 uncertainty appears to have increased even more, suggesting perhaps that South Africa's fiscal outlook has become more vulnerable to macro-fiscal shocks, and underlining the importance of taking into account the possible impact of unanticipated shocks in the calculation of an appropriate debt benchmark for South Africa.[10]

The Mendoza-Oviedo model described earlier provides a simple framework for taking into account the impact of uncertainty on debt. However, the framework is not well-suited to South Africa's current circumstances. In particular, Mendoza and Oviedo's suggestion to permanently set the minimum revenue-to-GDP ratio at two standard deviations below the mean revenue level would—absent completely unrealistic adjustments in expenditure—result in large primary deficits. We argue this is because Mendoza and Oviedo's suggestion that the sovereign should target a debt level which would allow it to meet its debt obligations in a state of permanent crisis is unrealistic. Instead of a permanent shock we calculate the debt level that South Africa could sustain if its revenue collection was two standard deviations lower than the baseline for the next 10 years. Using a discount rate of 0.8 and IMF's baseline fiscal projections results in a debt benchmark of 39 percent of GDP. If the discount rate were 0.9— the level for South Africa found in Topalova and Nyberg (2010) and below their estimate of the average discount rate across emerging markets (1.1)—this figure would decline to 31 percent of GDP.

As noted above, a more direct way of incorporating uncertainty into the estimation of the debt target involves simulation of a VAR model to create a stochastic projection of debt (a debt "fan chart") for different paths of the primary deficit. In particular, we estimate a three-variable VAR in the real interest rate, the percentage change in the real effective exchange rate, and the output gap on quarterly data for 1983-2012. The revenue and expenditure-to-GDP ratios are included as exogenous variables to allow feedback from fiscal variables to the real economy (the multiplier effect). Simple fiscal reactions for revenue and expenditure that include lagged revenue and expenditure and the output gap are also estimated.

In order to generate the baseline stochastic forecast of debt we use 10000 draws from the estimated VAR residual covariance-variance matrix as well as from the residuals of the revenue and expenditure reaction functions. However, rather than rely on the simple VAR and fiscal reaction functions themselves to generate our forecasts we constrain the mean

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[10] Note that the volatility of the primary balance and debt forecasts did decline significantly in 2012/13.

forecasts of the output gap as well as the revenue and expenditure-to-GDP ratios to equal the IMF baseline projections. This not only ensures consistency with the IMF's macroframework, but also makes it easier to conduct policy experiments using the same framework.

The result of our baseline stochastic projection of the debt-to-GDP ratio is shown in Figure 9. As noted above, the mean of the distribution is constrained to equal the IMF's baseline forecast, with debt stabilizing just below 47 percent of GDP. However, the estimated VAR and fiscal reaction functions also suggests there is considerable uncertainty surrounding the forecast with a 10 percent chance—80 percent confidence interval—the debt ratio will exceed 63 percent and a 5 percent chance—90 percent confidence interval—it will exceed 68 percent by 2020.

Figure 9. South Africa: Government Debt Forecast (percent of GDP)
Baseline Projection
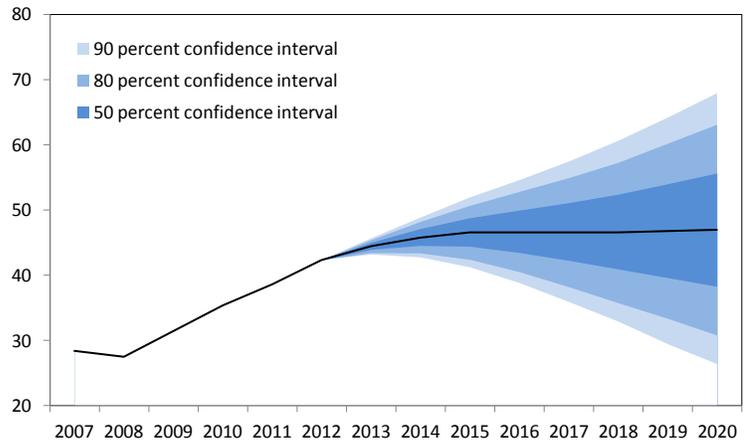
Source: Author's calculations

One aspect of the fan chart worth highlighting is the cumulative nature of uncertainty. As the forecast horizon increases so does uncertainty about the state of the economy and the debt outlook. In practice, this means that for a given confidence level the space between the debt ceiling and the debt benchmark necessary to absorb unanticipated shocks increases the longer the target horizon. A short horizon would allow the sovereign to maintain a debt level close to the debt ceiling while committing to remain below the debt ceiling with a high degree of confidence, but may not provide much guidance about the direction of fiscal policy. On the other hand, a longer horizon may be more useful to long-term investors but would make it harder for a sovereign to commit to remaining below a certain debt ceiling with a high degree of confidence and could therefore push up the risk premium charged by investors. There is therefore a trade-off between the length of the target horizon and the degree of certainty. For the purpose of this paper we adopt a target horizon of seven years—the modified duration of government debt at end-March 2012 was 6.8 years suggesting a 7 year horizon would be sufficient to provide guidance to investors—and a confidence interval of 90 percent. But as this discussion highlights, while economics can provide some guidance regarding the size of shocks, the extent to which a sovereign decides to eliminate uncertainty surrounding its future repayment capacity is also a political choice.

The baseline fan chart presented in Figure 9 suggests remaining below the 60 percent of GDP debt ceiling with 95 degree of confidence—equivalent to a 90 percent confidence interval—

will require significant adjustment to the primary balance moving forward. To simulate the necessary adjustment we impose either a slowdown in nominal non-interest real expenditure growth or an increase in the revenue-to-GDP ratio. In order to capture the feedback from fiscal policy to the real economy we impose a multiplier effect that is assumed to gradually dissipate in the long-run. Once the revised revenue, non-interest expenditure, and GDP numbers are derived, it is straightforward to calculate the post-consolidation primary balance and the revised path for debt using the standard debt accumulation formula in equation 4.[11]

Incorporating multiplier effects into our analysis is important from an operational point of view. For example, if the multiplier effect of a reduction in expenditure growth is high then a consolidation strategy that relies on expenditure cuts would have a significant impact on growth. This would not only limit the improvement in the primary balance as a share of GDP, but also worsen the interest-growth differential and automatic debt dynamics. Predicting the impact of revenue and expenditure measures on output—the fiscal multipliers—is, however, far from straight-forward and depends not only on the structure of the economy (see e.g., Ilzetzki et al., 2013) but also on the composition of the adjustment. For example, cutting government consumption may have a smaller impact on growth than cutting public investment, while raising additional revenue through improved tax administration—if feasible—would have a lower multiplier effect than an increase in corporate or labor taxes.

Our simple VAR model suggests the fiscal multiplier in South Africa is negligible. However, other studies on South Africa, including by the Fiscal and Financial Commission (2011) and by Jooste et al. (2013) suggest the short-run fiscal multiplier is around 0.6-1—revenue multipliers are estimated to be slightly higher than spending multipliers—with little to no long-term impact. The IMF's G35 model suggests short-run fiscal multipliers in South Africa are somewhat higher, around 0.7 for revenue and 1.2 for spending. Given the absence of reliable estimates we assume in our analysis a short-run multiplier of 0.8 for both spending and revenue—more or less the average of the estimates in the literature—with no-long term impact.

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[11] For the purpose of this analysis we assume a real interest rate of 2¼ percent, CPI inflation of 5 percent, and GDP inflation of 6.5 percent.

The results presented in Figure 10 suggest lowering the debt-ratio to just above 40 percent of GDP by 2020 would be sufficient to keep below the 60 percent debt ceiling with a 90 percent degree of confidence. Doing this through expenditure cuts would require slowing expenditure growth by 1.4 percentage points per annum relative to the announced spending plans starting from 2014/15. This is on top of the moderation in the pace of real non-interest expenditure from an average of 2.9 to 2.3 percent per annum over the three-year medium-term expenditure framework (MTEF) period that was announced in the 2013 Budget Review, and would reduce the non-interest expenditure-to-GDP ratio from 27.2 percent in 2012/13 to 23.8 percent of GDP by 2020. If the start of the consolidation was delayed till the end of the current three-year MTEF period (2016/17), the required decline in real non-interest expenditure growth would rise to 2.5 percentage points per annum.

Figure 10. South Africa: Government Debt Forecast (percent of GDP)
Slowdown in expenditure growth from 2014/15

90 percent confidence interval
80 percent confidence interval
50 percent confidence interval

Source: Author's calculations

The simulations reported in Figure 11 suggest that keeping the debt-to-GDP ratio below the 60 percent of GDP ceiling till 2020 would require a permanent 1.2 percent of GDP increase in revenues in 2014/15. Such an increase in revenues would lower the debt-to-GDP ratio to around 40 percent of GDP by 2020. Delaying the increase in tax till after the three-year MTEF period would result in the need for additional revenue increases totaling 1.6 percent of GDP.

Figure 11. South Africa: Government Debt Forecast (percent of GDP)
Revenue increase from 2014/15

90 percent confidence interval
80 percent confidence interval
50 percent confidence interval

Source: Author's calculations
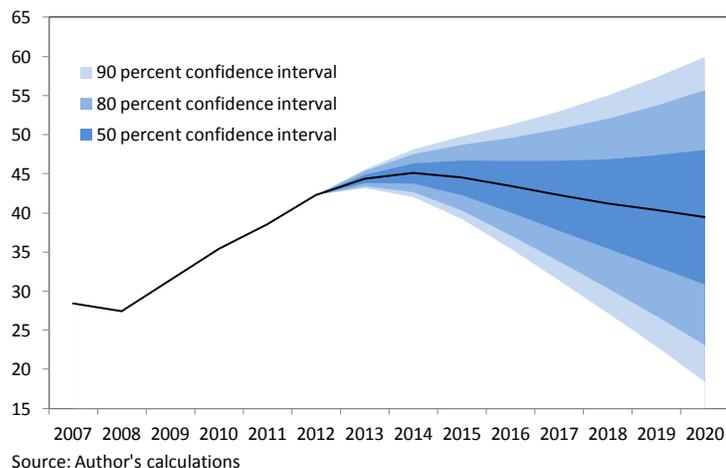
Other things equal, this amount of fiscal consolidation would have a significant impact on growth. As shown in Figure 12 the simulations suggest the cumulative output loss till 2020 is around 2 percent of potential GDP if the consolidation takes the form of continuous

expenditure cuts and around 1 percent of potential GDP if the adjustment is achieved using a one-time tax increase in 2013/14. The greater cumulative output loss when the consolidation is achieved using spending cuts reflects the assumed permanent slowdown in expenditure growth relative to the baseline—and thus a continuous fiscal impulse— compared to a one-off revenue increase with a large up front

Figure 12. South Africa: Output Loss
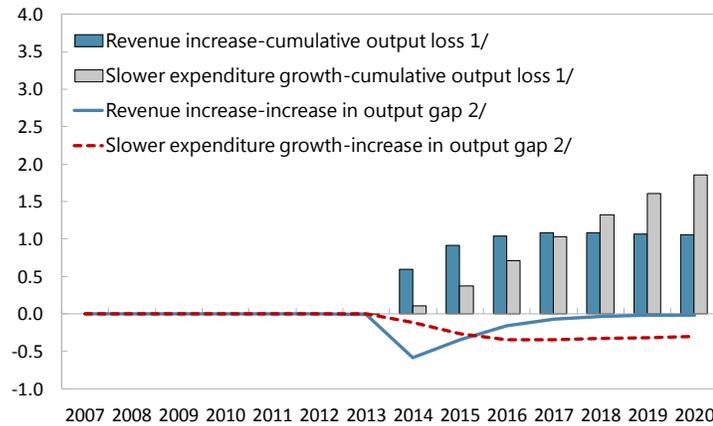
1/ Relative to baseline projection. In percent of potential GDP each year.
2/ Percentage point deviation from baseline output gap projection.
Source: Author's calculations

but decaying impact on output. Of course these results are sensitive to the design of the tax or expenditure measures as well as the size of the revenue and expenditure multipliers.

Undertaking structural reforms or public investment projects that would boost growth would facilitate the consolidation.[12] For example, our simulations (Figure 13) suggest that an increase in potential growth to 3¾ percent—significantly less than the 5.4 percent target in the authorities' National Development Plan (NDP) — starting in 2014/15 would be sufficient to achieve fiscal consolidation to remain below the 60 percent debt ceiling till 2020.[13]

Figure 13. South Africa: Government Debt Forecast (percent of GDP)
Increase in potential growth from 2014/15
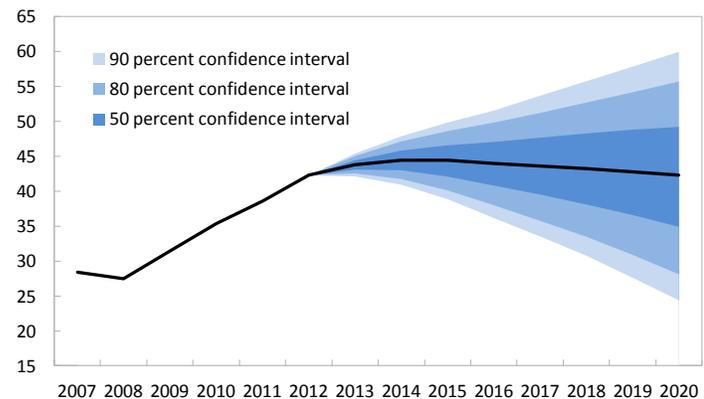
Source: Author's calculations.

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[12] See Buffie et al. (2012) for an example of a modeling framework which analyses the impact of growth-enhancing public investment surges on debt sustainability, and Mabugu et al. (2013) for an analysis of the impact of public investment on potential growth and public debt.

[13] The simulations assume that growth increases in line with potential growth so that the path of the output gap is unchanged relative to the baseline.

V. CONCLUSION

The aim of this paper has been to propose a method for determining a debt-to-GDP ceiling consistent with a country's debt tolerance in an environment where economic outcomes are uncertain. To be credible fiscal policy needs to be able to meet all debt obligations even when the economy is buffeted by shocks, or when fiscal risks materialize. This implies that fiscal policy should target a debt level well below the debt ceiling to allow space to absorb shocks that increase the fiscal borrowing requirement.

To illustrate our findings we use the example of South Africa. South Africa has a long history of sustainable fiscal policy and a debt-to-GDP ratio similar to the median peer EM, but the economy is subject to large shocks. Furthermore, fiscal space has been eroded since the global financial crisis, and the government's debt outlook has come under increasing scrutiny. Policymakers therefore need to determine whether South Africa still has the fiscal space to support the weak economy, or whether fiscal consolidation plans need to be brought forward to ensure public debt remains sustainable.

Using a wide range of methodologies, we estimate that South Africa's debt ceiling is around 60 per cent, although the range is large and depends on the long-run fiscal stance as well as the outlook for economic growth and domestic interest rates. Our simulations suggest that the authorities should aim to reduce the debt-to GDP ratio to around 40 percent of GDP from its current level of 42.5 percent of GDP at end-2012/13 in order to keep government debt below the 60 percent of GDP debt ceiling for the next seven years with a high degree of confidence and allow for the impact of temporary shocks that are likely to hit the economy during this period. Achieving this consolidation through revenue or expenditure measures would have a significant impact on output. Structural reforms to boost potential growth or a reorientation of spending toward investment could help offset some of the impact on the economy and deliver a more growth-friendly fiscal consolidation.

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