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Federico Sturzenegger (Universidad de San Andrés/Harvard Kennedy School)

Nicolás Der Meguerditchian (Universidad de San Andrés)

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A Balance-Sheet Model of Fiscal Policy in Namibia[1]

Federico Sturzenegger[2] Nicolás Der Meguerditchian[3]

Abstract

The issue of debt sustainability has been the focus of continued theoretical and practical interest over the years. In emerging markets, much of the debate has focused on explicit government liabilities, which, while relevant, only represents a small share of government´s liabilities. In contrast the balance-sheet approach estimates all government assets (the most important being the net present value of taxes) and liabilities (the most important being the net present value of expenditures) to compute the government´s net worth. In this paper we apply this methodology to study fiscal sustainability in Namibia. We find that, currently, the Namibian government´s net worth is tilted sharply to the left. We simulate the impact of two types of shocks, a depreciation of the real exchange rate and an additional GDP growth, and find that both produce a further deterioration of the government's balance sheet. Finally, we ask about what type of policies would allow the government to recover the fiscal sustainability and show that, for example, a partial freeze in public salaries allows to recover fiscal sustainability very quickly.

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[2] Universidad de San Andrés and Harvard Kennedy School.

[3] Universidad de San Andrés.

I. Introduction

The issue of debt sustainability has been the focus of continued theoretical and practical interest over the years. As the asset class of sovereign debt has become deeper, the tools to assess sustainability have remained at the forefront of the public policy debate in emerging economies. The recent surge in debt ratios around the world as a result of Covid-19 has added an additional sense of urgency to the debate and has brought the issue to most advanced economies. In these, the debate centers on whether low interest rates ($r<g$) can allow us to give away with the concept of sustainability altogether. Barro (2020), Cochrane (2020) and Svensson (2020) argue not, while Blanchard (2019) presents a more nuanced and positive view.

In spite of all this debate the concept of debt sustainability remains elusive. Wyplosz (2011) puts it nicely: fiscal solvency is a "known unknown", and assessing it is "mission impossible". The reason is straightforward: fiscal sustainability has to do with expectations about future policy outcomes which are always difficult to assess.

Buiter (2002) argues that the sustainability concept is meaningless, because, at the end of the day, budget constraints always hold. If so by debt sustainability we mean a situation in which debt is paid without resorting to defaults or the erosion of its real value through inflation. But where do we establish a limit for inflation dilution before we consider the debt unsustainable? With all these questions in mind, a recent survey by Abbas, Piencowzki, and Rogoff (2019) reviews the literature in its current state.

Closer to the objective of this paper, we notice that in emerging markets debt, much of the debate focuses on *explicit* government *liabilities,* government issued debt and its ratio to GDP. The key insight of this paper is that these liabilities, while relevant, usually represent a small share of actual government liabilities: indeed, as an indicator of fiscal solvency, they are relatively uninformative – and possibly misleading– if not matched with the asset side of the government's balance sheet. Much in the same way as in corporate finance, where no debt analysis is done without taking into consideration the asset side of the corporation's balance sheet and its revenue generating potential, a fiscal sustainability analysis should factor in the value of financial and real government assets as well as the present value of future tax collection. Furthermore, among the government's liabilities, explicit government liabilities such as debt, are probably a very small fraction of government's obligations that include public sector wages, pension payments and transfers.

These non-debt liabilities and assets may be affected by changes in many variables. For example, when considering the real exchange rate, they may be impacted in a way that dwarfs the effect on the explicit liabilities which are typically the focus of attention. With this in mind, this paper contributes proposes a balance-sheet approach that, as illustrated by the practical applications included here, may radically alter the results from traditional sustainability evaluations –and, more generally, the perception of a country's fiscal vulnerability.

Levy Yeyati and Sturzenegger (2021) produce a methodology that is both operational and replicable, and that could complement the standard sustainability assessments regularly conducted by governments and market practitioners. This paper reviews the conceptual issues that distinguish the new approach from the traditional ones and highlights the different implications it yields in terms of the country's currency imbalances and its response to growth and real exchange rate shocks.

Intuitively, while fiscal liabilities (most notably, pensions and wages that comprise the largest part of current expenditure in most developing economies) are largely denominated in the domestic currency, taxes collected on the tradable sector of the economy are in part "foreign-currency indexed" –particularly so in the case of commodity exporters where a significant share of the exported production is owned by the government. In that case, once the whole balance sheet effect is computed, by diluting the value of domestic currency liabilities while enlarging the resource base, a real depreciation may enhance the net worth of the government even in partially dollarized economies or for government that issued foreign currency debt. More generally, the vulnerability and response to shocks associated with a given debt level and structure computes differently once the fiscal surplus is broken into its individual components, and the effect of the shocks is estimated on *all* asset and liability items. Understanding this response is useful to discuss the optimal denomination of foreign debt, we come back to this at the end.

Measuring debt sustainability by relating debts to assets (rather than to the more traditional debt-to-GDP ratio) allows to fully include the effects of changes that have an impact on the asset side of the balance sheet of the government with relatively little impact on debt ratios in the short run. A growth shock, for example, affects the balance sheet by changing the value of future taxes and future expenditures. We can then assess the elasticity of net worth to growth to answer the question of whether growth can help a specific country get out of a debt problem, a question that is key to current policy decisions in southern Africa.

The paper is organized as follows. Section II provides a brief survey of the related literature. Section III presents the Levy-Yeyati, Sturzenegger (2021) balance sheet approach and describes the methodology. Section IV applies the methodology to the case of Namibia. Section V concludes.

II. Sustainability and solvency: what's in the menu?

Determining fiscal sustainability, namely, the government's ability to repay existing obligations over the indefinite future, presents a daunting task that cannot be addressed in the form of simple summary indicators. Governments will claim that they can make the payments and generate the needed primary surpluses to do so even when history or common sense tends to suggest that the attainable surplus depends on growth, interest rates, and real exchange rate, factors that are largely beyond the control of the government in the short run and on which forecasts by the parties involved often disagree.

Hence, assessing debt sustainability is as much an art as it is a science, and can be tackled through a wide range of alternative methodologies. Abbas, Piencowzki, and Rogoff (2019) and Chalk and Hemming (2000) provide excellent surveys of the traditional approaches and their practical application to developing economies.[4] The purpose of this section is not to provide a new survey

[4] See, Bohn (1995), Díaz Alvarado et al. (2004) and Mendoza and Oviedo (2004), Brumm, Kotlikoff, and Kubler (2020), Hasanhodzi (2020) and Sergeyev and Mehrotra (2020) for alternative developments.

of this growing literature, but rather to cover three key aspects on the subject: i) the basic intertemporal approach, which gives a rule of thumb to evaluate sustainability under the assumption that the economy is in its steady state; ii) the link between the exchange rate and sustainability in the traditional approach; and iii) the link between sustainability and the volatility of key drivers such as growth and financial market conditions.

The Basic Intertemporal Approach[5]

We start from a basic debt accumulation equation ignoring, for the time being, the distinction between local currency and foreign currency debt (that is, we assume all debt is in local currency):

$$D_{t+1} - D_t = i_{t+1} D_t - P_{t+1}$$

where P_{t+1} is primary surplus of period t+1, D_{t+1} is the total end-of-period t+1 public debt stock, and i_{t+1} is period t+1 interest rate.

Dividing both sides by GDP and rearranging, we obtain

$$d_{t+1} = \frac{(1+i_{t+1})}{(1+g_{t+1})} d_t - p_{t+1}$$

where lower case letters denote ratios to GDP and g_{t+1} is the GDP growth rate from period t to period t+1.

Substituting forward and imposing the "no Ponzi game condition" that the present value of future debt as a percentage of GDP value must converge to zero, we obtain the present value budget constraint:

[5] This section draws on Blanchard (1990) and Chalk and Hemming (2000).

$$d_t = \sum_{v=0}^{\infty} R_{t+1,v} p_{t+1+v} \tag{1}$$

where $R_{t+1,v} \equiv \prod_{s=0}^{v} \frac{1+g_{t+1+s}}{1+i_{t+1+s}}$. This just says that the debt stock has to equal the present value of future primary surpluses.

In what sense is (1) a "debt sustainability condition"? Other than imposing the no-Ponzi-games condition —which follows from the very basic idea that individuals holding government debt will not allow the government to run a "Ponzi game" in which debt is rolled over forever—, we have derived equation (1) using only accounting identities. Here, the present value budget constraint simply tells us that there must be consistency between today's debt stock and the projected path of primary surpluses, interest rates, and growth, but not how this consistency is to be achieved. This could be done, for example, by adjusting the present debt stock through a restructuring, or diluting it through inflation (which raises nominal growth relative to interest rates and hence the discount factor *R*). Hence, the present value budget constraint is a condition on future required primary surpluses only if one assumes that the government wants to avoid these other ways of adjusting, that is, if the current debt stock as well as the path of *g* and *i* are taken to be exogenously fixed, rather than endogenously determined –at least partially– by government choices.

However, even when this assumption is made, the present value budget constraint imposes little "discipline" in the sense that there are infinitely many primary surplus paths that will make the equation hold. Whether debt is sustainable or not boils down to the question of whether at least some sustainable path is feasible. How do we know if this is the case? In essence, three approaches have been suggested and applied in practice.

First, one can impose "discipline" artificially, by way of a thought experiment, pretending that the economy is in steady state, and considering only flat primary surplus paths –in what is usually referred to as "static sustainability analysis". Thus, assuming that the interest rate and GDP growth rate are constant, equation (1) becomes:

$$d_t = \sum_{v=0}^{\infty} \left(\frac{1+g}{1+i} \right)^{v+1} p_{t+1+v} \tag{2}$$

If, in addition, we assume the primary surplus to be constant over time, we obtain:

$$p = d_t \left[\frac{1+i}{1+g} - 1 \right] = d_t \left[\frac{i-g}{1+g} \right], \text{ assuming } 0 < \frac{1+g}{1+i} < 1 \tag{3}$$

which gives the level of primary surplus that makes the current debt sustainable (or stable as a share of GDP, to be more precise), a measure that can be computed very easily. While (3) is a useful rule of thumb, the underlying static sustainability approach is incomplete, as it does not deal with possible uncertainty regarding GDP and interest rate paths (even though the analysis can be done assuming the future values for growth and the interest rate), and it abstracts from complications that arise if a portion of the debt is in foreign currency –two issues to which we return later in the paper.

In addition, one implication of static sustainability analysis is that it delivers something stronger that we actually need, namely, a primary surplus path that not only makes the debt sustainable, but also keeps it constant at its current level. However, there is no reason to assume that the current debt-to-GDP ratio is optimal.[6]

In practice, this problem can be dealt with in two ways. One approach is a more flexible version of the static one, in which equation (3) is used to calculate the required long-run primary surplus, while the short and medium run debt dynamics that might lead to that long run are modeled explicitly, assuming alternative short and medium term transition paths for interest rates, growth, and the primary surplus. This is the way in which debt sustainability analysis has traditionally been conducted by country authorities and international institutions such as the IMF (Chalk and Hemming, 2000).

[6] Additionally, this framework is silent about the practical feasibility of the "sustainable" primary surplus.

An alternative approach, based on Bohn (1998) has recently been applied to developing countries (IMF 2003a, Abiad and Ostry, 2005), modeling explicitly the primary surplus as a function of control variables such as the debt stock, the growth rate and the interest rate using historical data. In turn, fiscal sustainability is assessed by comparing the present value of fitted primary surpluses (predicted based on projected values of the controls) with the debt outstanding. The advantage of this approach is that it systematizes the historical evidence and models fiscal accounts more realistically; its disadvantage is that it assumes that the ability of the authorities or the country to generate primary surpluses will be the same in the future as it was in the past, ruling out the exceptional fiscal performance that is sometimes observed in the face of crises or after crises –as the Greek recent case exemplifies–. Therefore, while this approach may be a reasonable starting point if the goal is to assess the sustainability of the *current* policies, it may be unduly pessimistic about the government's adjustment capacity in the event of a crisis.[7]

How does a devaluation affect fiscal sustainability in the traditional approach? [8]

Because the currency composition of debt may differ from that of GDP or government resources, it is critical for our analysis to keep track of the denomination of debt in foreign and domestic currency. Ignoring the distinction between end of period and period average exchange rates, and focusing on the real exchange rate as the relative price of tradables and non-tradables, the debt to GDP ratio d can be expressed as:

$$d = \frac{D + eD^*}{Y + eY^*}, \tag{4}$$

where e is the real exchange rate (defined as the price of non-tradable goods relative to tradable goods), D is debt payable in domestic currency, D^* is debt payable in foreign currency, Y is output of non-tradables, and Y^* is output of tradables.

Mismatches between debt and output currency composition can result in a substantial impact of real exchange rate variations on the debt ratio. At one extreme, consider the case of an indebted

[7] See Abiad and Ostry (2005) for refinements of the endogenous primary surplus approach which attempt to address this objection.
[8] This section closely follows Calvo, Izquierdo and Talvi (2003).

closed economy where output is denominated in non-tradables, and all debt is foreign denominated, i.e. $d = eB^*/Y$. At the other extreme, suppose $(B/eB^*)/(Y/eY^*) = 1$, so that the composition of debt and output is perfectly matched. In the latter case, a real depreciation has no effect on the debt ratio; in the former case, it raises it one to one. Calvo et al (2003) illustrate this point by estimating the effects of 50% real depreciation in a selected group of emerging economies. Using 1998 debt stocks and focusing on the relative price adjustment—i.e. assuming that interest rates on public debt and GDP growth remain unchanged—they argue that the debt ratio would have jumped from 36.5 percent of GDP to 50.8 in dollarized Argentina, whereas it would have barely moved in non-dollarized Chile (from 17.3 percent to 18.7 percent), and while the level of dollarization is low in southern African countries, understanding the response of debt ratios to real exchange rate changes remains useful to understand the optimal denomination of debt.

This analysis, however, is partially silent on the response of fiscal accounts as a result of a real devaluation. While it recognizes that a certain fraction of GDP –hence, of tax revenues– are foreign currency linked, it abstracts from the fact that the main public liability (in turn, the main fiscal outlays) is not associated with the service of explicit debt but rather with spending promises, most of which, particularly wages and pensions, are quoted in domestic currency and tend to be diluted in a high depreciation-high inflation scenario. As long as wages and pensions lag behind prices in their adjustment to the new exchange rate, we should expect the higher debt service to be partially offset (or, in some cases, even outweighed) by the improvement in the primary surplus as a result of the devaluation.[9] The approach of this paper takes this effect fully into account.

Dealing with Uncertainty

From the previous discussion, it is clear that projected paths of output, interest rates, real exchange rates –as well as any additional determinant of the primary surplus– is critical for a fiscal sustainability assessment. How can one deal with the uncertainty surrounding these projections?

[9] Note that, even if real wages (measured in CPI units) are kept constant, fiscal revenues, often proportional to the nominal GDP, will tend to outpace wages to the extent that the tradable component of GDP exceeds that of the consumption basket.

Two broad approaches have been applied in practice. The first one, popular among practitioners, consist in subjecting a particular debt sustainability scenario to "stress tests" that assume alternative extreme paths for the critical variables. These stress tests answer whether the debt would still be sustainable if, say, there is a sharp rise in international interest rates, a dramatic deterioration of terms of trade, or a sudden economic slowdown. In order to choose a "reasonably" adverse scenario, one can calibrate (permanent and transitory) shocks based on the stochastic behavior of the relevant variables in the past. The International Monetary Fund has extensively used this approach in recent years, and refined it in several ways (IMF, 2005c).

Although this approach is useful in giving a sense of the sensitivity of the debt sustainability analysis to a range of plausible scenarios, it falls short of using the whole joint distribution of shocks. Specifically, it disregards correlations among shocks, as well as the joint dynamic response of the relevant policy variables. In response to these shortcomings, a number of authors have recently attempted to estimate the variance-covariance structure of the shocks and used these estimates to generate probabilistic forecasts of debt dynamics. These forecasts can then be used to estimate the probability that the debt ratio rise beyond a pre-specified threshold.

The approaches taken in these papers differ —in particular, with respect to whether and how the government's behavior is modeled. However, most of them share the basic methodological perspective: a vector autoregression is estimated to simulate the main exogenous drivers of debt dynamics, fiscal policy is treated as endogenous (either by including the primary balance in the vector autoregression, or by separately estimating a policy reaction function), and a probability distribution of the debt ratio is generated using Monte Carlo simulations. The results can be presented in highly intuitive ways; for example, Ferrucci and Penalver (2003) and Celasun, Debrun and Ostry (2006) use "fan-charts" familiar from the inflation forecasting literature to illustrate the distribution of paths of debt ratios, whereas Garcia and Rigobón (2004) report impulse-response charts to illustrate the trajectory of debt ratios in response to a variety of shocks—in the spirit of "stress tests" but on more solid econometric grounds. To varying degrees, these new approaches encompass and enrich the more traditional ones. A different strand, borrowing from the financial literature, has tried to extend the now standard Value at Risk approach to the case of a central bank (Blejer and Schumacher, 1998) or, closer to our agenda, to fiscal accounts (Barnhill and Kopits, 2003).

With the exception of the static approach, all of these models pay due attention to the concept of vulnerability that stresses the importance of the negative tail of the distribution of the relevant variable –typically, the debt ratio–, in contrast with the emphasis on the expected (average) level placed by the traditional sustainability analysis. All of these models, however, relate debt ratios to either reduced forms of the underlying future primary surplus or, at best, to the composition of *explicit* liabilities (documented debt stocks).

III. The Balance sheet approach

In a recent analysis of sovereign debt statistics (which included the Americas as well as some other key emerging and developed economies), Cowan et al (2006) unveiled a number of cases in which governments have made an effort to bring their debt numbers closer to the net worth concept underlying the balance sheet approach. Brazil, for example, reports only net public debt, that is, debt net of international reserves. Mexico computes a net debt number by netting some off-balance sheet assets. Canada, in turn, reports a debt figure net of public assets, where the latter includes both liquid assets and other computable government claims such as student loans.[10] Finally, the US also reports a net debt concept.

Perhaps the clearer example in this regard is New Zealand, which, in compliance with the Public Finance Act of 1989 (Part III), must prepare annual consolidated financial statements in accordance with generally accepted accounting practices.[11] New Zealand's approach falls short of

[10] In an early precedent, Buiter (1985) has suggested that items typically excluded by the conventional approach should be an integral part of sustainability analysis,

[11] Specifically, they must include, in addition to financial statements, a statement of borrowings, a statement of no used expenses and capital expenditures, a statement of emergency expenses and capital expenditure, a statement of trust money administered by department and offices of Parliament, and any additional information and explanations needed to fairly reflect the consolidated financial operation and its financial position. They must also include the government's interest in all Crown entities, all organizations, state enterprises, parliament and the Reserve Bank of New Zealand, as well as that of any other entity whose financial statement must be consolidated into the financial statements of the Government to comply with generally accepted accounting practice.

the comprehensive net worth concept that we use here in that, while it considers liquid and physical *assets* –including items such as public roads or the national library that may be considered of little "redeeming value"– it ignores the present value of future government resources –less straightforward to value but economically more important. It does come closer to our approach on the liability side, where they add the actuarial value of pension fund liabilities.

With the exception of New Zealand, it seems that governments accept that assets that have the necessary liquidity (reserves), were issued with an equivalent collateral (debt operations) or are one off deviations from normal behavior (Mexico's financial losses due to the 1995 bank bailout) should be netted out from the debt stock figure. In line with this, and to make debt numbers more coherent across countries, Cowan et al (2005) propose three debt concepts: one in which government debt held by the central bank is netted out, a second in which foreign currency reserves are netted out, and a third one (to attain comparability between countries that have and have not privatized their social security system) where the assets of privatized social security funds are netted out (under the assumption that these assets approximate the values of liabilities that the government will not have under a private regime whereas they exist when the system has not been privatized). At any rate, all these attempts are only halfway efforts that, while closer to a true depiction of the debt situation, fall short of providing a summary statistic of fiscal sustainability.

Table 1 presents a scheme of Levy-Yeyati and Sturzenegger´s (2021) government balance sheet and the resulting net worth. Measuring each of these components is not straightforward and entails methodological decisions. For example: Should physical assets be treated as "marketable" in the sense that they can be used to finance liabilities? Should debt be valued at face or market value? Should contingent liabilities be taken at their actuarial value? Should the cash flow of state-owned-enterprises (SOE) –which typically includes a subsidy component–, social security or tax revenue be extended forward assuming today's legislation? [12] Last but not least, given that the balance sheet is the present value of future flows, what discount rate should be used to do such discounting?

[12] This appears to be the natural choice if sustainability is to be mixed under the current policy mix. Stress tests on net worth based on specific policy changes can be used to complement the analysis.

Table 1. The Balance Sheet

Assets	Liabilities
Liquid Assets	Explicit Liabilities
Physical Assets	Contingent Liabilities
NPV of taxes	(NPV Social Security)
Net worth of SOE	(NPV Health insurence)
	(NPV Other expenditures)
	Net Worth

The implementation of this methodology follows directly from the balance sheet in Table 1. The measurement of each of its components merits some comment. Within the asset side, liquid assets should be measured at their current market value. Because many countries have actually run down significantly their reserve levels at times –and more generally because they are liquid assets that can be disposed of almost immediately at any point in time– we choose to include the full value of reserves in our estimation of the value of assets. While physical assets are also valued at market value, to the extent that they are assets that may be disposed of, we choose not to include physical assets that are unlikely to be sold on short notice at a reasonable price (roads, government buildings, IMF quotas, etc). Finally, the net worth of SOEs should come from its approximate market value whenever there is one.

Importantly, the main component of the asset side is also the most difficult to evaluate: the net present value of taxes. To compute it, we need to estimate a future path of tax revenues. To simplify our discussion, we deliberately abstract from potential changes in tax policy (unless known), and take the current tax structure as given and constant looking ahead. This means we discuss the sustainability of the *current known path* of fiscal policy. More precisely, we estimate how tax revenues respond to key exogenous variables, project revenues as a function of the (projected) evolution of these variables and discount the revenue flow to obtain its present value. Regarding the liability side, with the exception of liabilities with a predetermined cash flow such as net social security outlays and debt payments (which are computed separately), government spending is estimated as before, as a function of a few exogenous variables.

The methodology consists of the following four steps:

1. Define a set of exogenous variables (in our example, GDP, the real exchange rate, terms of trade and the international interest rate) and estimate a model that simulates their future evolution.[13]
2. Estimate response functions for specific components of income and expenditures; in our case, standard OLS regressions of revenues and spending items on the exogenous variables of choice.
3. Generate paths for the exogenous variables bootstrapping the VAR residuals and simulate income and expenditure flows by plugging the simulated paths for the exogenous variables in the revenue and spending functions obtained in (2). Then compute the primary surplus.
4. Add the predetermined cash flows to obtain the government's cash flow, and discount everything to compute the government's net worth (the net present value of the government's cash flows) for each simulated path to obtain a distribution of net worth that represents the summary expression of fiscal sustainability according to the balance-sheet approach.

In what follows, we apply each of these steps to the case of Namibia.

III. 1. *Modeling the environment*

We model the macroeconomic environment by means of a simple VAR representation of four exogenous variables: terms of trade, the international interest rate, the level of the real exchange rate and the rate of growth of real GDP. The general specification has the form

$$y_t = A(L)y_t + BX_t + v_t,$$

where y stands for the vector of endogenous variables. From the VAR we obtain the dynamic response function as well as an estimate of the shocks to the exogenous variables. These are then

[13] Notice that this implies that we assume that the evolution of output and the real exchange rate are independent of fiscal policy in the short run.

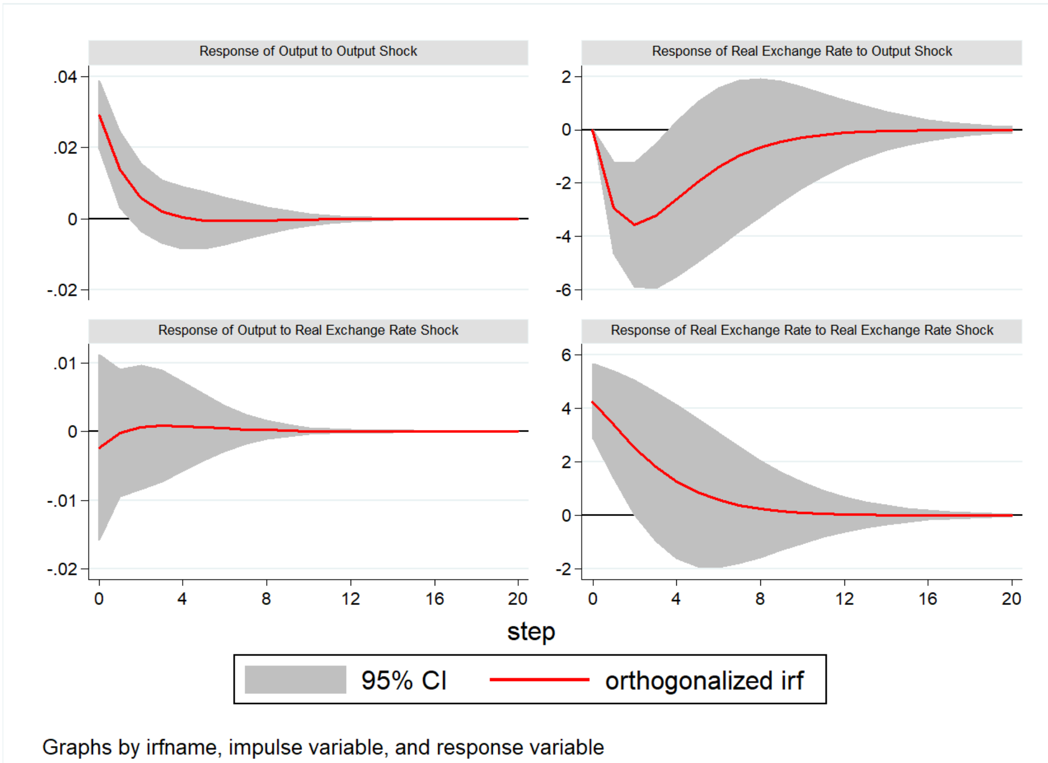
used to compute a stochastic future path for the endogenous variables, bootstrapping from the joint distribution of shocks implied by the residual matrix *v*. Table 2 reports the VAR coefficients and Figure 1 the impulse response functions of interest. Here, the libor interest rate and the terms of trade are introduced as an exogenous variable and modeled separately as an independent AR (1) process and the period runs from 2004 through 2023, assuming that the 2021-2023 data complies with Namibia's fiscal forecasts presented in Ministry of Finance (2021).

Table 2. VAR Coefficients

	Real exchange rate equation	Output growth equation
Real exchange rate L1	0.724*** (0.122)	0.0208 (0.0860)
Output growth L1	-0.972*** (0.238)	0.472*** (0.168)
Libor rate L1	-0.00555 (0.00605)	0.000170 (0.00427)
Terms of Trade L1	-0.00105 (0.00200)	-0.00423*** (0.00141)
Constant	1.419** (0.625)	0.329 (0.442)

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 1. Impulse-Response for GDP and Real Exchange Rate



III. 2. Modeling fiscal accounts as a function of exogenous variables

III.2.1 Taxes and current expenditures

A critical part of our analysis refers to the sensitivity of income and expenditure lines in the balance sheet with respect to the exogenous variables in the VAR.[14] These sensitivities can be computed from historical data assuming that there is a relatively stable relation between, say, output growth and the real exchange rate and the tax or expenditure base. As noted, we do not model the deficit as a function of our exogenous variables based on historical data; rather, we break down the fiscal accounts into its individual revenue and expenditure components and estimate the elasticity of each of the latter with respect to the relevant exogenous variables. We

[14] For brevity, we will refer to both the *X*´s and the *y*´s as "exogenous" variables, as they are assumed to be independent from the fiscal accounts calculated below.

then apply these elasticities to estimate future changes relative to the *current* value of the revenues and expenditures. In this way, we can estimate the deficit as a function of the exogenous variables for the *current* fiscal policy mix.

A general equation could be written for each source of revenue or expense:

$$R_{it} = GDP_t t_i e^{\alpha_i q_t} e^{\beta_i \Delta gdp_t} e^{X\beta} e^{\varepsilon_{it}}, \tag{5}$$

$$E_{it} = GDP_t s_i e^{\alpha_i q_t} e^{\beta_i \Delta gdp_t} e^{X\beta} e^{\varepsilon_{it}},$$

where R (E) and GDP refer to nominal revenues (expenditures) and output, t (s) is the average *effective* tax (spending) rate which may change with real GDP (*gdp*), if tax compliance or public spending display cyclicality. Considering that $e\,p^*/p_{NT} = q$, the specification assumes that each tax revenue and expense has a certain "tradability", understood here as their elasticity with respect to the real exchange rate.[15] Both the elasticity with respect to the real exchange rate and to real growth can be estimated by running a log version of equation (5) for each line of the primary surplus. The estimation equation for revenues is

$$\ln\left(\frac{R_{it}}{GDP_t}\right) = \alpha_i q_{it} + \beta_i \ln \Delta gdp_t + \ln t_i + X\beta + \varepsilon_{it}, \tag{6}$$

where X stands for other exogenous variables that affect tax revenues or expenditure decisions.

In practice, the output and real exchange rate elasticities for income and expenditure data are estimated by studying the relationship between revenues and expenditures as percentage of GDP with output growth and the real exchange rate. Additionally, where there has been a sharp change in tax collection (though not on tax rates, as the estimation was deliberately done over periods of stable rates), a time trend is included.

[15] This elasticity will be critical when we estimate the balance sheet vulnerability to a real depreciation in the next section.

Table 3 show how income and expenditure relate to gdp growth, the real exchange rate[16] and the terms of trade. The table shows some peculiar features. Value added tax and income tax increase as a share of GDP with output growth, as expected, but the coefficient is statistically significant on for the value added tax. The value added tax share in GDP falls with a real exchange rate appreciation, possibly as a result of the fact that non-tradable sector has lower taxes relative to the tradable sector. Surprisingly, trade taxes are not linked to the exchange rate, a feature specific to Namibia and related to the fact that trade taxes are associated to the wider SACU area trade flows. On the expenditure side government expenditure increase as a share of GDP when growth is high and decrease with a real appreciation, while interest payments naturally fall as a percentage of GDP with growth, and contrary to many other developing countries the ratio of interest to GDP falls with a depreciation, the result of a debt that is mostly denominated in local currency. Many components show very large and statistically significant trends that are associated to changes in fiscal policy in the initial years after independence. These trends will be a source of problem in our estimation as they cannot be projected into the indefinite future. Thus, the estimations will assume that this trend term is zero going forward, indicating that fiscal policy in Namibia has already matured.

Table 3. Income and expenditure sources and economic variables

	Income Tax	Trade Tax	Value Added Tax	Non Tax	Current Expenditure	Interest Payments
Log (real exchange rate)	0.0157 (0.0179)	-0.0516 (0.0517)	-0.0495** (0.0177)	-0.00243 (0.00842)	-0.228** (0.0958)	0.0473** (0.0205)
Growth of GDP	0.0334 (0.0448)	-0.0697 (0.129)	0.174*** (0.0441)	0.00815 (0.0210)	0.0749 (0.239)	-0.150** (0.0512)
Terms of Trade	-0.00009 (0.000330)	0.00108 (0.000951)	-0.000921** (0.000325)	0.0000353 (0.000155)	-0.00387** (0.00176)	0.000126 (0.000377)
Trend	0.00187*** (0.000396)	-0.000543 (0.00114)	0.00104** (0.000390)	-0.000523** (0.000186)	0.00802*** (0.00212)	0.000859* (0.000453)
Constant	0.0364 (0.0953)	0.246 (0.275)	0.372*** (0.0939)	0.0354 (0.0448)	1.648*** (0.509)	-0.213* (0.109)
R-squared	0.778	0.191	0.660	0.614	0.603	0.800

[16] Here, an increase in this variable implies an appreciation in real terms.

III. 3. Simulating the exogenous variables and income and expenditure flows

The third step follows directly from steps 1 and 2. Using the most recent fiscal numbers of Namibia going through 2023, the exogenous variables are forecasted thereafter by bootstrapping the VAR residuals. Figure 2 shows the results of this exercise, with the corresponding standard errors in a fan-chart graphical representation (where the outer area covers 95% of the distribution). Cash flows beyond the 20tth year are computed as a perpetuity based on the steady state values of the exogenous variables.[17] These exogenous variables –more precisely, the 1000 simulations that underlie the charts– are used to generate a stochastic representation of the income and expenditure equations. Figure 3 report the results in fan chart form. Combining these scenarios with the response functions estimated in step 2, we simulate the fiscal flows consistent each of these simulated environments.

[17] Steady state refers here to the steady state values of the VAR estimation.

Figure 2. VAR representation and AR (1) representation of exogenous variables

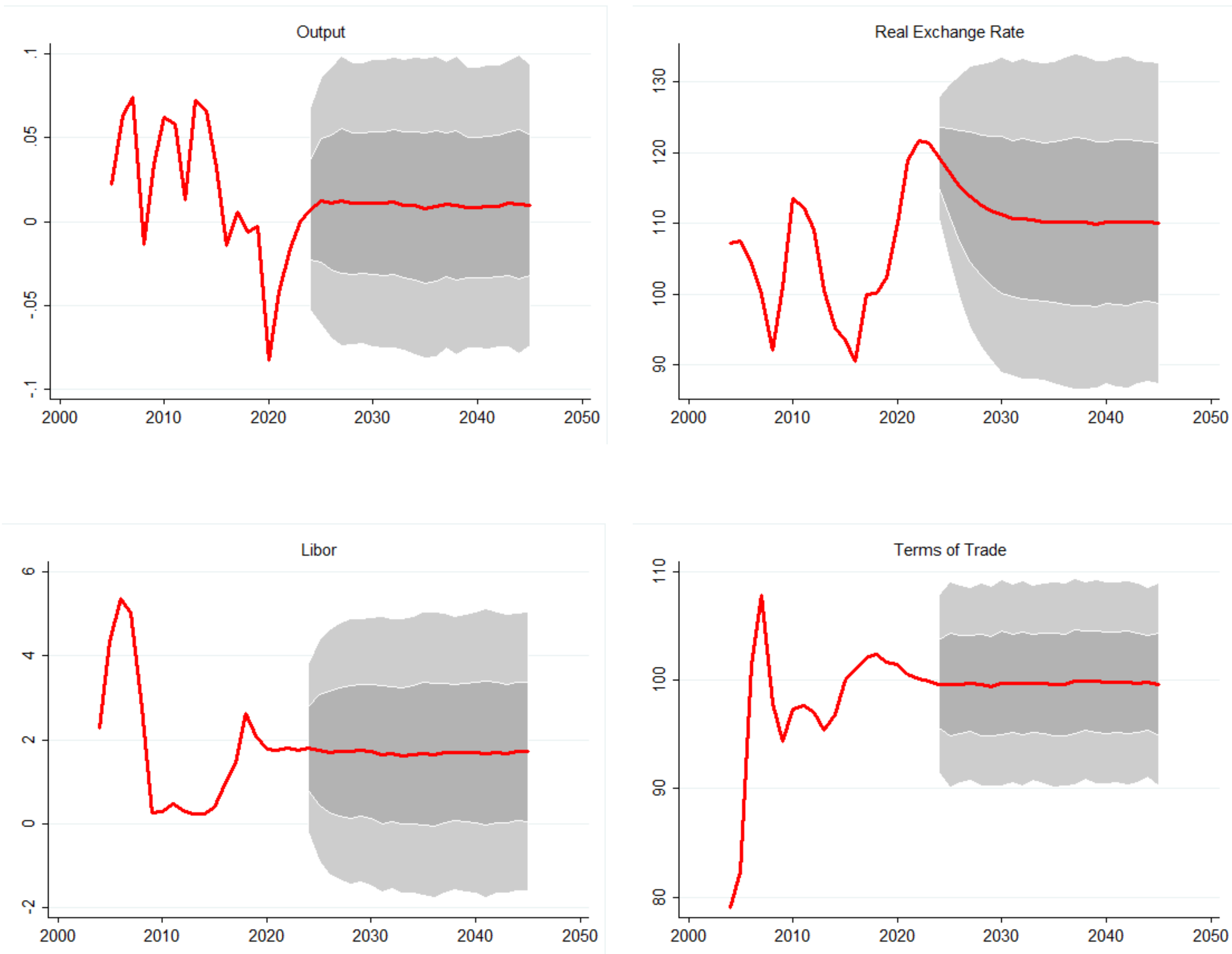
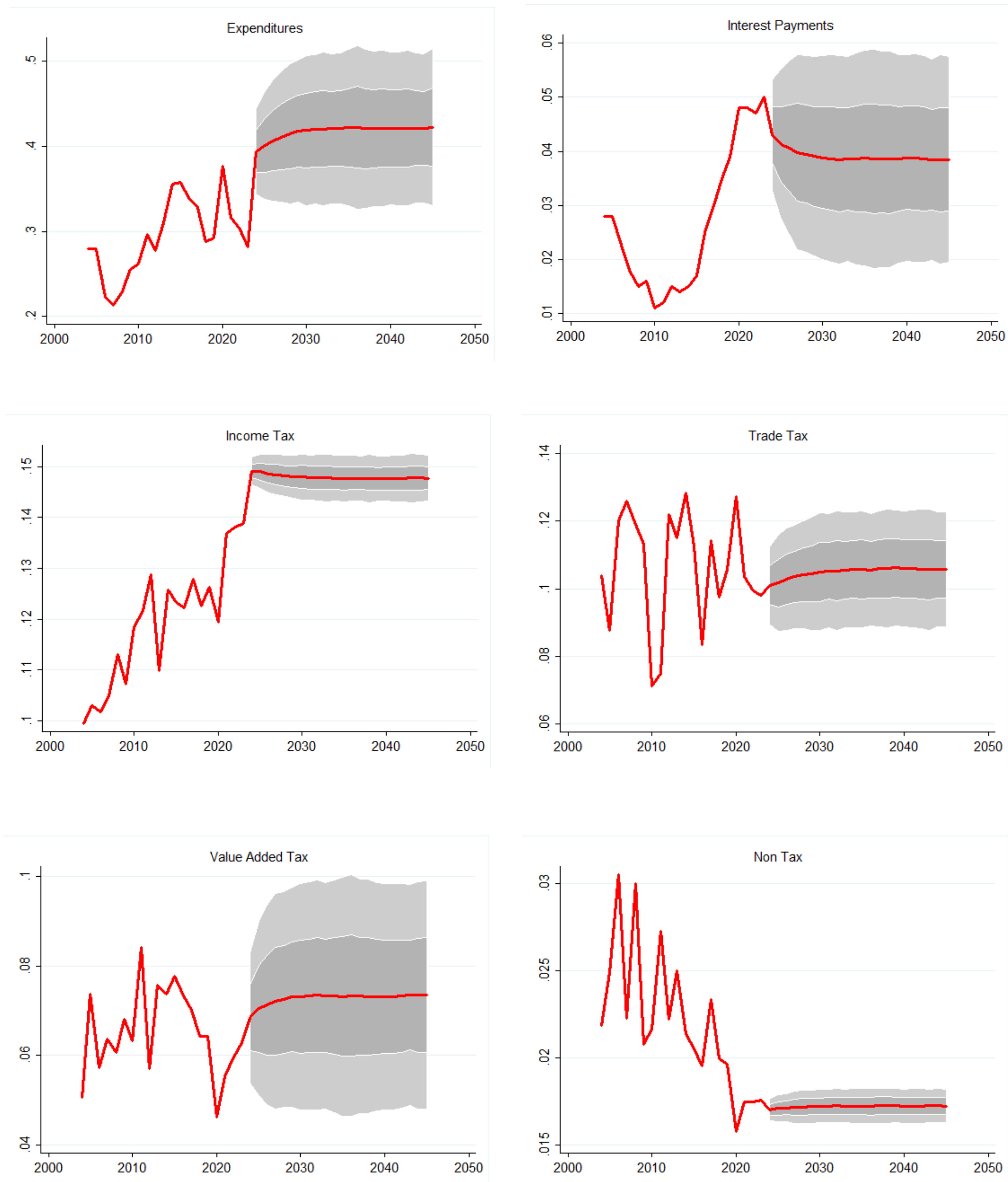


Figure 3. Expenditures and income to GDP



III.4. Putting it all together: estimating net worth

The balance-sheet representation of the net worth breaks it down into its relevant components:

$$V_t(x) = \sum_t \sum_j \frac{a_{jt}(x)}{(1+r)^t} - \sum_t \sum_j \frac{l_{jt}(x)}{(1+r)^t}$$

where *a* and *l* denote, respectively, the different assets and liabilities identified in the balance sheet of Table 1, and *x* are the fundamental variables that determine the value of individual balance-sheet items. The net-worth can then be computed by aggregating the income and expenditure flows simulated in step 3 into a primary surplus series discounting it to obtain the net present value.

III.4.1 *The discount rate*

From a methodological point of view, the definition of the rate to be used to discount the stream of fiscal cash flows is crucial. The problem is to some extent analogous to that of discounting the cash flow of a firm in order to obtain its net worth. Firm valuation typically uses the risk-adjusted discount rate that can be inferred from a pricing model of financial assets –often different ones for different cash flows. What is the logical equivalent in the case of government cash flows? Should we use different rates according to the nature of the flow? How can we evaluate the solvency of the government ruling out insolvency due to a liquidity run?

For a closed economy (autarky) a good approximation would be given by the modified golden rule (even if it differs from the discount rate of an individual or of the social planner).[18] In a financially integrated economy, the social rate of return would in principle be equal to the rate at which the country can borrow or lend in international markets, being the relevant rate the one which is currently binding (the borrowing rate for a net borrower; the lending rate for a net creditor).[19]

[18] Recall that the modified golden rule includes a term to account for the fact that population is growing so that in the case of no discounting, by using the modified golden rule the central planner would generate a steady consumption profile across generations by generating a consumption stream that increases at the rate of population growth.

[19] Note that this condition pertains to flows rather than stocks, and may be at odds with the net foreign asset position of the country. Assume a country with a fiscal surplus and a large debt maturing many years from now; if debt

However, this solution is still debatable. A borrowing rate that includes a sovereign credit risk premium (as it typically does in developing economies and in the standard debt sustainability evaluations) implicitly contradicts the question the exercise intends to answer, namely, what are the conditions under which the country never becomes insolvent? Clearly, in most cases there is an interest rate that, if high and persistent enough, makes debt dynamics explosive leading to insolvency.[20] To rule out the case of a self-fulfilling liquidity run that eventually evolves into an insolvency episode, we start by assuming solvency (hence, zero credit risk premium) and compute the distribution of net worth based on the international risk-free rate or, more precisely, the simulated path for the international risk-free rate.

III.4.2 *Computing net worth*

Note that the government's net worth should be computed based on the full simulated path for the relevant exogenous variables discounted using the simulated interest rate. To do that, we use the complete paths simulated in step 3 and compute the distribution of net worth at T=0. More precisely, each of the 1000 simulated paths delivers a net worth figure. A distribution of net worth is thus constructed based on these 1000 observations. The results are summarized in Figure 4, which reports the histogram for Namibia (expressed in terms of current GDP). The curve has a mean at around -6.8 GDPs and does not reach positive territory. Government net worth is strongly skewed to the left indicating the persistence of big primary deficits.

Also, the exercise delivers a median net worth close to -6.3 GDPs and, in the best case of -2.2 % of GDP. A look at the main components of public finances (Figure 3) shed light on this high figure: in the last years Namibia has increased its primary deficit through increases in total spending, maintaining a markedly lower trajectory on the revenue side. However, it is not the negative tail rather than the median that provides a measure of debt sustainability. In this regard,

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buybacks are not allowed or are too costly, the fiscal surpluses would be invested abroad at the international rate reducing the negative foreign asset position of the country.

[20] Note that traditional studies assume, at the same time, that new debt will continue to pay current risk-adjusted borrowing rates, and that all the debt is actually repaid (to obtain the primary surplus needed to satisfy this hypothesis). This entails an implicit contradiction since certain repayment should eliminate the credit risk premium incorporated in the interest rate.

Figure 4 shows that, under the *current* fiscal policy, Namibia is fiscally unsustainable in almost all states of the world. Needless to say, one could expect that, in light of these fiscal results, the government will be tempted to modify its fiscal stance in the future increasing taxes or cutting expenditures.

Figures 5 (a, b and c) shows how the model can be used to evaluate the fiscal sensitivity to large shocks in the exogenous variables. Here, for example, we simulate three different scenarios of additional GDP growth, to see how government net worth is modified. As can be seen, as the growth of the GDP increases, the net worth of the government moves to the left. This relatively counterintuitive result derives from two reasons, the fact that the elasticity of spending to GDP appears to be higher than that of revenues, and the impact of growth on the real exchange rate. The important practical implication is that growth will not solve the sustainability issue, which means that action needs to be taken.

Figure 4. Histogram for Namibia's net worth

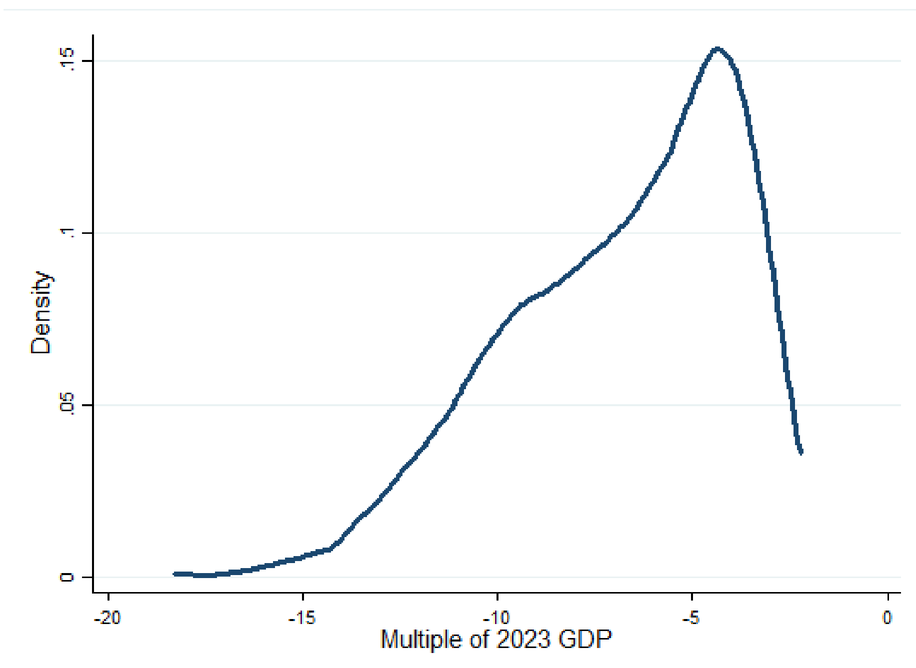


Figure 5a Additional GDP Growth (1%)

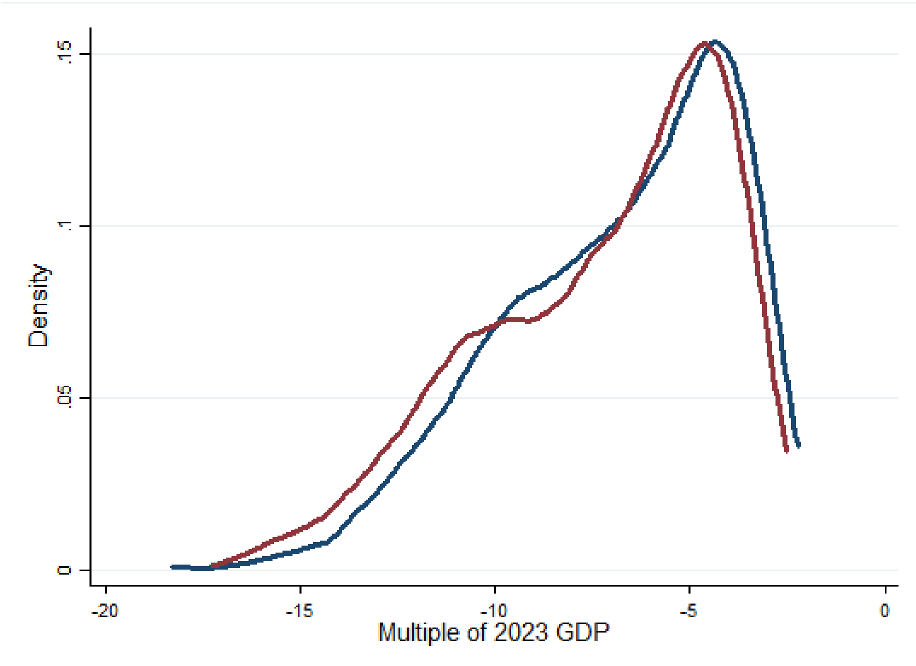


Figure 5b. Additional GDP Growth (2%)

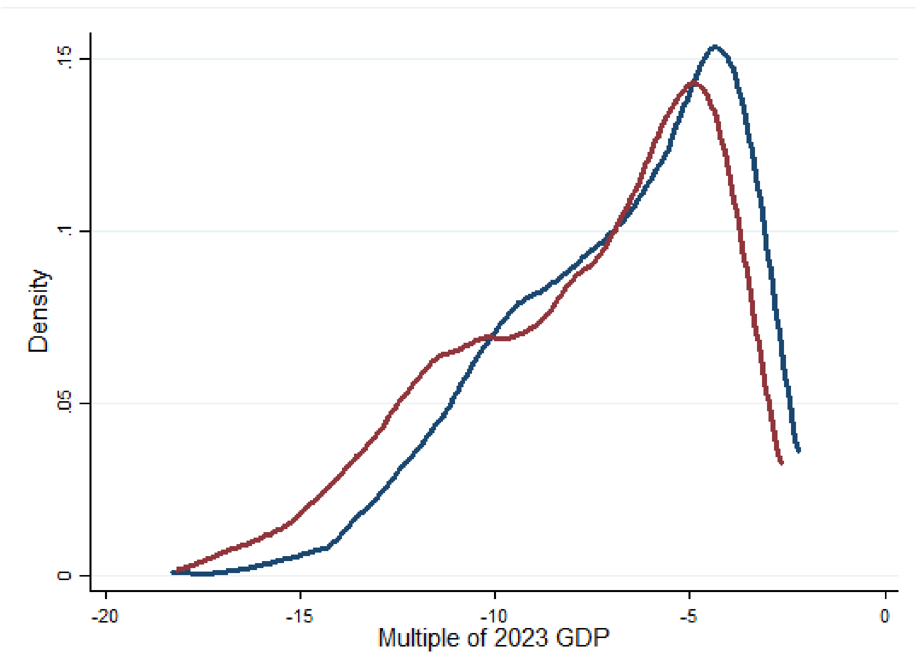
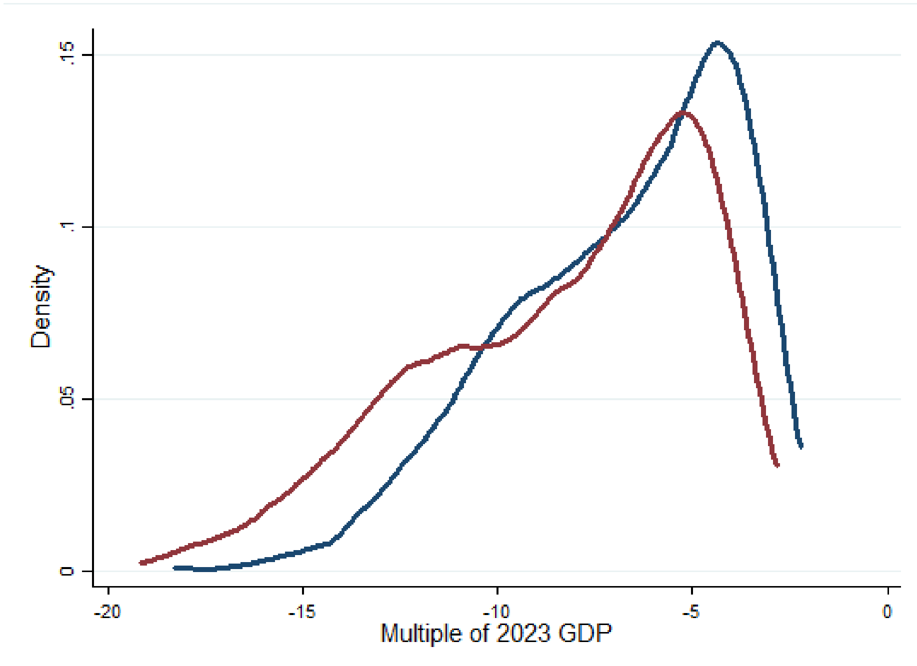


Figure 5c. Additional GDP Growth (3%)



Real depreciations and fiscal sustainability

An important part of our exercise is to show that the sensitivity of income and expenditure to the real exchange rate may differ squarely from what is implicitly assumed in the traditional analysis, since both expenditures and taxes are affected by changes in the real exchange rate making the overall effect uncertain. In the case of Southern African countries, most of the debt is denominated in local currency, so there is a belief that exchange rate depreciations would not affect sustainability.

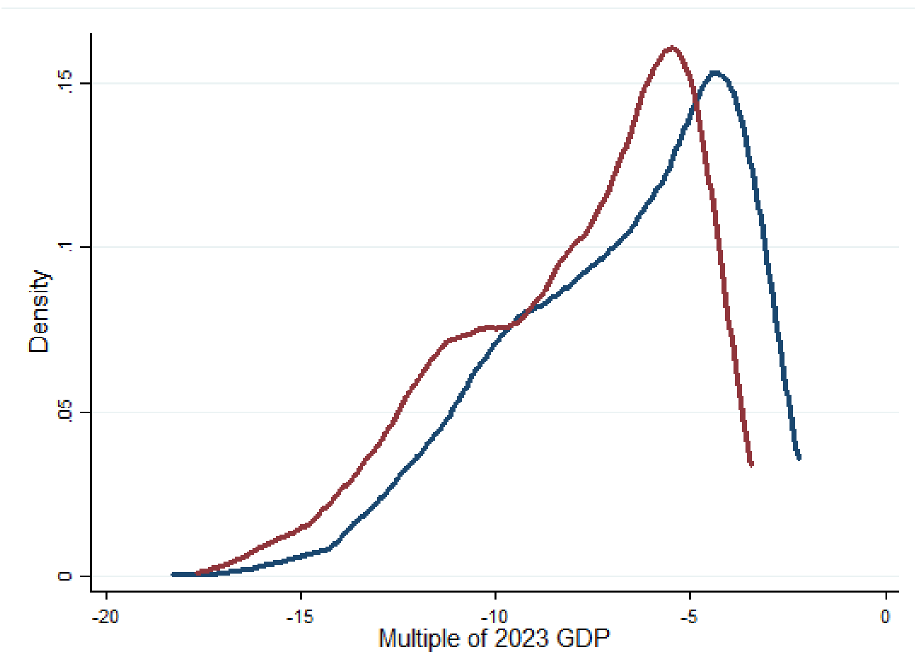
Our methodology can be used to provide an additional check to this presumption, by stress-testing the system with a one-off large real exchange rate shock that phases out over time. The effect can be assessed dynamically in a simple way, as the resulting displacement of the distribution of net worth (Figure 6).

In the case of Namibia, we simulate a *temporary* 30% real depreciation between the first five years of the projection, and find that the government net worth moves to the left. Table 4 summarizes the results. The result then is that, in spite of debt being denominated in local currency, the government still is exposed to a deterioration in solvency as a result of real exchange rate depreciations. This suggests that skewing the debt denomination to local currency is the right choice and should even be deepened.

Table 4. The effects of an exchange rate shock on Net Worth (as % of GDP)

	Basic simulation	With an exchange rate shock
Mean	-6.846	-7.999
Median	-6.307	-7.324
Maximum	-2.229	-3.418
Minimum	-18.285	-17.641
Stand. Dev.	2.973	2.966

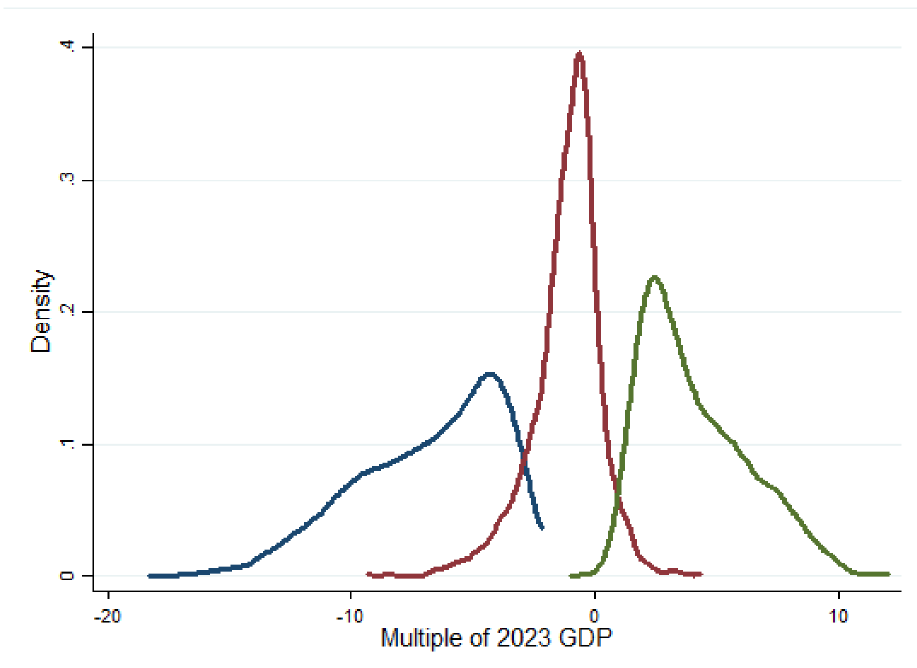
Figure 6. Histogram for Namibia's net worth in response to a RER shock



Expenditure containment

The above exercises suggest that Namibia has still a way to go in terms of fiscal sustainability. What would a policy be that may restore such balance? Of course, the possible combinations are many. For example, one way to do so is to increase expenditures at a pace slower than expected inflation. The impact is shown in Figure 7. In figure 7 we show three exercises, on in which growth of expenditures falls by 1,5% in real terms for five years after 2023. Given that wage spending is 50% of total spending this is equivalent to a fall in the public sector wage bill of 3% per year for five years, or, in other words, that wages remain almost, if not totally, nominally frozen. This leads to the middle histogram in Figure 7 where sustainability is restored. If *total* expenditures fall by 3% for five years, we obtain the histogram to the right which already places the fiscal situation in a region of strong sustainability.

Figure 7. Histogram for Namibia's net worth with expenditures fall



IV. Conclusions

In this paper, we used the balance sheet approach to assess Namibia´s fiscal sustainability based on the estimation of the country's net worth and its distribution as a function of a changing macroeconomic environment. The methodology allows to run specific counterfactual scenarios:

the fiscal sensitivity to additional GDP growth and a real devaluation, as well as a way of assessing the impact of alternative fiscal policies to restore sustainability.

In the case of Namibia, we found that given the historical elasticities or revenues and expenditures, growth would further deteriorate the fiscal situation and so do real depreciations. These results have important practical implications. First, that policy makers should not expect that growth will solve their fiscal problems, second that their balance sheet remains exposed to real exchange rate shocks, a result that validates the strategy of denominating it´s debt in domestic currency. We also showed possible actions that may restore sustainability.

We believe that our analysis allows to evaluate public accounts within a framework that is at the same time stochastic and comprehensive of all the components of the government's balance sheet. By providing a comprehensive measure of fiscal policy it can usefully complement traditional approaches to price debt instruments or evaluate the benefits and scope of debt relief initiatives. The example reported here, hopefully motivates the application of similar exercises, for South Africa and other African economies.

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