

**Effect of External Debt on Economic Growth of Sudan:
Empirical Analysis (1969-2015)**

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This study examines the effect of external debt on economic growth of Sudan. The model built uses gross domestic product as the dependent variable to measure economic growth as a function of the ratio of external debt to exports, exchange rate and foreign direct investments as the explanatory variables using annual time series for the period 1969-2015. Empirically, the study employs the econometric techniques of the Augmented Dickey-Fuller (ADF) unit root test for stationarity, the Johansen cointegration method and the Vector Error Correction Method (VECM). The cointegration test shows that a long-run equilibrium relationship exists among the variables of the study. Findings from the VECM show that external debt proxied by the external debt to exports ratio has contributed positively to the Sudan economy, while exchange rate and foreign direct investment have negative effects on GDP growth which is consistent with findings of most empirical studies at the macroeconomic level. The study recommends that the government should ensure macroeconomic and price stability and maintaining access to foreign loans so that to supplement low the levels of domestic savings in order to enable long term economic growth. Exchange rate needs to be stabilized and perceived effect of foreign direct investments on economic growth needs be reinvestigated with enhancement of human capital and institutions.

Keywords: External Debt, Economic Growth, Gross Domestic Product, VECM, Sudan.

1. Introduction

Most of developing countries need external financial resources to support their internal and external balances and supplement low levels of domestic savings in order to promote economic growth. Sudan is not an exception and has been receiving international capital flows both in

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terms of foreign loans and aids for more than five decades and more recently increasing inflows of foreign direct investment. The major source of international capital flow to Sudan is foreign borrowing accumulating into external debt. The dual-gap analysis provides the framework which shows that the development of a nation may largely be dependent on investment financed through foreign aid and loans where domestic savings are lacking behind (Thirlwall, 1991, 2003). Hameed, Ashraf, and Chaudhary (2008) stated that external borrowing is ought to accelerate economic growth especially when domestic financial resources are inadequate. Within the orthodox macroeconomic framework in such cases foreign loans and external debt are expected to play a positive role on the growth process of the receiving economy. Soludo (2003) states that countries borrow for two broad reasons; macroeconomic reasons, either finance higher investment or higher consumption, and to circumvent hard budget constraint. This implies that an economy borrows to boost economic growth and alleviate poverty meanwhile. However, when debt reaches a certain level, it becomes to have adverse effect as debt servicing becomes a huge burden and countries find themselves on the wrong side of the debt-laffer curve, with debt crowding out investment and growth.

In special set of literature, external debt is understood to retard economic growth in the context of the debt overhang hypothesis and the crowding out of public investment resulting from debt services (Krugman, 1989). Alesina and Tabellini (1989) demonstrated that governments in Low Income Countries (LICs) with varying distributional goals and objectives often create fiscal uncertainty that generate capital flight, low investment and over-accumulation of external debts, which retard economic growth. Cohen (1993) found that the level of the debt had no important effect on investments during the debt crisis of the early 1980s although debt repayment is found to correlate negatively with investment, suggesting a crowding out effect. Also, Clements, Bhattacharya and Nguyen (2003) estimated a quadratic relation between debt and growth in some LICs finding that high levels of debt tended to crowd-out public investment.

However, one fact is that for many low income and middle income countries foreign loans are major sources of public receipts, which would reduce public deficit. If foreign loans are well utilized and managed, the accumulation of external debt should not lead to slow

economic growth. In particular payment and management of debt services play the crucial role in this interplay of external debt and economic growth. At what rate a country achieves economic growth and capital accumulation as compared with how fast it accumulates debt and debt services are the two main processes which determine the net effect of external debt on economic growth. However, foreign borrowing with poor external debt management causes a country to default and inability to meet its debt obligation caused for example by the lack of information on the nature, structure and magnitude of external debt (Were, 2001).

The roots of Sudan's external debt can be traced to 1961 and in 1969 total external debt amounted to US\$ 244 million compared with a GDP of US\$ 1,848 which makes Debt/GDP ratio 13.20%. In 1978, Sudan had to adopt a World Bank/International Monetary Fund (IMF) sponsored Structural Adjustment Programme (SAP), with a view to revamping the economy making the country better-able to service its external debt. In the same year external debt had already cumulated to US\$ 3,159 billion of which US\$ 1,895 billion were arrears with a GDP estimated at US\$ 8,074 (i.e., Debt/GDP ratio trebled to 39.13%) compared with 1969, with total exports value of 979.138 resulting in a ratio of debt/exports of goods and services of 332.84%. As a result of accumulated debt principal and services Sudan has become one of the highly indebted countries in Africa and ranks 46 in the world since the mid 2000s (World Bank 2004). Lack of government revenues coupled with massive debt arrears exerted a negative influence on government finances and it became even more necessary to borrow to correct public budget deficit and balance of payment distortions as well as financing development projects mostly agricultural projects with minor portion of financial resources allocated to industrial development (Elwasila SEM 2011). According to the External Debt Unit, Sudan external debt outstanding stood at US\$ 20,531 billion in 2000 increased to US\$ 27,005 billion, US\$ 37,845 billion in 2005 and 2010 respectively. By the end of 2015, Sudan's total external debt amounted to US\$ 45,350 billion, with a debt/GDP ratio of 53.99% and debt/exports of goods and services of 735.66%. Notably by end of 2011 (the year of South Sudan secession) Sudan's stock of external debt amounted to about US\$ 41,5 billion in nominal terms equivalent to 65 percent of GDP, of which 84 percent was in arrears. The structure of external debt had not changed since the early 2000s. In 2012 the bulk of the external debt was public and publicly guaranteed (PPG) representing US\$ 39,9 billion, with 84

percent in arrears, and almost the same structure remains as up to the end of 2015. From this total debt, Sudan owns 73 percent to bilateral creditors (roughly equally divided between Paris and non-Paris Club creditors) and 13 percent to multilateral and commercial creditors. Private external debt to suppliers amounted to US\$1.6 billion and almost the same structure of distribution of debt by creditor remains as up to the end of 2015 (IMF 2016). As of 2012, the increasing fiscal deficits and the massive drop of government revenues as result of sharp reduction in oil revenues with higher level of external debt servicing have become major threat to growth of the country, and continue to be up to date, with debt being unsustainable by all measures and indicators of sustainability, (IMF, 2014, 2016). The resultant effect of large accumulation of debt with major portion of it being arrears has been exposing the nation to high debt burden. The other major capital inflow to Sudan is foreign direct investment which in 2000 amounted to only 0.07% of GDP, increased to 3.20% in 2000, reaching 5.89% in 2005 but dropped to 3.17% in 2010 and to 2.07% in 2015.

Sudan is well endowed with diverse natural resources, but has been one of the poorest countries with numerous macroeconomic problems, such as persistent inflation, high unemployment rates, sole dependency on crude oil as a major source of revenue over the period 1999-2011, and more recently an increasing mining and role of gold. In addition, Sudan faces mounting external debt and debt service payment. As a result of these interactive economic development factors more than 45.6 percent of population fall below the poverty line far behind the target of 23 percent target by the end of 2015 MDG poverty reduction goal.

Upon this background, the objective of this paper is to undertake an empirical investigation of the impacts of external debt on economic growth of Sudan. The study provides a critical discussion of the inconclusive literature of the effects of external debt on economic growth and development against which the findings of this study are compared and placed, and recommendations provided accordingly. Another feature of this study is that it uses a relatively long time period spanning over 1969 to 2015 compared with other single country studies in the field and also the only one undertaken in the case of Sudan.

Section two provides inexhaustive review of the literature on external debt and economic growth with a discussion of its conclusiveness.

Section three describes the methodology, and section four presents the data analysis and interpretation. Section five provides the conclusion and recommendations.

2. Literature Review

Countries experiencing fiscal and current account deficits, especially the low income ones, have been historically in need to borrow to improve their economic growth. Government borrows in principle to finance public goods that increase welfare and contribute to promote economic growth. Due to the fact that domestic financial resources are not adequate in poor countries, borrowing is acquired from foreign sources. External debt is one of the main sources of financing capital formation in any country. The amount of fund provided by these foreign sources constitutes the external debt of a nation and creates about debt burden and the potential negative effects of external debt itself. External debt is defined as all external obligations of a maturity of one year or more and outstanding at a particular point in time and are payable in terms of reserves currency or goods and services.

Purposively external debt is acquired to contribute to the economy but the future debt service payment poses threats to sustainability of debt itself and to economic growth. A number of researchers have examined the effect of external debt on economic growth at least since the 1970s of the past century in both rich and poor countries. In econometric and simulation study, Iyoha (1999) investigated the impact of alternative debt stock reduction scenario packages of 5%, 10%, 20% and 50%, effective in 1986, on investment and economic growth in the subsequent years for Sub Saharan Africa countries. The study finds that mounting external debt depresses investment through both a “disincentive” effect and a “crowding out” effect and showed that 20% debt stock reduction would, on average, have increased investment by 18% and increased gross domestic product (GDP) growth by 1% during the 1987-1994 for Sub Saharan countries. Karogol (2002) investigated both the short-run and long-run relationships between economic growth and external debt service for Turkey during 1956 – 1996. The study employed a standard production function model analyzed using multivariate co-integration techniques with a vector autoregression estimates showing existence of only one cointegration equation. The study reveals that debt service is negatively related to economic growth in the long-run with

unidirectional causality between debt service and economic growth. Clements, Bhattacharya, and Nguyen (2003) examined the channels through which external debt affects growth in low income countries (LICs). Their results suggest that the substantial reduction in the stock of external debt projected for highly indebted poor countries (HIPC) would directly increase per capita income growth by about 1 percentage point per annum while reductions in external debt service could also provide an indirect boost to growth through their effects on public investment. Audu (2004) examined the impact of external debt on economic growth and public investment in Nigeria for the period 1970-2002 using co-integration test and an error correction model. The study shows that debt servicing pressure in the country has had a significant adverse effect on the growth process and past debt accumulation negatively affect public investment. Adepoju, Salau and Obayelu (2007) analyzed the effects of external debt management on economic growth of Nigeria for the period 1962 to 2006 using time series data of the various bilateral and multi lateral arrangements. Their study concluded that accumulation of external debt adversely affected Nigeria's economic growth. Also, Adesola (2009) empirically investigated the effect of external debt service payment practices on the economic growth of Nigeria. OLS method was used to examine how debt payment to multilateral financial creditors, Paris club creditors, London club creditors, Promissory Notes holders and other creditors relates to GDP and gross fixed capital formation (GFCF) using data from 1981 to 2004. The study provides mixed evidence in that debt payment to Paris club creditors and Promissory Notes holders are positively related to GDP and GFCF while debt payment to London club creditors and other creditors show a negative significant relation to GDP and GFCF. Comparatively, Ayadi and Ayadi (2008) examined the impact of the large external debt, with its servicing requirements on economic growth of the Nigerian and South African economies. They used the neoclassical growth model which incorporates external debt, debt burden indicators, and some macroeconomic variables analyzed it using both OLS and Generalized Least Square (GLS) methods. Their finding revealed negative impact of debt and its servicing requirement on the economic growth of Nigeria and South Africa. However, Ogunmuyiwa (2011) examined whether external debt promotes economic growth in Nigeria using time-series data for the period 1970-2007. The study estimated a regression equation using ADF test, Granger causality test, Johansen co-integration

test and a VECM. The results revealed that there is no causality between external debt and economic growth in Nigeria.

Hameed, Ashraf, and Chaudhary (2008) analyze dynamic the long run and short run relationships between external debt and economic growth for the case of Pakistan using annual time series data on the GDP, debt service, capital stock and labour force from 1970 to 2003. The study concludes that debt servicing burden has a negative effect on the productivity of labour and capital, thereby adversely affecting economic growth. Also, Malik, Hayat, and Hayat (2010) explored the relationship between external debt and economic growth in Pakistan for the period between 1972 – 2005 using time series econometric techniques. Their result shows that external debt is negatively and significantly related to economic growth suggesting that increase in external debt leads to decline in economic growth. Choong, Lau, Liew, and Puah (2010) examined the effect of different types of debts on the economic growth in Malaysia during the period 1970 – 2006. Using co-integration test, their findings suggest that all components of debts have a negative effect on long run economic growth. The Granger causality test reveals the existence of a short-run causality linkage between all debt measures and economic growth. Put together, the outcomes of these studies suggest that the relationship between external debt and economic growth is mostly negative but still inconclusive. This is despite of the similarities of methods employed and time series data used even in the same country context as it appears from studies' findings on Nigeria. Adding to this the mixed effects of FDI and exchange rate misalignment, make the effect of external debt on economic growth more complicated and more ambiguous. This also reveals a contradiction between theoretical predictions and empirical findings particularly with regard to theoretical contributions on the effect of FDI on economic growth which argues that the relationship is positive in that FDI inflows to poorer countries facilitate technological transfer and create positive spillover at all firms in the receiving countries translated at the macroeconomic level (Romer, 1992). In contrast, Boyd and Smith (1992) argue that FDI in the presence of preexisting trade, price, financial and other distortions will hurt resource allocation and slow economic growth. In fact, empirical studies at the macroeconomic level find that FDI alone does not boost economic growth (Maria C. and R. Levine 2005).

In Sudan, sources of external loans and debt are multilateral agencies, mainly the IMF and the World Bank, Paris and Non-Paris club creditors as well as the Islamic Development Bank, African Development Bank and Some Arab Funds. Empirical studies examining the relationship between external debt and economic growth in Sudan are rare. El Shibly M. (1986) showed that foreign capital, namely foreign aid has a positive impact on economic development of Sudan over the period 1961-1975. Abdelmawla and Mohammed (2005) show that debt services burden have negatively impacted Sudan economic development and worsened the social problems. They investigated the impact of external debt on economic growth of Sudan for the period 1978 – 2001 and showed that export earnings have a significant positive impact while external debt and inflation had negative impact on Sudan's economic growth. Elwasila SEM (2011) shows that external debts of Sudan by all known debt burden indicators are unsustainable in the long term. Investigations of the international monetary fund (IMF, 2014 and 2016) confirm this. In a model for estimating the green net national product, Elwasila SEM (2011) shows that external debt manifested in major current account deficit has negatively affected economic growth of Sudan over the period 1969-2009.

The accumulation of an enormous external debt in the Sudan coupled with substantial debt burden indicators could depress total and real per capita income growth and thus frustrate development and welfare of the people. Medani (2008) through different fitted regression equations shows negative relationships between the growth of real per capita income and the stock of the external debt in the Sudan for the period 1980-2006. The negative coefficient of external debt ranges from -0.20 to -0.89 indicating that persistence of this huge amount of external debts would reduce the growth rate of per capita income greatly and a full relief of those debts would likewise enhance growth of per capita income substantially. The debt overhang hypothesis argues that debt has uncontrolled effects on the growth only after it reaches certain threshold levels. These levels are estimated at around 50% of GDP for the face value of the external debts and at around 20%-25% of GDP of the Net Present Value (NPV). For the Sudan, as presented above these debt thresholds have been preached since a long time ago. Put together, external debt and FDI could be counteractive catalysts in the process of economic growth. However, empirical studies at the macroeconomic

level find that FDI alone does not boost economic growth (Maria C. and R. Levine 2005).

3. Methodology

3.1. Data Sources and Method of Analysis

This study is mainly empirical, though it highlighted some theoretical debates on the relationship between external debt, FDI and economic growth. It employs annual time series data obtained from the Central Bank of Sudan (CBOS) Annual Reports, Statistical and other reports of the External Debt Unit of the CBOS for the period 1969 – 2015. The methods of analysis and estimation techniques are the Augmented Dickey-Fuller (ADF) Unit Root to test for stationarity of the variables, Johansen Cointegration method for testing long-run relationships and a vector error correction model (VECM). The estimation technique follows a three-step modelling procedure outlined as follows:

- i.** The stationarity of data would be established with the order of integration determined by using the (ADF) unit root test. For meaningful estimation, time series data are assumed to be stationary; therefore it is necessary to carry out the unit root test since a non-stationary data produce spurious results.
- ii.** After establishing the stationarity of data, Johansen cointegration test is applied. The cointegration test determines whether a long run equilibrium relationship exist among the variables of the study.
- iii.** When the variables are found to be co-integrated, a VECM is developed which involves lagging of the variables in order to introduce the short run dynamism into the model.

3.2. Model Specification

The study hypothesizes that external debt has a positive effect on the economic growth of Sudan given the low level of domestic savings. The model uses GDP as the dependent variable to measure economic growth explained by external debt represented by ratio of External debt to Exports (EDX), nominal official Exchange Rate (EXR) and Foreign Direct Investment (FDI) since these variables are interlinked to external

debt. The inclusion of FDI is thought of as to encounter any possible negative effect of external debt on economic growth of Sudan. Or otherwise, what role has been played by FDI in the growth process of Sudan given fluctuating but general declining trends of debt/exports ratio? The econometric model in a general neoclassical production function form is specified as;

$$GDP = f(EDX, EXR, FDI)$$

The econometric model in stochastic form to be estimated is written as;

$$GDP = \beta_0 (EDX)^{\beta_1} (EXR)^{\beta_2} (FDI)^{\beta_3} \mu_t \dots \dots (1)$$

Thus, the model in natural logarithm becomes:

$$\text{Log}(GDP) = \beta_0 + \beta_1 \text{Log}(EDX) + \beta_2 \text{Log}(EXR) + \beta_3 \text{Log}(FDI) + \mu_t \dots (2)$$

Where;

β_0 = the intercept of the relationship in the model (the constant).
 $\beta_1, \beta_2, \text{ and } \beta_3$ are the coefficients of EDX, EXR and FDI respectively,
and μ is the error term.

The a priori expectations for the coefficients in the model are $\beta_1, \beta_3 > 0$ while $\beta_2 < 0$. Stating equation (1) in terms of a general error correction method (ECM), the model in log lagged values becomes;

$$\Delta \text{Log}GDP_{t-i} = \beta_0 + \beta_1 \sum \text{Log}EDX_{t-i} + \beta_2 \sum \text{Log}EXR_{t-i} + \beta_3 \sum \text{Log}FDI_{t-i} + \sum \text{VECT}_{t-i} + \varepsilon_t \dots (3)$$

Where;

$\sum \text{VECT}$ is the Vector Error Correction Term, $t-i$ means that the variable is lagged by i period and ε_t is the assumed white noise residual.

The long-run relationship is tested through the hypothesis for the co-integration stated as;

Null hypothesis (H_0): $\beta_1 = \beta_2 = \beta_3 = 0$ (No Co-integration) and the alternative hypothesis (H_1): $\beta_1 \neq \beta_2 \neq \beta_3 \neq 0$ (Co-integration exists).

4. Data Analysis and Interpretation of Results

This section deals with the analysis of data and interpretation of results. The methods used for the analysis of data are descriptive statistics, the OLS method, ADF Unit Root test, Johansen Co-integration test and the VECM. The logarithms of the variables were obtained so as to bring the time-series data on the variables to the same base, reduce its variability and enable direct estimation of elasticities.

4.1. Analysis and Interpretation of Results

We start by a descriptive statistical analysis. As presented in table (1), the maximum value was US\$ 840667 billion and 4550.881 for GDP and EDX respectively. The minimum value was US\$ 1848 and 66.718 for GDP and EDX respectively. It is also observed that all variables are positively skewed to the right as indicated by Jarque-Bera statistics and the corresponding probity values, which means that time series are not normally distributed.

Table 1: Basic Descriptive Statistics

	GDP	EDX	EXR	FDI
Mean	2.13E+10	1159.710	1.225205	1.559615
Median	1.23E+10	630.8810	0.097432	0.110281
Maximum	8.41E+10	4550.480	6.025733	7.645651
Minimum	1.85E+09	66.71766	0.000348	0.000113
Std. Dev.	2.23E+10	1233.640	1.611666	2.115154
Skewness	1.484516	1.250809	1.251720	1.222604
Kurtosis	3.818777	3.563633	4.011834	3.532870
Jarque-Bera	18.57586	12.87757	14.27825	12.26504
Probability	0.000093	0.001598	0.000793	0.002171
Observations	47	47	47	47

Source: Authors' Computation

Table (2) presents the correlation matrix of the variables included in the study.

Table 2: Correlation Matrix

	GDP	EDX	EXR	FDI
GDP	1			
EDX	-0.28	1		
EXR	0.81	-0.20	1	
FDI	0.42	-0.19	0.67	1

Source: Authors' Computation

As from table (2), the diagonal entries show the correlation of the variable with itself which is perfectly unity. The off diagonal entries show the pair-wise correlation amongst the explanatory variables which is found to be less than 0.8 except the correlation coefficient between EXR and GDP. It is also clear from this simple test that EDX has a positive effect on GDP.

4.2. Stationarity of the Data

It is known that the OLS results are short run oriented and because of the possibility of the non stationarity of macroeconomic data, spurious regression is likely to occur. Furthermore, the stationarity of data is essential for carrying out a Johnson co-integration test and for estimating a vector error correction model. Hence, the stationarity of data needs to be established. The conventional test for stationarity of variables used in this study is (ADF) unit root test.

4.2.1. ADF Unit Root Test

In this study the stationarity of variables is established using the ADF test. The decision rule for the ADF unit root test states that the ADF test statistic value must be greater than the Mackinnon Critical Value at 5% at absolute term for stationarity to be established at level and if otherwise, differencing is needed using the same decision rule. Table (3) presents the summary results of the stationarity test on the logarithm (L) of the series and the order of integration.

Table 3: ADF Unit Root Test and Order of Integration (level)

Variable	ADF Test Statistic Value	1% Mackinnon Critical Value	5% Mackinnon Critical Value	P	Remark	Order of Integration
L(GDP)	-0.836103	-3.581152	-2.926622	0.7991	Nonstationary	1(0)
L(EDX)	-1.681279	-3.581152	-2.926622	0.4338	Nonstationary	1(0)
L(EXR)	-0.292623	-3.581152	-2.926622	0.9180	Nonstationary	1(0)
L(FDI)	-2.539289	-3.581152	-2.926622	0.1131	Nonstationary	1(0)

Source: Author's Computation

As from table (3) and according to ADF statistics, critical and p values all variables included in the study are found to be nonstationary at level. Thus stationarity is tested on first differencing of the variables and the results are reported in table (4).

Table 4: ADF Unit Root Test and Order of Integration (first difference)

Variable	ADF Test Statistic Value	1% Mackinnon Critical Value	5% Mackinnon Critical Value	P	Remark	Order of Integration
L(GDP)	-5.717966	-3.584743	-2.928142	0.0000	Stationary	1(1)
L(EDX)	-5.348218	-3.584743	-2.928142	0.0001	Stationary	1(1)
L(EXR)	-4.782800	-3.584743	-2.928142	0.0003	Stationary	1(1)
L(FDI)	-9.787254	-3.584743	-2.928142	0.0000	Stationary	1(1)

Source: Author's Computation

As from table (4) and according to ADF statistics, critical and p values all variables included in the study are found to be stationary at first difference.

4.3 Johansen Cointegration Test

The cointegration test establishes whether a long-run equilibrium relationship exist among the variables of the study. The well known rule is that in order to establish co-integration, the trace statistics must be

greater than the Mackinnon Critical Value at 1% and 5% levels of significance and the co-integrating equation is chosen as the normalized co-integrating coefficient with the lowest log likelihood. Table (5) and table (6) present the results of Johansen co-integration test and it indicates one cointegrating equation.

Table 5: Johansen Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.505001	51.45288	47.85613	0.0221
At most 1	0.265255	21.21532	29.79707	0.3444
At most 2	0.164653	7.961369	15.49471	0.4695
At most 3	0.005226	0.225317	3.841466	0.6350
Trace test indicates 1 cointegrating equation at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Source: Author's Computation

Table 6: Johansen Unrestricted Cointegration Rank Test
(Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.505001	30.23756	27.58434	0.0223
At most 1	0.265255	13.25395	21.13162	0.4291
At most 2	0.164653	7.736052	14.26460	0.4062
At most 3	0.005226	0.225317	3.841466	0.6350
Max-Eigen value test indicates 1 cointegrating equation at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Source: Author's Computation

The Johansen cointegration test results indicate that there is only one cointegrating equation according to both the trace statistics and the maximum Eigen value statistics at 5% significance level. Thus, there exists a long run relationship amongst the variables of the model, which lead to the rejection of the hypothesis of no cointegration. The

cointegrating equation chosen from the normalized cointegrating coefficients with the minimum log likelihood of -20.80846 is:

$$\text{LogGDP} = 0.12\text{LogEDX} - 0.11\text{LogEXR} - 0.38\text{LogFDI} \dots \dots \dots (4)$$

STD (0.11721) (0.06350) (0.10826)

STD: Standard Error statistics

From the cointegrating equation, external debt to exports ratio EDX has a positive and significant relationship with GDP; 1 percentage increase (decrease) in EDX leads to 12 percentage decrease (increase) in GDP. Exchange rate EXR and foreign direct investment exert FDI negative and significant effects on GDP, which are in conformity with findings of other studies in the field.

4.4 Vector Error Correction Model (VECM)

Cointegration is a prerequisite for the application of the error correction mechanism. Since cointegration has been established at 1(1), it is pertinent to proceed to the VECM. From the unrestricted estimated VAR model a lag of 3 is selected based on LR, FPE, and AIC as shown table (7) since FPE and AIC give the minimum statistics.

Table 7: VAR Lag Order Selection Criteria

Sample (1969-2015); Included observations: 43						
Lag	LogL	LR	FPE	AIC	SC	HQ
1	-76.10844	NA	0.000854	4.284114	4.939444*	4.525779*
2	-60.26399	25.79329	0.000874	4.291348	5.602009	4.774679
3	-37.17273	33.29437*	0.000656*	3.961523*	5.927513	4.686519
4	-23.33437	17.37841	0.000793	4.062064	6.683385	5.028726

* indicates lag order selected by the criterion; LR: sequential modified LR test statistic (each test at 5% level); FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion

Source: Author's Computation

The VECM specified in equation (2) is estimated and the results are presented in table (8) and represented by equation (5) where the dependent variable is DLOG(GDP) with a lag order of 3.

Table 8: Summary of VECM Results

Variable	D(LOG(GDP))	Standard errors	t-statistics	p. value
ECT _{t-1}	-0.176548	(0.04062)	[-4.34585]	0.0000*
D(LOG(GDP(-1)))	-0.026248	(0.16438)	[-0.15968]	0.8734
D(LOG(GDP(-2)))	0.612754	(0.14547)	[4.21220]	0.0001*
D(LOG(GDP(-3)))	-0.086291	(0.17891)	[-0.48231]	0.6305
D(LOG(EDX(-1)))	0.147021	(0.06795)	[2.16359]	0.0325**
D(LOG(EDX(-2)))	0.121174	(0.07055)	[1.71751]	0.0886***
D(LOG(EDX(-3)))	0.123574	(0.08037)	[1.53764]	0.1269
D(LOG(EXR(-1)))	-0.068996	(0.06687)	[-1.03172]	0.3043
D(LOG(EXR(-2)))	0.346783	(0.07320)	[4.73740]	0.0000*
D(LOG(EXR(-3)))	-0.002707	(0.11438)	[-0.02367]	0.9812
D(LOG(FDI(-1)))	-0.065642	(0.02400)	[-2.73476]	0.0072*
D(LOG(FDI(-2)))	-0.096775	(0.01860)	[-5.20396]	0.0000*
D(LOG(FDI(-3)))	-0.020582	(0.02014)	[-1.02183]	0.3090
C	-0.017156	(0.03951)	[-0.43425]	0.6649

R-squared 0.73; Adj. R-squared 0.61; SSR 0.3969; SEE 0.1169; F-statistic 5.9989; LL 39.7149; AIC -1.1960; SC -0.6226; Mean Dependent 0.0919; S.D. dependent 0.1867; DW 2.2

*,**,*** indicate significance at 1%, 5% and 10% level of significance respectively

$$\begin{aligned}
 d\text{Log}(GDP) = & -0.18L(GDP)_{t-1} + 0.12L(EDX)_{t-1} \\
 & - 0.11L(EXR)_{t-1} - 0.38L(FDI)_{t-1} - 0.03d\text{Log}(GDP)_{t-1} \\
 & + 0.61dL(GDP)_{t-2} - 0.09d\text{Log}(GDP)_{t-3} + 0.15dL(EDX)_{t-1} \\
 & + 0.12dL(EDX)_{t-2} + 0.12dL(EDX)_{t-3} - 0.07dL(EXR)_{t-1} \\
 & + 0.35dL(EXR)_{t-2} - 0.003dL(EXR)_{t-3} - 0.07dL(FDI)_{t-1} \\
 & - 0.10dL(FDI)_{t-2} - 0.02dL(FDI)_{t-3} - 0.02\dots\dots\dots(5)
 \end{aligned}$$

Where d is the difference operator and L stands for natural logarithm. All coefficients are the elasticities of GDP with respect to the respected regressors as the estimation is carried out on the natural logarithm of variables. The VECM equation shows that EDX has a positive and significant relationship on GDP growth at all time lags and also in the long run. A unit change in EDX means that GDP rises by 0.15, 0.12 and

0.12 in one, two and three time period respectively. The findings suggest that external borrowing have been beneficial and plays an important role in the growth process of Sudan. However, other external debt burden indicators such as the debt services may have crowded out the expected positive impact of FDI on the economy. The elasticity coefficients of the GDP with respect to FDI are found to be negative at the first, second and third lag. This could be due to a fact that FDI net inflows have not been adequate, inefficient or in sectors not stimulating economic growth and employment. Exchange rate effect is in conformity with the a priori expectation as it turns to be negatively related to GDP with time lag one and three but positively and significantly related to GDP at time lag two. A 10 percentage increase (i.e. depreciation) in EXR leads to 0.35 percent decrease in GDP. This implies that the depreciation policy of the Sudanese currency since 1978 has not been effective in stimulating exports and reducing imports. The coefficient of VECM is significant with the appropriate negative sign and it means that present value in GDP adjusts to an equilibrium position at speed of 18 percentages each year. The adjusted R^2 of the VECM is reasonable showing that that the exogenous variables in the VECM equation explains 61% of total variation or changes in GDP. Also, the F-Statistic of 5.998937 with its probability value of 0.0032 provides a basis to logically conclude that the overall result of the VECM is statistically significant. Furthermore, the reliability of the estimated VECM is tested and the diagnosis test results are presented in table (10).

Table 9: VECM Diagnosis Tests

	Chi-sq	DF	Prob.	Conclusion
VEC Residual Normality tests:				Residuals are multivariate normally distributed
Skewness	4.1308	4	0.3886	
Kurtosis	5.2051	4	0.2669	
Jarque-Bera	9.3358	8	0.3148	
VEC Residual Heteroskedasticity Tests (Joint Test)	267.7032	260	0.3580	Residuals are Homoskedastic
VEC Residual Serial Correlation LM Tests (LM-Stat) at lag order 3	15.50644		0.4879	No autocorrelation

Source: Author's Computation

5. Conclusion and Recommendations

External debt plays a crucial and a critical role in low income and low domestic savings economies including Sudan. However, if not well utilized and optimally managed, external debt could lead to debt overhang and crowding out of public and private investments including FDI and thus retard economic growth. The objective of the study has been to examine the effect of external debt on economic growth of Sudan using annual time series data for the period 1969-2015, which seems reasonably long enough period to capture such complicated effect of foreign capital flows including the most conventional types of external debt and foreign direct investments, together with implicit examination of various macroeconomic policy changes such as economic liberalization declared and adopted since 1992, depreciation of exchange rate pursued since 1978 and more recently inflation targeting and expansionary monetary policies. The study established stationarity of the included variables and then employed the Johansen cointegration test followed by the VECM. The cointegration test shows the existence of long run equilibrium relationship among the variables of the study of GDP, EDX, EXR and FDI, which confirms the effect of external debt in terms of EDX on economic growth together with the effect of the control variables of FDI and exchange rate in the long term. On the other hand, the inflows of FDI have not been beneficial to economic growth of Sudan as the elasticity coefficients of the GDP with respect to FDI are found to be negative at the first, second and third lag. This could be due to a fact that FDI net inflows have not been adequate, or attracted into sectors not stimulating economic growth, on one hand. On the other hand, and interestingly, the effect of inflows of foreign loans has been more powerful in encountering such apparent negative effect of FDI probably due to lack of human capital and financial development in Sudan. Generally our finding is in line with Maria C. and R. Levine (2005) who find that after resolving biases in previous studies, the exogenous component of FDI does not exert a robust, independent influence on economic growth. However, Azman-Saini, Law and Ahmad (2009) used a minimum threshold model also found that FDI does not have an independent positive effect on economic growth, but once a minimum threshold for human capital stock and financial sector development are reached the effect turns positive. Exchange rate effect is found to be in conformity with the a priori expectation as it turns to be is negatively related to GDP but only

statistically significant at a time lag of 2. A 10 percentage increase (i.e. depreciation) in EXR leads to 0.35 percent decrease in GDP in two time periods. This implies that the depreciation policy of the Sudanese currency since 1978 has not been effective in either stimulating exports or reducing imports, or both. Or, in short the Marshall-Lerner condition – i.e., the sum of price elasticity of exports and imports should be greater than zero for effective exchange rate depreciation has not been met in Sudan. In other words, net exports haven't increased; prices haven't fallen while the value of national currency has been deteriorating. A negative effect of the depreciation of the national currency on economic growth could also be explained as a reflection of inflationary finance of government budget deficit through money printing particularly for countries facing unsustainable external debt and limited access to international credit market since 19972. The finding of this study is in line with other empirical studies suggesting that misaligned real exchange rate has had an adverse effect on economic indicators, such as economic growth and export performance (see for example, Cottani et al., 1990; Ghura & Grennes, 1993; Razin & Collins, 1997; Domaç & Shabsigh, 1999, and Ebaidalla, 2013). The VECM reveals that the lagged error correction term is significant judging from its negatively signed coefficient with speed of adjustment of 18% annually. The coefficient of multiple-determination (R²) of the VECM (61%) led to rejection of the null hypothesis which states that external debt does not have a significant effect on the economic growth of Sudan. Also, the F-statistics shows that the time to time behaviour of the ratio of external debt to exports, exchange rate and foreign direct investments all put together cause a significant change on the performance of Sudan economy.

Based on the findings of this study, recommendations were made. Firstly, the government should ensure economic and political stability in order to enjoy the benefits of sustained foreign capital flows namely foreign loans and foreign direct investments but debt burden should be made minimal particularly the debt/exports of goods and services ratio. Secondly, government should acquire external debt largely for stabilisation of the major economic indicators such as the general price level, exchange rate and the balance of payments, as they proved to

² For further discussions on the interplay of these macroeconomic variables see Stephanie S and Martin U. 2014.

interact together as determinants of economic growth. Thirdly, the government should diversify the nation's export base so as to increase export earnings and promote industrialization in order to reduce import dependency which if well managed together and in a consistent manner should lead to reduce the ratio of external debt to exports and stimulate further economic growth. Furthermore, stability in the exchange rate should be pursued and the depreciation of the Sudanese pound should be avoided by the government as the continuous depreciation of the national currency has been found to negatively impacts economic growth. This could be due to low response of both exports and imports of Sudan in the international market, or inability of the economy to produce large volume of import substitute goods. Lastly, the government should press with multilateral creditors and donors for permanent debt relief so as to avert potential negative effects of both the debt overhang and crowding out effects associated with unsustainable external debt. Importantly, foreign direct investment policy of the country needs to be revisited and revised seriously in order to redirect inflows FDI for more productive, more efficient, more labour-intensive and the most economic growth enhancing sectors, together with human capital and financial deepening indicators an issue call for urgent and sound further investigation.

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