Is Sudan's Public Debt sustainable?

Preliminary Assessment

The Horn Economic and Social Policy Institute (HESPI)

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HESPI is a non-profit, non-political research institute that conducts economic, social and policy oriented research to promote high quality policy analysis and advisory service to assist African government, the private sector and other stakeholders with a special focus on the IGAD sub-region. HESPI conducts commissioned studies and interacts with principal institutions and entities to address the challenges the region faces. HESPI's focus also covers institutional capacity building and instilling values for better management of social and broad based sustainable economic growth aimed at prosperous future for the region.

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Abstract

The motivation of this study is the recently launched global agenda of SDGs goals (17.4) that proposes to " Assist developing countries in attaining long-term debt sustainability; this is to be attained through coordinated policies aimed at fostering debt financing, debt relief and debt restructuring, as appropriate, and address the external debt of highly indebted poor countries to reduce debt distress". The current state of debt in Sudan falls in his category.

To this effect, the paper briefly reviews the general approaches to address debt sustainability both from a theoretical and empirical perspectives. It further reviews the economy of Sudan as a background to the study. Finally it calculated the extent to which Sudan's debt is likely to be sustainable. It carried out the exercise under different economic growth scenarios.

First, it attempted to examine the sustainability of Sudan's debt using two conventional approaches. The first approach used an econometrics technique to test the stationarity using co-integration of government revenue and expenditures, since this has been one of the approaches in the literature. Second both a crude and more elaborate tests that focused on non-econometric approaches have also been carried out. All the crude indicators suggest similar results in that Sudan's debt is not sustainable. And the more elaborate approach that attempted to trace the dynamic path of fiscal deficits and debt under various growth scenarios indicated that sustainability will require a growth rate of GDP in Sudan that exceeds the historical national and regional average of 4%. Both approaches, therefore, suggest that under the attendant economic environment, Sudan's debt is unlikely to be sustainable

To gauge the sensitivity of the dynamic path, the exercise also considered (a) if Sudan's debt to GDP ratio is only 80% (as some reports suggest instead of the 96%), and (2) what would happen to the sustainability path if interest rate on both domestic and concessional loans increased by 2 percentage points. There is potentially a menu of sensitivity tests that could be carried out (changes in exchange rate for instance) to check the extent to which the result is sensitive to possible changes to the parameters used. But the study limited itself to the above tests.

In sum, all the approaches seem to suggest the same conclusion regarding the sustainability of the accumulated debt in Sudan. Unless donners are willing to lend more than the real value of the existing amount or cancel its debt under the Advanced HIPCs initiative, Sudan's economy has to grow by more than 4% to register a surplus in its budget balance or could only afford a small deficit as a share of its GDP if it wants to even modestly sustain its attendant debt whether it is 96% or the lower level of 80% of GDP.

1. Introduction

Sudan's economy is mainly driven by rain-fed agriculture, mineral resources and oil transit fees. In terms of the sectoral composition of the economy, agriculture (which constituted about 42% of GDP and 80% of employment in 2014) has remained as one of its main pillars. The manufacturing sector, on the other hand, which mainly focused on investment in the sugar and textile industries is relatively small. This is partly because it is characterized by low productivity. During the same year (2014), the service sector was the most dominant and accounted for about 45.6% GDP and grew by 3.1% during the same period.

The economy of Sudan has been negatively affected by the cession of South Sudan in 2011. The cessation of the South coupled with the political instability in other parts of the country (like Darfur) has further dampened the performance of the economy. In addition to the open conflicts that have prevailed in the country, various unsettled border disputes and other political tensions have probably also contributed to the weak economic performance as well and entailed some sanctions from some countries (such as the US, for instance).

In addition to the weak economic growth, inflation has also been high (in most cases double digit) in Sudan in the last 5 years. Following the decline in oil revenue, Sudan's economy was hit hard both in terms of revenue flow and foreign direct investment. Consequently, its internal and external balances have significantly deteriorated.

Similarly, Sudan's twin deficit (fiscal and trade) is worth emphasizing. This happened despite the reforms undertaken to stabilize the macroeconomic environment. Both budget and trade deficits as a ratio of GDP were negative, despite the healthy foreign reserve position that had prevailed during the oil-boom years of 1999 to 2010. The local currency also took a direct hit (against the US Dollar) following the reduction in oil revenue.

In terms of the specific focus of this paper, in addition to the above macroeconomic imbalances, Sudan has also been one of the highly indebted countries in Africa. Its debt to GDP ratio shows (depending on sources) between 70 to 100 percent of GDP. Clearly even if one takes the least figure reported, it is very high and could easily be categorized as an economy with a debt distress. This is partly due to the fact that Sudan has yet to qualify for a debt relief which many African countries took that advantage few years back. Until that opportunity avails itself and Sudan qualifies for a debt relief under what is called the Advanced HIPICs initiative, it is likely to remain as a huge burden for the Sudanese economy.

The rate of inflation showed a relative decline in the last two years compared to 2013 and 2014, but still has remained double digit and one of the highest in Africa. The recent relative reduction in inflation followed the macroeconomic reforms that took place, particularly due to the relatively tight monetary policy and prudent fiscal policy stance in recent years.

Clearly, the twin deficits and inflation have been some of the most important constrains that have faced the Sudan economy in recent years. After a weak performance for some years, however, there seem to be some improvements in the performance of the macro economy in recent years. For instance, as noted in Table 1, a slight improvement in GDP growth and a relative reduction in inflation was observed in recent years.

Table 1: Major Macro Economic Indicators in Sudan

Indicator	2013	2014	2015 (f)	2016 (f)
GDP growth (%)	4.4	3.6	3.0	2.9
Inflation (yearly average) (%)	36.5	36.9	19.8	12.8
Budget balance (% GDP)	-2.3	-1.1	-1.8	-1.3
Current account balance (% GDP)	-8.9	-7.7	-5.8	-5.6
Public debt (% GDP)	89.9	74.0	71.5	74.0

(e) Estimate (f) Forecast
Source: http://www.coface.com/Economic-Studies-and-Country-Risks (2016).

Despite the improvement in some macroeconomic indicators, however, GDP growth rate that is less than the African average, the double digit rate of inflation and the continuous internal and external imbalances that had prevailed until 2015 are some of the significant macroeconomic concern for Sudan. And most importantly, the huge indebtedness probably has far reaching negative consequences on the economic recovery process.

In line with this concern, the purpose of this study is, therefore, to assess the extent to which Sudan's recent improvements in some macroeconomic indicators could bring its debt burden to sustainable level under some plausible economic growth assumptions. More specifically, in the context of the recent macroeconomic reforms that seemed to have resulted in improved GDP growth and a decline in inflation, would the prospect of Sudan's debt sustainability improve? What possible economic growth trajectories are likely to make the attendant debt sustainable under plausible donor behavior?

The remainder of the paper is organized as follows. Following this introduction, the next section will briefly outline some of the approaches in the literature that are used to address debt sustainability issues to be followed by a description of the model that would be followed in this exercise to gauge debt sustainability in Section three. Section four will report the results of the exercise and section five will conclude the paper.

2. Approaches to Address Debt Sustainability

There have been various attempts to assess debt sustainability. These attempts started in the 1940s and 1950s. Some used econometric technique to examine sustainability while others focused on non-econometric techniques. These approaches will be briefly examined below.

2.1. Econometric Approach

The recent econometric literature for testing the sustainability of debt proceeded along two lines: one focusing on the flow and the other on the stock component of debt. The first approach (for instance used by Hamilton and Flavin (1986), Kreamers (1988), Wilcox (1989), Haug (1991) and Crosetti and Roubini (1991)), focused on testing whether the discounted value of the debt converges to zero in some future date or not. This has been examined using a unit root test to see whether the discounted debt stock is stationary or not whereby stationarity of the series is interpreted as indication of sustainability.

On the other hand, some authors focused on the proposition that for the stock of debt to converge to zero, the flow or the budget balance must on average be zero. This suggests that the necessary and sufficient condition for debt sustainability is for government revenue and expenditures to be co-integrated. Focusing on the latter approach, as Trehan and Walsh (1988, 1991), Hakkio and Rush (1991), and Arghyrou (2003) showed, the typical model specified starts with the following basic definition of debt:

$$D_{t+1} = (1+\rho) D_t + G_t - R_t \qquad (1)$$

Where D is the level of outstanding public debt, ρ is the real interest rate, G and R are real government expenditure and revenue including seignorage, respectively.

Solving for D_t and taking expectations, (1) becomes:

$$D_t = -E \Sigma_{j=0} (1+\rho)^{-(j+1)}(G_{t+j} - R_{t+j}) + \lim_{j\to\infty} E_t (1+\rho)^{-(j+1)} D_{t+j+1} \qquad (2)$$

(2) is the conventional inter-temporal government budget constraint which simply states that the outstanding debt in period t must equal the expected sum of the discounted value of budget deficit and the limit term which accounts for the discounted value of the debt in some future period.

In a steady state with zero deficit, therefore, the interaction between revenue and expenditure could be written as:

$$R_t = \alpha + \beta G_t + \sum_{i=-k}^{k} \gamma_i \Delta G_{t-i} + u_t \qquad (3)$$

Where R and G are as defined above, u is a white-nose error term and α, β are coefficients.

In principle equation (3) could be estimated in many ways, but usually many prefer using form of a co-integration techniques such as Dynamic OLS (DOLS) and similar methods. A tests for the existence of co-integration (or there lack of) between Rt and Gt indicates whether a given debt is sustainable or not. That is, if the two flow variables are co-integrated, a debt is said to be sustainable. Alternatively, once it is established that the variables are co-integrated, sustainability could be further tested using an Error-Correction formulation and checking the significance of the error correcting term, as in (4).

$$\Delta R_t = \delta + \sum_{t=1}^{m} \Psi_i \Delta R_{t-n} + \sum_{n=1}^{j} \gamma_i \Delta G_{t-n} + k\Phi_{t-1} + v_t \qquad (4)$$

Where Φ is the error-correcting term, δ, Ψ, γ, and k are respective coefficients, and Δ is a first difference operator.

Hence, if k in (4) is significant it suggests that debt is sustainable otherwise it indicates lack of equilibrium and, therefore, unsustainability of debt.

2.2. Non-Econometric Approaches: Calculating Sustainability and Its Evolution

While the above econometrics approach has been widely used in the literature to assess the sustainability of debt, alternative techniques have also been used to assess the sustainability of debt. Among the early frameworks suggested to gauge sustainability include Domar's approach in the 1940s; more recent and relatively elaborate frameworks have also been suggested by Edwards (2002), among others. These two related frameworks will be briefly discussed below.

2.2.1. Early Non-Econometric Approaches

In the early 1940s Domar suggested the following framework to capture the interface of budget deficit and debt. Domar started using the basic definition that a deficit (D) is the difference between government expenditure (G) and tax revenue (T) which is financed by either the changes in borrowing from both the domestic and the international markets (ΔB) and changes in money creation (ΔM) or both. That is,

$$D = G - T = \Delta B + \Delta M \qquad (5)$$

If we assume, as is usually the case to ease tractability and simplify the analysis, money financing is restricted and hence ΔM = 0, then, all deficit is financed by issuing bonds which implies **D = ΔB**.

Expressing both variables as ratios of GDP (d=D/Y and b=B/Y suggest that B=b*Y and D=d*Y). Totally differentiating and solving, (i.e. **ΔB = b *** ΔY + Y *Δ **b),** dividing by y, substituting 'g' for ΔY/Y (which is nominal growth rate of GDP), also recalling **ΔB =D and ΔB /Y = d** , debt to GDP ratio could be written as:

$$d = b*g \qquad (6)$$

If we apply this crude test to the deficits in Sudan (i.e. comparing the interest rate as an average of the last five years and the average borrowing to GDP ratio), it implies that the nominal GDP has to grow, on average, by more than 6% for fiscal sustainability. This exceeds the historical average growth even during the oil-boom years. This crude measure also suggests that the debt in Sudan, given the attendant economic parameters, is unlikely to be sustained.

But while the above formulation is appealing for its simplicity, it, however, understates the extent of the debt by ignoring the interest payment to service the debt. Redefining the deficit to include both the primary budget balance and the interest rates equals:

$$D = P + i * B$$

Where P = G-T and therefore D = P + i*B. Dividing by Y as before gives,

$$d = p + i*b \qquad (7)$$

but we know that $d = \Delta b + b* g$ and hence

$\Delta b = p + i*b - b*g$ and since $\Delta b = 0$ for sustainability:

$$-p = (i - g)*b \qquad (8)$$

Equation (8) states that fiscal sustainability depends on the magnitudes of the interest rate and the nominal growth of GDP. For instance, if $i > g$, then $p < 0$, which suggests that fiscal sustainability requires that the government has to have a budget surplus (revenue exceeding expenditures). On the other hand, if $i < g$, then $P > 0$, the government could afford to incur a temporary deficit (at least in the short to medium term but not in the long term) without entailing a serious sustainability issue. Clearly, the interest rate (i) in Sudan has averaged about 14% in the last few years, suggesting that sustainability requires the government having to register a budget surplus.

What do all the above noted crude measures suggest about the likelihood of Sudan's sustainability of its current level of debt?

First, the econometrics based results suggest that:

(i) the revenue and expenditure series are not stationary (Appendix 1);

(ii) Government revenue and expenditure in Sudan are not co-integrated (Appendix 2);

according to the above noted econometrics approaches, albeit crude, therefore, both suggest that as it stands Sudan's debt is not sustainable. Further,

(iii) The growth of GDP over the last five years averaged around 5.45%. Hence in equation (8) $p < 0$ because $i > g$. This again suggests that, at least in the medium term, the debt seems unsustainable as was the case using the above simple calculations.

In sum, therefore, using all the crude indicators described above, Sudan's debt seems to be unsustainable, given the magnitudes of the variables over the last five years.

2.2.2. More Recent Non-Econometric Approaches

Despite their simplicity, the crude frameworks and the econometric approaches noted above, do not track the dynamic path of the debt over time. They also fail to examine the impact of other crucial magnitudes (domestic debt, the monetary sector and inflation) in gauging the trajectories of debt sustainability. To remedy that, authors, such as Edwards (2002) and others, suggested the following relationship between public debt and the primary fiscal balance:

$$\Delta D_t = \{\mathbf{r^f} * DF_{t-1} + r^{\mathbf{d}} * DD_{t-1}\} + pb_{t-1} * \Delta B_t \qquad \textbf{(9)}$$

Where: ΔD_t = changes in accumulated debt**;**

DF_{t-1} = accumulated foreign debt;

DD_{t-1} = accumulated domestic debt;

Pb_t =primary government balance

ΔB_t = Changes in monetary base used as a proxy for seignorage revenue;

And $\mathbf{r^f}$, $r^{\mathbf{d}}$ are nominal interest rates on foreign and domestic debt, respectively.

The variable of interest in (9) is the government primary balance **(Pb_t)** which is, the primary balance that is consistent with a sustainable[1] debt burden. It is conventional to assume that international flow of credit (**θ)** will have an upper limit equal to or less than the growth of real GDP (**g)** and foreign inflation (π^f), and domestic credit (**β)** will increase by a similar magnitude. Both are, therefore, defined as follows:

$$\theta \leq (g + \pi^f) \text{ ; and } \beta \leq (g + \pi^f). \qquad (10)$$

Given the above basic relationships, the dynamic path of the sustainable primary government balance could be written as:

$$\{Pb_t/Y_t) = [\{\theta - r^f\}(DF_0/Y_0)e^{(\theta - g - \pi^f)(t-1)} + \{\beta - r_t\}(DD_0/Y_0)\, e^{(\beta - g - \pi^f)(t-1)}][1/(1+g+\pi^f)] - (g+\pi)(B_0/Y_0). \quad (11)$$

Similarly, the steady-state sustainable primary balance could be written as follows:

$$\{pb/Y) = \{g+\pi^f - r\}(DD_0/Y_0)[1/(1+g+\pi^f)] + (g+\pi)(B_{t0}/Y_0) \qquad (12)$$

Where**:** DF_0/Y_0 and DD_0/Y_0 are as defined above, π and B_0/Y_0 are the target rate of domestic inflation and the initial ratio of base money to GDP ratio, respectively.

Clearly, the sustainable primary balance that is consistent with a sustainable debt is determined by both initial ratios of domestic and foreign debts to GDP, nominal domestic and foreign interest rates, domestic and foreign inflation rates, the rate of growth of real GDP, and the sustainable increases in both foreign and domestic debt (θ and β, respectively),

Given the above basic relationship between government primary balance and debt outstanding, it is possible to conjure various paths regarding the likely behavior of the determinants of debt sustainability. Among others, just to name a few, it is possible to consider different international credit flows, variations in GDP growth rates, changes in both foreign and domestic interest rates and inflation rates, and changes in the domestic exchange rate which may affect the domestic inflation rate if there is a substantial pass-through to the domestic economy.

As a first step, this note is initially concerned with the impact of different economic growth scenarios consistent with Sudan's economic position. The study will later be subjected to some changes as sensitivity analyses. As its main focus, however, it will only consider two possible aspects of donor behavior regarding the flow of funds to the country in the form of loans. In particular it assumes the following donor behavior in computing the relevant tables:

Table 2: Summary of parameters and values used for simulation

Variable	Value	Explanations
Pb_t/Y_t	…	Primary balance to GDP ratio (to be computed).
θ	…	Values vary depending on assumptions.
r^f	0.03	The approximate interest rate for concessional loans
DF_0/Y_0	0.96	Ratio of foreign public debt to GDP (based on IMF Article IV 2009)
G		Different growth rates (ranging from -6 to 10%)
$\boldsymbol{\pi^f}$	0.025	Since most debt is denominated in US$ and inflation in the US averaged around 2.5% in recent years.
β	$g + \pi^*$	Assumed a constant - domestic debt grows at this rate.
r_t	0.14	Domestic nominal interest rate
DD_0/Y_0	0.15	The domestic debt is about 15% of GDP.
Π	0.15	The most recent inflation rate (note that: some use the dollar denominated inflation target which will be less).
B_0 / Y_0	0.21	Recent ratio of base money to GDP.

[1] Edwards (2002) defined debt sustainability as "a situation where increases in each type of debt are in line with the pace at which national and international creditors desire to accumulate government-issued securities".

And in terms of donor behavior:

First, in scenario A, it assumes that "maturing concessional loans are fully rolled over'. That is, the nominal value of concessional debt is maintained constant through time, while no new funds (in real terms) are provided". In terms of the parameter in the model (reported in Table 2), this means $\theta = 0$. This probably is what one would expect given the donor fatigue that is frequently observed.

Second, in scenario B, it is assumed that the international credit flow continues to be available at the rate of $\theta = \rho g + \pi^f$, where $0 \leq \rho \leq 1$**.** This relatively generous assumption postulates that donors will make more loans available in real terms in excess of the existing nominal loan by a small margin (hence ρ is given the value of 0.5 in this exercise).

Using the parameters noted in table 2 and relevant assumptions[2], the computed sustainable path under different economic growth scenarios is presented in Tables 3 and 4. It has to be noted that the debt data used are based on IMF's 2014 Article IV for foreign debt for Sudan. Different sources put Sudan's debt to GDP ratio that slightly vary, ranging from 80% to 96% of GDP. To err on the side of caution, however, the highest figure reported is taken in estimating whether the debt is sustainable or not. Additional computations assuming the debt to GDP ratio is 80% is also presented (see Appendixes 3 and 4) to gauge how sensitive the result is.

Table 3: Sudan's Debt Sustainability under No loan increase in Real Terms (A)

	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
2016	-1.167%	-0.731%	-0.301%	0.126%	0.549%	0.968%	1.383%	1.794%	2.201%	2.606%
2017	-1.168%	-0.734%	-0.302%	0.124%	0.546%	0.964%	1.379%	1.790%	2.206%	2.600%
2018	-1.169%	-0.736%	-0.304%	0.122%	0.543%	0.961%	1.375%	1.790%	2.202%	2.596%
2019	-1.170%	-0.738%	-0.305%	0.120%	0.541%	0.958%	1.372%	1.790%	2.203%	2.591%
2020	-1.171%	-0.740%	-0.307%	0.118%	0.538%	0.955%	1.368%	1.799%	2.204%	2.587%
2021	-1.172%	-0.742%	-0.309%	0.116%	0.536%	0.952%	1.365%	1.790%	2.204%	2.582%
2022	-1.173%	-0.744%	-0.310%	0.114%	0.534%	0.950%	1.362%	1.790%	2.205%	2.578%
2023	-1.174%	-0.746%	-0.312%	0.112%	0.531%	0.947%	1.359%	1.790%	2.205%	2.575%
2024	-1.175%	-0.748%	-0.313%	0.110%	0.529%	0.944%	1.356%	1.790%	2.206%	2.571%
2025	-1.176%	-0.750%	-0.315%	0.108%	0.527%	0.942%	1.353%	1.790%	2.206%	2.567%
Steady state	1.98%	2.35%	2.71%	3.07%	3.43%	3.79%	4.14%	4.49%	4.84%	5.18%

The computed path could be summarized as follows (Table 3):

First, if the GDP grows by 1%, then the primary fiscal balance required to maintain a sustainable fiscal balance is a surplus of about 1% of GDP.

Second, in general, for any economic growth that is less than 4%, the government has to register a budget surplus to maintain a sustainable primary balance. But if and when the economy grows by more than 4% then it can afford to incur a deficit and yet maintain a sustainable debt ratio, albiet a small deficit to GDP ratio. This required surplus is initially a small percentage of GDP but reaches up to 3% when the economy grows by 10%;

[2] In addition to the variations in GDP growth rates, the model will also be calibrated by using variations in interest rates, exchange rate and inflation to gauge the sensitivity of the conclusions to changes in such parameter.

Third, the steady-state primary fiscal balance that maintains sustainability ranges from about 2% when GDP grows by 1% to about 5% when GDP grows by an optimistic rate of 10%; and

Fourth, it is worth indicating that (a) Sudan's GDP growth rate in recent years was less than 4% (see Table 1); and (b) this growth rate is less than the Sub-Sahara African average during the same period;

Hence given the registered growth rate, under the scenario in which donners are only willing to increase lending in nominal terms or less, Sudan's debt is unlikely to be sustainable.

A more relaxed scenario assuming that donners will be willing to increase the real value of the concessional loan is reported in Table 4.under this scenario it is assumed that the flow of credit will increase in real terms. In terms of the parameters, the value of θ will be $\theta=\rho g+\pi^f$, where $0 \leq \rho \leq 1$.

As could be seen in Table 4 a couple of issues could be noted:

As could be noted, a 4% GDP growth is close to the African average growth rate and that of Sudan in recent years. But it was much higher during the oil boom period while it significantly declined following that boom.

Sudan primary budget balance is likely to be sustainable even if the economy registers a growth rate as low as 1% of GDP under this scenario. Though the deficit to GDP ratio has to be small to have a sustainable primary balance, yet it could afford to carry some deficit in its balance.

Table 4: Sudan's Debt Sustainability under loan increase in Real Terms (B)

	1%	*2%*	*3%*	*4%*	*5%*	*6%*	*7%*	*8%*	*9%*	*10%*
2016	1.983%	2.809%	3.624%	4.427%	5.219%	6.000%	6.771%	7.531%	8.282%	8.383%
2017	1.983%	2.810%	3.624%	4.428%	5.220%	6.003%	6.774%	7.536%	8.276%	9.031%
2018	1.983%	2.810%	3.625%	4.429%	5.222%	6.005%	6.778%	7.536%	8.281%	9.038%
2019	1.983%	2.810%	3.625%	4.430%	5.224%	6.008%	6.781%	7.536%	8.280%	9.045%
2020	1.983%	2.811%	3.626%	4.431%	5.226%	6.010%	6.785%	7.526%	8.279%	9.052%
2021	1.983%	2.811%	3.626%	4.432%	5.227%	6.012%	6.788%	7.536%	8.279%	9.058%
2022	1.983%	2.811%	3.627%	4.433%	5.229%	6.015%	6.791%	7.536%	8.278%	9.064%
2023	1.983%	2.812%	3.627%	4.434%	5.230%	6.017%	6.794%	7.536%	8.277%	9.070%
2024	1.983%	2.812%	3.628%	4.435%	5.232%	6.019%	6.797%	7.536%	8.276%	9.075%
2025	1.983%	2.812%	3.628%	4.436%	5.233%	6.021%	6.800%	7.536%	8.276%	9.081%
Steady State	**1.98%**	**2.35%**	**2.71%**	**3.07%**	**3.43%**	**3.79%**	**4.14%**	**4.49%**	**4.84%**	**5.18%**

And the main conclusion that emerges under a steady-state is that Sudan's fiscal balance will only be sustainable as long as its GDP growth rate is positive. That is, under a steady-state, Sudan could incur about 2% of budget deficit and maintain a sustainable fiscal balance. In short, under the above scenario in which, donners are willing to increase lending in real terms, Sudan's fiscal balance will be sustainable under all plausible GDP growth scenarios, even as low as 1% of GDP. The crucial question is will donors be generous enough to offer Sudan such a loan?

In addition to the dynamic path, Sustainability is also gauged using the evolution of Sudan's debt burden under different economic growth scenarios but considering a lower debt to GDP ratio of 80%; this is

done to gauge to speed with which the debt burden declines under different growth scenarios (reported in Appendixes 3) even when the size of debt smaller as reported in some sources. Assuming the debt is 80 and not 96% of GDP, the yearly decline in the ratio of debt to GDP is very gradual and only declines to about 47% of GDP by 2050 or to less than half in about 35 years. As indicated in Appendix 3, this is even the case if debt accumulates at the rate of θ (= $g+\pi^*$) every year.

3. Conclusions

The motivation of this study has been to shed light on the extent to which one of the goals of the SDGS (Goal 17) is likely to be met in Sudan. That is, to examine the extent to which one should worry about the sustainability of the existing annual deficit and accumulated debt in Sudan. Accordingly, it attempted to examine the sustainability of the debt using two conventional approaches. The first approach used an econometrics technique to test for the stationarity and co-integration of the government revenue and expenditures; both tests indicate that under the attendant economic environment, Sudan's debt is unlikely to be sustainable. Second both crude and more elaborate tests that focused on non-econometric approaches have also been carried out. All the crude indicators also suggest similar results in that Sudan's debt is not likely to be sustainable. And the more elaborate approach that attempted to trace the dynamic path of fiscal deficits and debt under various growth scenarios does also indicate sustainability will require a growth rate of GDP in Sudan that exceeds the historical national and regional average of 4% and a generous loan inflow.

In sum, as indicated in Table 5, all the approaches seem to suggest the same conclusion regarding the sustainability of the accumulated debt in Sudan. That is, unless donors are willing to lend more than the real value of the existing amount or cancel its debt under the Advanced HIPCs initiative, Sudan's economy has to grow by more than 4% to register a surplus in its budget balance or could only afford a small deficit as a share of it GDP (as noted in Tables 3 and 4.

Before concluding, it is important to highlight some less emphasized issues in this paper. These include:

First, the study has only carried out limited sensitivity analysis (mainly related to growth scenarios);

Second, different sources (publications) report various figures in relation to the used basic national data such as debt to GDP ratio, government deficits, monetary base, for instance. No attempt was made to examine the sensitivity of the results for any possible variation(s) in the national figures, except the debt to GDP ratio.

And, finally, making a serious effort to net out the various components of government assets and liabilities in computing government's actual net indebtedness was considered beyond the scope of this brief note. Hence the macro aggregate of gross debt, as is usually the case, was taken as the true measure of public debt.

Table 5: Summary of Approaches and Results

Approach	**Indicator**	**Decision Rule**	**Outcome: suggesting**
Econometrics	Stationarity	Non-stationary	Unsustainable
	Co-integration	Not-Co-integrated	Unsustainable
Non-Econometrics	Crude indicators	Interest rate > growth	Unsustainable
	Dynamic Path	Primary balance	Unsustainable for GDOP growth < 4%
Speed of Adjustment	Evolution of debt	Takes long time to decline	Weak speed of decline

Limited attempts to gauge the extent to which sustainability will be affected by changes in concessional loans and domestic interest rates on debt sustainability were also carried out. Specifically, the exercise considered what would happen to the sustainability path if interest rate on both domestic and concessional loans increase by 2 percentage points on the two donors' willingness to lend . The impacts of such change in donors' attitude on the sustainable primary balance suggest the following. Compared to Tables 3 & 4 the changes (see Appendixes 4 and 5) could be summarized as follows:

1. It seems Sudan's sustainability of primary balance is sensitive to changes in both domestic and concessional interest rates; for instance,

a. Sudan cannot afford to incur a deficit unless its annual GDP growth rate exceeds 9% compared to only 4% as noted in Table 3; and

b. Even with a 10% of GDP growth rate (which Sudan's economy has never achieved in its recent history), the deficit that it could afford to incur is only about 0.5% of GDP for a sustainable primary balance compared to about 3% in Table 3.

2. When there is an increase in the flow credit available in real terms, however, Sudan can afford to incur a deficit, albeit with a slightly reduced debt to GDP ratio and yet maintain a sustainable primary balance.

References

African Development Bank (Web Page: www.afdb.org/.

Arnone, Marco, L. Bandiera, and A. Presbiten (2005), "External Debt Sustainability: Theory and Empirical Evidence", The World Bank.

Arghyrou, M. (2003), " Debt Sustainability, Structural Breaks and Non-linear adjustment: A testing Application to Greek fiscal policy", Department of Economics and Finance, Brunel University.

CSO (Central Statistical Office (2007)) *Informal Sector Survey*.

Cronin, D. and D. McCoy (2000), "Fiscal Sustainability when time is on Your Side", Technical Paper, 4/RT/00.

Corsetti, G. and Roubini N. (1991), "Fiscal deficits, public debt and government Solvency: Evidence from OECD countries", Journal of Japanese and International Economies, 5, PP. 354-80.

Edwards, S. (2002), "Debt Relief and Fiscal Sustainability," NBER Working Paper Series 8939.

Hamilton, J. and Flavin M. A. (1986), "On the Limitations of Government Borrowing: A Framework for Testing," American Economic Review, 76, pp. 808-819.

Hakkio, C. S. and Rush M. (1991), "Cointegration and Government Borrowing Constraints: Evidence for the United States", Journal of Business & Economics Statistics", 9, PP. 429-445.

Haug, A. A. (1991), "Cointegration and Government Borrowing Constraints: Evidence for the United States", Journal of Business & Economics Statistics", 9, PP. 97-101.

IMF (2009), Article IV, Public Information Notice (Pin) No. 10/68 (June 1).

Johansen, S. (1988), "Statistical Analysis of Co-Integration Vectors", *Journal of Economic Dynamics and Control, 12, 231-54.*

Kremers, J. J. (1988), "Long-Run limits on the US federal debt", Economic Letters, 28, pp. 259-262.

Stock, J. and Watson. M. (1993), "A Simple Estimator of Cointegrating Vectors in Higher Order Integrated System", Econometrica, 5, pp. 1035-1056.

Trehan, B. and Walsh C. E. (1988), "Common Trends, The Governemnt's Budget Constraint and Revenue Smoothing", Journal of Economic Dynamics and Control, pp. 425-444.

Wilcox, D. (1989), "The Sustainability of Government Deficits: Implications of the Present-Value Borrowing Constraint," Journal of Money, Credit and Banking, 21, pp. 291-306.

Appendix 1: Stationarity of Government Expenditure and Revenue in Sudan

Variable	***T*- test statistic**	***Test critical values:***	
EXPGDP_SDN	**-2.437164**	***1% level***	***-3.596616***
REVGDP_sdn	-1.752008	***5% level***	***-2.933158***
		10% level	***-2.604867***

Appendix 2: Co-integration Test between Government Expenditure and Revenue in Sudan

Trend assumption: Linear deterministic trend				
Series: LOG(REVGDP_SDN) LOG(EXPGDP_SDN)				
Lags interval (in first differences): 1 to 1				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.202652	11.64230	15.49471	0.1749
At most 1	0.055873	2.357260	3.841466	0.1247
Trace test indicates no cointegration at the 0.05 level Max-eigenvalue test indicates no cointegration at the 0.05 level * denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values				

Appendix 3: Sudan's Evolution of Debt If DEBT is 80 – Case A

	1%	*2%*	*3%*	*4%*	*5%*	*6%*	*7%*	*10%*
	80	*80*	*80*	*80*	*80*	*80*	*80*	*80*
2016	*78.809*	*78.809*	*78.809*	*78.809*	*78.809*	*78.809*	*78.809*	*78.809*
2017	*77.636*	*77.636*	*77.636*	*77.636*	*77.636*	*77.636*	*77.636*	*77.636*
2018	*76.48*	*76.48*	*76.48*	*76.48*	*76.48*	*76.48*	*76.48*	*76.48*
2019	*75.341*	*75.341*	*75.341*	*75.341*	*75.341*	*75.341*	*75.341*	*75.341*
2020	*74.219*	*74.219*	*74.219*	*74.219*	*74.219*	*74.219*	*74.219*	*74.219*
2021	*73.114*	*73.114*	*73.114*	*73.114*	*73.114*	*73.114*	*73.114*	*73.114*
2022	*72.026*	*72.026*	*72.026*	*72.026*	*72.026*	*72.026*	*72.026*	*72.026*
2023	*70.954*	*70.954*	*70.954*	*70.954*	*70.954*	*70.954*	*70.954*	*70.954*
2024	*69.897*	*69.897*	*69.897*	*69.897*	*69.897*	*69.897*	*69.897*	*69.897*
2025	*68.857*	*68.857*	*68.857*	*68.857*	*68.857*	*68.857*	*68.857*	*68.857*
2026	*67.831*	*67.831*	*67.831*	*67.831*	*67.831*	*67.831*	*67.831*	*67.831*
2027	*66.822*	*66.822*	*66.822*	*66.822*	*66.822*	*66.822*	*66.822*	*66.822*
2028	*65.827*	*65.827*	*65.827*	*65.827*	*65.827*	*65.827*	*65.827*	*65.827*
2029	*64.847*	*64.847*	*64.847*	*64.847*	*64.847*	*64.847*	*64.847*	*64.847*
2030	*63.881*	*63.881*	*63.881*	*63.881*	*63.881*	*63.881*	*63.881*	*63.881*
2031	*62.93*	*62.93*	*62.93*	*62.93*	*62.93*	*62.93*	*62.93*	*62.93*
2032	*61.993*	*61.993*	*61.993*	*61.993*	*61.993*	*61.993*	*61.993*	*61.993*
2033	*61.07*	*61.07*	*61.07*	*61.07*	*61.07*	*61.07*	*61.07*	*61.07*
2034	*60.161*	*60.161*	*60.161*	*60.161*	*60.161*	*60.161*	*60.161*	*60.161*
2035	*59.265*	*59.265*	*59.265*	*59.265*	*59.265*	*59.265*	*59.265*	*59.265*
2036	*58.383*	*58.383*	*58.383*	*58.383*	*58.383*	*58.383*	*58.383*	*58.383*

2037	57.514	57.514	57.514	57.514	57.514	57.514	57.514	57.514
2038	56.658	56.658	56.658	56.658	56.658	56.658	56.658	56.658
2039	55.814	55.814	55.814	55.814	55.814	55.814	55.814	55.814
2040	54.983	54.983	54.983	54.983	54.983	54.983	54.983	54.983
2041	54.165	54.165	54.165	54.165	54.165	54.165	54.165	54.165
2042	53.358	53.358	53.358	53.358	53.358	53.358	53.358	53.358
2043	52.564	52.564	52.564	52.564	52.564	52.564	52.564	52.564
2044	51.781	51.781	51.781	51.781	51.781	51.781	51.781	51.781
2045	51.01	51.01	51.01	51.01	51.01	51.01	51.01	51.01
2046	50.251	50.251	50.251	50.251	50.251	50.251	50.251	50.251
2047	49.503	49.503	49.503	49.503	49.503	49.503	49.503	49.503
2048	48.766	48.766	48.766	48.766	48.766	48.766	48.766	48.766
2049	48.04	48.04	48.04	48.04	48.04	48.04	48.04	48.04
2050	47.324	47.324	47.324	47.324	47.324	47.324	47.324	47.324

Appendix 4: Sudan Case A - With a 2 percentage Point increase in Domestic and Concessional Interest Rates

	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
2016	-3.389	-2.932	-2.481	-2.033	-1.591	-1.152	-0.718	-0.288	0.139	0.561
2017	-3.391	-2.936	-2.483	-2.037	-1.595	-1.158	-0.724	-0.295	0.147	0.553
2018	-3.393	-2.940	-2.486	-2.041	-1.600	-1.163	-0.730	-0.295	0.140	0.545
2019	-3.394	-2.943	-2.489	-2.044	-1.604	-1.168	-0.736	-0.295	0.141	0.537
2020	-3.396	-2.947	-2.491	-2.048	-1.608	-1.173	-0.741	-0.279	0.142	0.529
2021	-3.398	-2.950	-2.494	-2.051	-1.612	-1.177	-0.747	-0.295	0.143	0.522
2022	-3.400	-2.954	-2.497	-2.054	-1.616	-1.182	-0.752	-0.295	0.144	0.516
2023	-3.402	-2.957	-2.499	-2.058	-1.620	-1.187	-0.757	-0.295	0.145	0.509
2024	-3.403	-2.960	-2.502	-2.061	-1.624	-1.191	-0.762	-0.295	0.146	0.503
2025	-3.405	-2.963	-2.504	-2.064	-1.628	-1.195	-0.767	-0.295	0.147	0.498
Steady state	1.6933	2.0628	2.4293	2.7928	3.1535	3.5114	3.8666	4.2191	4.5691	4.9167

Appendix 5: Sudan Case B - With a 2 percentage Point increase in Domestic and Concessional Interest Rates

	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
2016	1.693	0.685	1.519	2.342	3.153	3.954	4.743	5.522	6.291	6.694
2017	1.693	0.684	1.519	2.342	3.153	3.954	4.745	5.524	6.288	6.714
2018	1.693	0.683	1.518	2.341	3.153	3.955	4.746	5.524	6.290	6.733
2019	1.693	0.682	1.518	2.341	3.153	3.955	4.747	5.524	6.290	6.751
2020	1.693	0.681	1.517	2.341	3.153	3.956	4.748	5.52	6.290	6.768
2021	1.693	0.679	1.517	2.340	3.153	3.956	4.749	5.524	6.289	6.784
2022	1.693	0.678	1.516	2.340	3.153	3.957	4.750	5.524	6.289	6.800
2023	1.693	0.677	1.516	2.340	3.153	3.957	4.751	5.524	6.289	6.816
2024	1.693	0.676	1.515	2.339	3.153	3.958	4.752	5.524	6.288	6.830
2025	1.693	0.676	1.515	2.339	3.153	3.958	4.753	5.524	6.288	6.844
Steady State	0.94	0.57	0.18	-0.20	-0.59	-0.9	-1.38	-1.78	-2.19	-2.60

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