

Sustainability and Genuine Saving: Empirical Evidence from Sudan Economy

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Abstract

This paper assesses economic development path of Sudan during the period 1977 -2009 via genuine saving rate GSR, determines factors affect genuine saving, using vector autoregression. Genuine saving estimates were obtained from World Bank over the period 1977 to the referendum on South Sudan succession in 2009. Results show that the past values of manufacturing share to GDP, GSR lagged once, and growth rate GR have positive effects on GSR, contrary to GSR lagged twice, and import duty rate values IDR. Almost half the period Sudan suffers from dis-saving, affecting adversely well-being and sustainability. Dutch disease DD is apparent since the export of oil in the last quarter 1999.

Keyword: dis-saving, Dutch disease, genuine saving, growth, sustainability, well-being

1. Introduction

Development theories supported by empirical evidence emphasize the vital role of saving in economic growth. The growing amount of empirical evidence that prove negative relationship between resource abundance and growth led to the adoption of the notion of genuine saving GS (Sachs & Warner, 1997; Hamilton & Clemens, 1999; Boos, 2001, 2011; Daspupta & Mitra, 2002; Neumayer, 2004; Dietz & Neumayer, 2005; Asheim, 2011; and Boos & Müller, 2013). This notion is considered as a measure of dis-saving, sustainability, and shadow prices that value green net national product gNNP which maximizes social welfare (Hamilton and Clemens, 1999; Dietz & Neumayer 2005). Sustainability is the requirement to maintain capacity to provide non-declining well-being over time i.e. keep manufactured, human and natural capital intact.

Weak sustainability holds that natural capital is sustainable with other forms of capital (Neumayer, 2004, 2010). Well-being (welfare/utility) in turn can be defined as the satisfaction of human preferences that is education, health, freedom, autonomy, and recreation.

The negative relation between growth GR and GS marked as resource curse RC is explained as Dutch Disease: boom in natural resources sector due to new discovery or increasing world market prices and terms of trade changes the composition of consumption and investment, appreciates the real exchange, and the demand for manufactured goods has to be met by imports increasing the competition in this sector, wages in services sector rise therefore employees move from manufacturing sector to services sector (Boos 2011). In other words the inflow of resources windfall in the country causes the real exchange rate to appreciate, thereby reducing the country competitiveness.

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Glyfason (2007) identified five channels through which natural resources can negatively affect an economy: corruption, neglect of education, reduction of private and public investment, crowding out of financial capital, and reduced competitiveness.

Sudan is a developing country endowed with abundance of natural resources. The total area suitable for cultivation is 300,000 square kilometers, only 60,000 are utilized, and one third of the utilized area is forests and pasture. White and Blue Nile, and Atbara, Rahad, Dindir and Sitait rivers carry 93 billion cubic meters of water annually, the Sudan's share is 18.6 cubic meters according to 1959 Water sharing treaty with Egypt. Traditional agriculture is the major mode of living for 80 percent of the population. The last quarter of 1999 witnessed the first shipment of Sudanese oil. The main mineral exports comprise gold, chrome. Sudan formulated seven development plans since 1960, commencing with ten year plan and ends with 25 year plan (2000 -2025). Economic planning is based mainly on the two-gap model. The internal gap is the dominant one (Arabi 2012). Gross domestic saving has been found to be influenced by foreign saving, ratios of investment, money supply, and disposable income in GDP and inflation (Arabi 2002, Osman 2014). Despite an average annual growth rate of 5 percent, the percentage of people under the poverty line is ranging from 46 percent as an official figure to 80 percent of independent academic research. Climate change endangers 12 million hectares of Mechanized rain-fed agriculture, and 6.6 of traditional rain-fed agriculture.

The most prominent risks are drought which frequently affects North and West Sudan; floods are frequent in Nile basin, and East Sudan, while dust storms affect the centre and the north. The average rain fall shrink from 425 to 360 by 0.5 percent rates annually (Awadalla 2001).

This paper aims first to empirically provide evidence that economic growth is not always synonymous with improved well-being in Sudan; second answer the following questions: are society goals for basic needs food, shelter, freedom, participation, and sustainably met? What are the main factors that affect genuine saving? How effective is fiscal policy in raising saving?. This paper differs from other in many aspects: aim, methodology, and included variables. The study will first investigate the correlation between GS and GR, cointegration and causality and among GS and its determinants, and then run vector autoregression.

2. Empirical Studies

Saving has been studied intensively using domestic and national saving as dependent variable. The main analytical tools were correlation, OLS, autoregressive distributed lag, vector autoregressive, Granger causality, and GARCH models. Elbadawi & Mwegu (1998), Loayza, Hebel, & Servin (1998), Arabi (2002) Arabi & Abdalla (2013), and Mualley (2011) using OLS found significant effects of the following explanatory variables: per capita gross private disposable income, terms of trade, dependency ratio, public saving, current account, changes in nominal exchange rate, general government consumption expenditure, rate of interest (commercial banks' deposit rate), degree of financial depth, private sector credit, inflation transitory income, openness, and investment ratio to GDP that affect saving ratio to GDP for Africa, across the world, and Sudan. Ogoe (2009), Misztal (2011) & Budha (2012) used causality and error correction to examine saving, investment, and growth relationship for Ghana, advanced countries and Nepal respectively. Arent (2012) analyzed the impact of the expectations about future labor income on the saving behavior of German households. Shahbaz & Mahmood (2004) showed that the investment and saving rates in Pakistan.

The negative relation between abundance of resources and economic growth (Resource Curse) has been found by many studies.

Solow (1974) and Hartwick (1977) were concerned with intergenerational equality if all profits from exhaustible resources are invested in reproducible capital. Hamilton & Clemens (1999) presented empirical estimates for developing countries using consistent time series data for 1970–93 showing that levels of genuine savings are negative in a wide range of countries, particularly in Sub-Saharan Africa, and that these countries are being progressively impoverished.

Dietz & Neumayer (2005) critical appraise genuine savings as an indicator of sustainability. Hong (2009) attempted to answer some of the questions about policy-making in light of Dutch Disease and Natural Resource Curse if it is, in fact, an intractable problem. Hamilton (2012) commented on Arrow et al paper 'Sustainability and the Measurement of Wealth' stating that discrepancies between Arrow and WB due to different data sources, and different assumptions about depreciation, lifetimes and discount rates. Boos & Holm-Müller (2013) showed that factors leading to the RC are also useful explanatory variables for GS. Corruption is a major cause of poverty as well as a barrier to overcoming it.

3. Theoretical Background

Sturm (1983) defines saving ratio as the weighted average of saving ratios of household, business and government sectors. The weights are the share of these sectors in the disposable income. The saver may add to his cash balance, buy a new stock, or buy capital goods i.e. translate non-spending into spending. In general gross domestic saving GDS is the difference between GDP and private and public consumption. GDS is traditionally used as a measure of accumulation of nation's wealth. Net domestic savings are equal to the gross domestic saving less the consumption of fixed capital (Lin and Hope 2004). Saving has been treated by development theories as an essential ingredient. Harrod-Domar introduced the concept of the *warranted rate of growth*, which is the rate of growth of total output consistent with equilibrium in both input and output markets. This output growth rate equals the ratio i.e. saving rate divided by the constant capital-output ratio. Thus, an increase in the savings rate, which allows a higher level of investment and capital goods creation, will increase the growth rate of the economy, *ceteris paribus* (Sengupta 2011).

The World Banks defines adjusted net savings are equal to net national saving plus education expenditure minus energy depletion, mineral depletion, net forest depletion, carbon dioxide and particulate emission damage.

The Genuine Saving acts as counterweight to the traditional system of national accounting (Simon and Eric 2005). It specifies optimal adjustment to national income account, incorporates environmental factors into regional and national accounts, and a hybrid socio-political indicator of general social welfare or progress (Brown et al 2003). It operationalizes the concept of 'weak' sustainability. Its methodology and assumptions are very clear. A weakness of the method is that it can only suggest unsustainability, but not sustainability. Genuine Savings suggests unsustainability if the indicator is 'persistently' negative. It cannot assess whether an economy is truly sustainable (http://www.ivm.vu.nl/en/Images/AT3_tcm53-161574.pdf).

The determinants of genuine savings include economic growth, investment, terms of trade, demographic factors, fiscal and financial policies, macro-economic instability and uncertainty, and foreign aid. Urbanization may also be expected to reduce the saving rate as the precautionary savings associated with the volatility in agricultural sector are reduced. Public saving may or may not influence private saving. Depending on the assumptions made, this may have some impact (Keynesian) or is fully crowded-out (Ricardo equivalence). Sachs and Warner (1997) showed that economies with a high ratio of natural resource exports to GDP in 1970 (the base year) tended to grow slowly during the subsequent 20-year period 1970-1990. There were many factors behind this negative relationship: Dutch disease which pulls resources in and out of non-traded (industrial) sectors affecting long-term growth; declining terms of trade; impediments to innovation from special-interest groups; and volatile world prices. Explanatory variables used were GDP divided by economically active population (GEA); share of primary exports in GDP (SXP); integration with the world economy (SOPEN) maintaining low tariffs and quotas, not having excessive high black market exchange rate, and avoid extreme state control of its export sector; investment to GDP ratio (INV); rule of law (RL); and terms of trade (TOT).

Hamilton and Clemens (1999) showed that levels of genuine savings are negative in a wide range of countries, particularly in Sub-Saharan Africa, and that these countries are being progressively impoverished. They showed that factors leading to the RC are also useful explanatory variables for GS. The transmission is through factors leading to the RC are also useful exogenous for GS.

4- Methodology and Data Description

4.1 Methodology

Traditional econometric techniques lost grounds after the macroeconomic chaos of the 1970s in describing and summarizing of data, quantifying macroeconomy, forecasting and policy analysis. Sims in 1980 came with vector autoregression as an alternative. A vector autoregression VAR is n -equation, n variable linear model in which each variable is in turn explained by its own lagged values, plus current and past values of the remaining $n-1$ variables. This simple framework provides a systematic way to capture rich dynamics in multiple time series (Stock & Watson 2001). The mathematical representation of a VAR is:

$$y_t = \Phi_0 + \Phi y_{t-1} + a_t \quad (1)$$

where Φ_0 is a k -dimensional vector, Φ is a $k \times k$ matrix, and $\{a_t\}$ is a sequence of serially uncorrelated random vectors with mean zero and covariance matrix Σ (required to be positive definite; otherwise the dimension of r_t can be reduced (Tsay 2002).

If we substitute for y_{t-1} over $k-1$ times we get:

$$y_t = \sum_{j=1}^{k-1} \Phi_1^j \Phi_0 + \Phi_1^k y_{t-k} + \sum_{j=1}^{k-1} \Phi_1^k a_t \quad (2)$$

Differentiation of y_t with respect to y_{t-k} gives $[\Phi_1^k]_{i,j}$, this means (i, j) elements of matrix its plot as a function of k shows how future values of variable i are impacted by a one unit change in variable j , k periods in the past.

4.2 Data Description

The data used for investigating the determinant of GS in the Sudan economy during the period 1977 - 2009 are taken from different sources. Data symbols, description and sources are depicted in Table (1)

Table (1) Variables Included, their Description and Sources 1977-2009

Variable	Symbol	Description	Source
Genuine Saving Ratio	GSR	Ratio to GDP	World Bank Estimates
Real GDP Growth Rate	GR	Percentage	Central Bureau of Statistics
Gross Domestic Product	GDP	Million SDG	Central Bureau of Statistics
Total Investment	INV	Million SDG	Central Bureau of Statistics
Foreign Direct Investment	FDI	Million SDG	Central Bureau of Statistics
Total Active Population	LABF	Million Persons	Central Bureau of Statistics
Manufacturing share	MNF	Share of GDP	Central Bureau of Statistics
Import of Goods	MG	Million SDG	Central Bank of Sudan
Import Duty	Duty	Million SDG	Central Bank of Sudan
Export of Goods	XG	Million SDG	Central Bank of Sudan
Export Price Index	XP	Percentage	Central Bureau of Statistics
Import Price Index	MP	Percentage	Central Bureau of Statistics
Terms of Trade	TOT	Percentage	Own Calculation
Human Development Index	HDI	Score	UNDP
Corruption Perception Index	CPI	Score	Transparency international

* SDG means Sudanese Pound

Corruption perception index CPI score relates to perceptions of the degree of corruption as seen by business people and country analysts, and ranges between 10 (highly clean) and 0 – zero - (highly corrupt).

4.3 The Model

$$\begin{aligned} \text{GSR} &= C(1,1)*\text{GSR}(-1) + C(1,2)*\text{MNF}(-1)/\text{GDP}(-1)*100 + C(1,3)*\text{IDR}(-1) + C(1,4)*\text{GR}(-1) \\ \text{MNFR} &= C(2,1)*\text{GSR}(-1) + C(2,2)*\text{MNF}(-1)/\text{GDP}(-1)*100 + C(2,3)*\text{IDR}(-1) + C(2,4)*\text{GR}(-1) \\ \text{IDR} &= C(3,1)*\text{GSR}(-1) + C(3,2)*\text{MNF}(-1)/\text{GDP}(-1)*100 + C(3,3)*\text{IDR}(-1) + C(3,4)*\text{GR}(-1) \\ \text{GR} &= C(4,1)*\text{GSR}(-1) + C(4,2)*\text{MNF}(-1)/\text{GDP}(-1)*100 + C(4,3)*\text{IDR}(-1) + C(4,4)*\text{GR}(-1) \end{aligned}$$

Variables included in the two models are found by many empirical studies to be the determinants of genuine saving. The ratio of manufacturing value added to GDP is taken to show if there is Dutch disease which pulls resources in and out of non-traded to traded sector. Manufacturing sector comprises food and beverages, petroleum products, drugs, and light industries such as tanneries, weaving and textile, assemblies of cables, refrigerators and cars.

They all depend mainly on imported raw materials and spare parts, and suffers from lack of efficiency due to the obsolete technology used, power shortage, lack of skilled labor, excessive taxes, deteriorating local currency, high inflation rates, increased wages as a result of government minimum wage law, and lack of competitiveness with imported goods. The ratio of import duty to import of goods is used instead of a dummy variable that measure openness to measure whether the country maintains low tariffs. Import duty is levied at varying rate on most of imports consumer and durable goods, whereas the latter can be more than 100 percent of the face price specifically on vehicles. They are the source of income to the government, but act sometimes as a policy tool to limit the importation of certain good. The relation between growth rate and saving is well known. As stated above GSR is calculated by the World Bank for Sudan at five years basis and interpolated by EVIEWS making continuous time series. The growth rate is calculated as the ratio of current real GDP to the last year real GDP minus one.

5.1 Results

Trace test indicates 2 cointegrating equations at the 0.05 level Table (5).

Simple correlation between GSR and GR = 0.307, P-Value = 0.083 which is significant at 10 percent.

From figure (1) it is clear that between 1977 and 1980 GSR is positive while GDS is negative. They are both negative during 1983 - 1986. Since then the GDS has been positive except in 1996 while GSR has been oscillating between negative and positive. The import duty ratio to GDP is the most volatile one due to the changing policies of consecutive seven governments concerning the foreign sector.

Table (1) Vector Autoregression Estimates

Variable	Coefficient		Model 2	Coefficient	
GSR(-1)	-0.705***		GSR(-1)	0.657***	
MNF(-1)/GDP(-1)	0.401***		XG(-1)/GDP(-1)	0.198***	
IDR(-1)	-8.170***		DTR(-1)	-4.084**	
GR(-1)	-0.149**		GR(-1)	-0.130*	
R-Squared	0.664		R-Squared	0.634	
Adj. R-squared	0.628		Adj. R-squared	0.595	
Akaike Information Criterion	12.322	3.327	AIC	14.388	14.827
Schwarz Information Criterion	13.055	4.807	SCH	15.121	16.307

(*) (**), and (***) denote rejection of the null hypothesis at 10%, 5% and 1%

Model 1 has been selected on the basis of significance, coefficients of determination and information criteria.

Variance decomposition separates the variation in an endogenous variable into the component shocks to the VAR providing information about the relative importance of each random innovation in affecting the variables in the VAR.

Table (2) Variance Decomposition Averages

Variable	Standard Error	GSR_AVG	MNFR_AVG	IDR_AVG	GR_AVG
GSR	3.83	67.08	7.97	20.67	4.28
MNFR	2.49	1.18	95.61	0.85	2.36
IDR	0.16	1.01	6.24	92.27	0.49
GR	5.68	1.47	18.28	16.44	63.80

The 67.1 percent variance of GSR is explained mainly by IDR, MNFR, and GR percent variance. The 95.6 mean variance of MNFR is explained mainly by GR, GSR, and IDR mean variances. The 92.3 percent variance of IDR is explained mainly by MNFR, and GSR and GR percent variances. The 63.8 mean variance of GR is explained mainly by MNFR, IDR, and GSR percent variances. The role of MNFR is obvious.

Table (3): Scores and Ranks

Year Item	2003		2005		2007		2009	
	Score	Rank	Score	Rank	Score	Rank	Score	rank
CPI*	2.3	112	2.1	149	1.8	172	1.5	176
HDI**	0.37	147	0.39	141	0.401	147	0.407	171

Source: * Transparency International; ** UNDP HDI Reports

Table (4) below shows that all variables Granger cause each other except GSR does not Granger cause MNFR, and IDR does not Granger cause GR.

5.2 Discussion

Consecutive Sudanese governments have been using the growth of real GDP as an indicator of success due to its strong political effects, since the fall of GDP causes many problems of which business bankrupt, loss of jobs, fall of consumer spending, and rise of internal and external deficits, but economic success is not always synonymous with national sustainable development.

However, using alternative indicator i.e. GSR revealed that Sudan has been experiencing dis-saving and weak sustainability almost half of the sample period. The first dis-saving (negative sign) coincided with commence of the second civil war in 1982. The second was in 1984 and 1985 following the drought and famine due to climate change. Then continued as a series from 1988 to 1994 where two major floods had devastated the economy. This means that the overall capital wealth cannot be sustained for the future generations and failure of transforming depleting resource wealth into a portfolio of other assets to support sustained development. The fourth episode was during the period 2003-2006 as a result of culmination of civil war.

Moreover Sudan has not optimally managed rents of exhaustible natural resources to speed up development and to lift the country out of poverty. The official poverty rate is 46% compared to over 80% of independent researchers. This is caused mainly by high share of current consumption out of revenues from exhaustible resources due to the lavish spending on non-productive activities, lean government, and the ruling party with its different levels. Precautionary saving has been low, despite the volatility of revenue due to volatility in resource flows which led to significant output volatility and adversely impact overall macroeconomic performance, which, along with the undermining of institutions, could help explain the resource curse.

Use of genuine savings measures should draw the attention of policy makers to the extent to which monetary and fiscal policies, exports of exhaustible resources, stronger resource policies, and pollution abatement measures boost genuine savings rates.

For policymakers, linking sustainable development to genuine savings rates means that there are many possible interventions to increase sustainability, from the macroeconomic to the purely environmental (Kirk and Michael 1999). Climate change, civil war and inappropriate economic policies caused large scale displacement, rural-urban migration, and spread of poverty. The inappropriate economic policies have been endangering the fragile environment. Development planning created unbalanced growth among regions, and mechanized rain-fed farming was and still one of the main causes of deforestation. Frequent devaluation of exchange rate has not achieved the desired effects on the trade balance i.e. J-curve (Arabi & Abdalla 2014). The devaluation of exchange rate increased the cost of imported raw materials which in turn reduced the competitiveness of exports- due to the dependence of exports on imported raw materials. Excessive import duty has been one of the main sources of revenue.

It is 28 per cent in average. Infrastructure gaps and constrained capital market access imply that the returns on domestic investment projects are likely to be higher than returns to international financial assets mean that part of the resource wealth should be invested in building domestic capital, subject to absorptive capacity constraints (IMF 2012). Despite this fact the government is encouraging foreign investors at the expense of domestic which is apparent in the investment act. The outcome of the encouragement resulted in inflow of FDI in services sector without increasing human and physical capital.

Past values of import duty affect GS adversely taking into consideration that 80 percent of manufacturing raw materials are imported. Economic and trade liberalization and privatization of public entities and agricultural schemes in 1992 have profound negative effects on the economy.

Absence of rule of law increased the size corruption. The ranking according to CPI & HDI has been retreating from 112, 147 in 2003 to 176, and 171 in 2009 respectively; corruption is a major cause of poverty as well as a barrier to overcoming it (Eigen 2013)

Features of Dutch disease have been apparent since the commence of oil export in September 1999 expressed in terms of declining shares of agriculture and manufacturing to GDP sector, increased imports of manufactured goods. Sustainability is lacking since there is no reinvestment of depleted resources. Comparing GS with growth rate, the latter was negative only in the years 1978, 1979, 1984, 1985, and 1990 its passed values have negative impact on GS.

Variance decomposition (Figure 2) provided information about the relative importance of each random innovation in affecting the variables in the VAR as follows: MNFR, IDR, GSR, and GR. One S.D innovations GSR leads to rise in MNFR & GR and a decline in IDR., Shocks to MNFR and IDR decrease only IDR, while shock to GR increase all variables.

The forecast error of each variable at the given forecast horizon is least of 0.16 for IDR, 2.49 MNFR, 3.83 GSR and 5.68 GR. The source of this forecast error is the variation in the current and future values of the innovations to each endogenous variable in the VAR.

6. Conclusion

The World Bank calculated genuine saving of Sudan for the period 1977-2009. This paper used GSR as a measure for dis-saving and weak sustainability. The Sudan is ranked one of lowest countries in corruption and human development. This ranking is the result of climate change, civil war, inappropriate economic policies and lack of accountability. Export of oil and the surge of oil prices added Sudan to the list countries with abundant resources and low growth. The low performance of industries should be improved since the manufacturing is an important determinant of genuine saving. The ratio of import duty should be kept low in order to help boost genuine saving.

References

- Adrian Boos & Müller Karin Holm (May 2013) the Relationship between the Resource Curse and Genuine Savings: Empirical Evidence *Journal of Sustainable Development*; Vol. 6, No. 6; 201
- Adrian Boos (2011) the relationship between the Resource Curse and Genuine Savings: Empirical Evidence, EAAE PhD Workshop, Nitra Slovak Republic, April 27-29
- Anne Hong, A.B. (2009) Examining Sachs and Warner's Model of Natural Resource Curse: Implication and Lessons for Natural Resource-Rich Countries Master of Public Policy in the Georgetown Public Policy Institute
- Arabi, K. A. M. & Abdalla, S. Z. S. (2014) Is there evidence of a J-curve for the Sudanese trade data?. *International Journal of Social Sciences and Entrepreneurship*, 1 (10), 154-167.
- Bahadur Budha Birendra (Dec 2012) A Multivariate Analysis of Savings, Investment and Growth in Nepal Munich Personal RePEc Archive
- Brown R.C. , J. Asafu-Adjaye J, M. Draca M, & Straton A (2003) How Useful is the Genuine Saving Rate as A Macroeconomic Sustainability Indicator for Countries and Regions? *School of Economics ISSN 1446-5523, Discussion Paper No 33*
- Emmanuel Ogoe (August 2009) an Econometric Analysis of the Causal Relationship between Gross Domestic Savings and Economic Growth in Ghana (1961-2008) MSc Economics Kwame Nkrumah University of Science and Technology
- Eric Neumayer (2004) Sustainability and Well-being Indicators. Research Paper No. 23 United Nations University
- Grace T. R. LIN and Chris HOPE (2004) Genuine Saving and its Measurement Application to the United Kingdom and Taiwan the *Development Economics* XL11-3-41
- Gylfason T. (2007) *International Economics of Natural Resources and Growth, Minerals, and Energy* 22, 1004 - 1049
- Jaafar Awadalla (Sep 2001) Sudan Adjustment to Climate Change National Forest Kirk Hamilton (2012) *Environment and Development Economics* 17: 356–361 © Cambridge University Press doi: 10.1017/S1355770X12000125
- Ibrahim A. Elbadawi and Francis M Mwega (Sep 1998) Can Africa's Saving Collapse be reverted? World Bank IFO Working Paper No 128 Leibnitz Institute for Economic Research at the University of Munschlin
- IMF (Aug 2012) Macroeconomic Policy Frameworks for Resource-Rich Developing Countries www.imf.org/external/np/pp/.../082412.pdf
- James H. Stock and Mark W. Watson (2001) Vector Autoregression faculty. washington.edu/.../stck_watson_var.pdf
- Jati Sengupta (2011) *Understanding Economic Growth: Modern Theory and Experience* Springer New York
- Jeffrey D. Sachs and Andrew M Warner (1997) Natural Resource Abundance and Economic Growth
- John M. Hartwick (1977) Intergenerational Equity and the Investing of Rents from Exhaustible Resources, *The American Economic Review*, Vol. 67, No. 5 pp. 972-974
- Khalafalla A.M Arabi & Suliman Zakaria Abdalla (2013) "Impact of Human Capital on Economic Growth Empirical Evidence from Sudan" *Research in World Economy RWE* June- 2013
- Khalafalla .A.M (2012) Analyzing Sudanese Economy via Two Gap Model, *Journal of Human Sciences, Academy of Sudan* Issue No 3
- Kirk Hamilton & Clemens, M. (1999) Genuine Savings Rates in Developing Countries, *the World Bank Economic Review*, 13, Issue 2 333-356. <http://dx.doi.org/10.1093/wber/13.2.333>
- Kirk Hamilton (2011) "The Changing Wealth of Nations: Measuring Sustainable Development in New Millennium" World Bank
- Michela Coppla & Bettina Lama (2012)
- Nasir Shahbaz & Mahmood Khalid (2004) Saving – Investment Behavior in Pakistan: An Empirical Investigation
- Norman Loayza, Klaus Schmidt and Hebbel Luis Servin (Sep 1998) What drives saving across the World? *The World Bank Economic Review* Vol. 14, NO. 3: 393–414 Onno Kuik (19/7/2014) "Genuine Saving|" http://www.ivm.vu.nl/en/Images/AT3_tcm53-161574.pdf
- Peter Eigen (2013) Corruption Perception Index Chair of Transparency international
- Piotr Misztal (2011) The Relation between Savings and Economic Growth in Countries with Different Levels of Economic Development Ministry of Science and Higher Education eFinanse Financial Internet Quality *Financial Internet Quarterly „ e-Finanse"* 2011, vol. 7, No. 2 pp 17-29
- Robert M. Solow (May, 1974) "The American Economic Review" Vol. 64, No. 2,

Ruey Tsay (2002) Analysis of Financial Time Series John Wiley & Sons

<http://dx.doi.org/10.1002/0471264105>

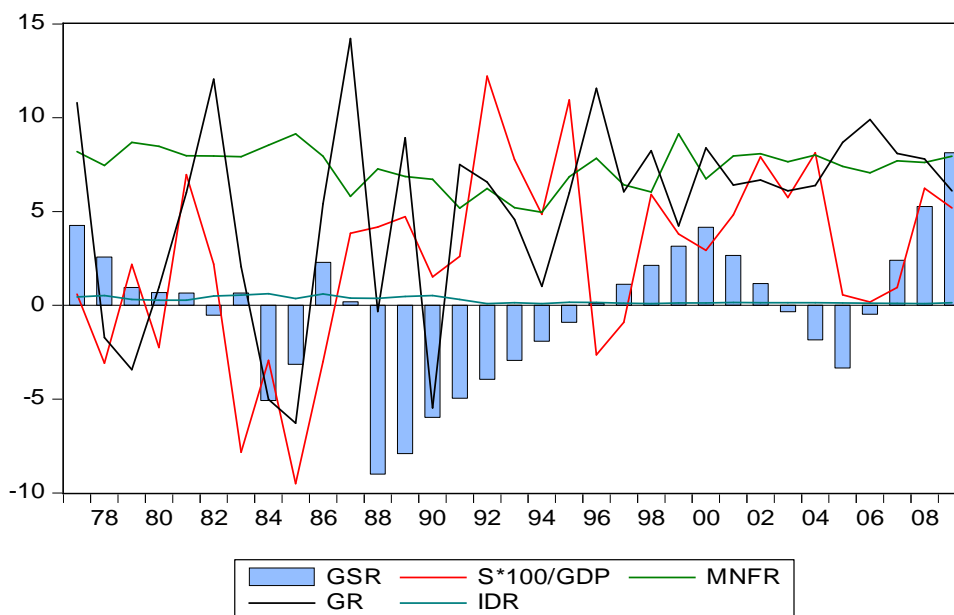
Salih Mustafa Ahmed Mualley (2011) Determinants of Savings: Empirical Evidence from African Countries, 1990-1999. Researcher Journal No. 9 pp 21-30

Simon Dietz and Eric Neumayer (2005) A critical appraisal of Genuine Savings as an Indicator of Sustainability London School of Economics 117 - 137

Stefan Arent (2012) Expectations and Saving Behavior: An Empirical Analysis

Swapan Dasgupta and Tapan Mitra (2002) Intertemporal Equity and Hartwick's Rule in Exhaustible Resource Model, CAE Working Paper 02-05 Annex

Figure (1)



P Table (4) Pairwise Granger Causality Tests

Date: 11/04/14 Time: 10:13

Sample: 1977 2014

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
MNFR does not Granger Cause GSR	32	3.21415	0.0560
GSR does not Granger Cause MNFR		6.11573	0.0064
IDR does not Granger Cause GSR	31	2.76468	0.0815
GSR does not Granger Cause IDR		0.03025	0.9702
GR does not Granger Cause GSR	32	1.14032	0.3346
GSR does not Granger Cause GR		0.46997	0.6300
IDR does not Granger Cause MNFR	33	0.12865	0.8798
MNFR does not Granger Cause IDR		1.33220	0.2801
GR does not Granger Cause MNFR	34	0.13969	0.8702
MNFR does not Granger Cause GR		0.38371	0.6847
GR does not Granger Cause IDR	33	0.12086	0.8866
IDR does not Granger Cause GR		6.32669	0.0054

Table (5) Cointegration Results

Date: 11/04/14 Time: 09:47
 Sample (adjusted): 1979 2009
 Included observations: 31 after adjustments
 Trend assumption: Linear deterministic trend
 Series: GSR MNFR IDR GR
 Lags interval (in first differences): 1 to 1
 Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.667698	71.21627	47.85613	0.0001
At most 1 *	0.596329	37.06320	29.79707	0.0061
At most 2	0.174140	8.941429	15.49471	0.3708
At most 3	0.092537	3.010180	3.841466	0.0827

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Table (6) Vector Autoregression Estimates

Date: 11/04/14 Time: 10:31
 Sample (adjusted): 1978 2009
 Included observations: 32 after adjustments
 Standard errors in () & t-statistics in []

	GSR	MNFR	IDR	GR
GSR(-1)	0.706392 (0.12240) [5.77134]	0.027463 (0.06547) [0.41950]	-0.116365 (0.59611) [-0.19521]	-0.200111 (0.25779) [-0.77626]
MNFR(-1)	0.405150 (0.12595) [3.21673]	0.955984 (0.06737) [14.1908]	0.767525 (0.61343) [1.25121]	1.134714 (0.26528) [4.27749]
IDR(-1)	-0.081470 (0.02542) [-3.20446]	0.002430 (0.01360) [0.17868]	0.752825 (0.12382) [6.07982]	-0.149215 (0.05355) [-2.78660]
GR(-1)	-0.163980 (0.07810) [-2.09954]	0.040706 (0.04177) [0.97442]	0.054744 (0.38039) [0.14392]	0.052293 (0.16450) [0.31789]
R-squared	0.672890	-0.067676	0.654119	0.221366
Adj. R-squared	0.637843	-0.182070	0.617061	0.137941
Sum sq. resids	141.3554	40.43874	3352.989	627.0508
S.E. equation	2.246866	1.201766	10.94302	4.732301
F-statistic	19.19941	-0.591604	17.65091	2.653474
Log likelihood	-69.17470	-49.15087	-119.8360	-93.01070
Akaike AIC	4.573419	3.321929	7.739749	6.063169
Schwarz SC	4.756636	3.505146	7.922966	6.246386
Mean dependent	-0.437031	7.340295	25.75014	4.756952
S.D. dependent	3.733608	1.105346	17.68365	5.096874
Determinant resid covariance (dof adj.)		17738.51		
Determinant resid covariance		10397.99		
Log likelihood		-329.6140		
Akaike information criterion		21.60088		
Schwarz criterion		22.33374		

Table (7) AR Residual Serial Correlation LM Tests

Null Hypothesis: no serial correlation at lag order h

Date: 11/04/14 Time: 10:14

Sample: 1977 2014

Included observations: 32

Lags	LM-Stat	Prob
1	24.69831	0.0753
2	19.77635	0.2305
3	43.15639	0.0003
4	9.055977	0.9111
5	33.60093	0.0061
6	23.57634	0.0992
7	14.55049	0.5578
8	14.50337	0.5613
9	13.23972	0.6552
10	11.43543	0.7818
11	11.62066	0.7697
12	8.604354	0.9288

Probs from chi-square with 16 df.

Table (8) VAR Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)

Date: 11/04/14 Time: 10:16

Sample: 1977 2014

Included observations: 32

Joint test:					
Chi-sq	df	Prob.			
100.7439	80	0.0584			
Individual components:					
Dependent	R-squared	F(8,23)	Prob.	Chi-sq(8)	Prob.
res1*res1	0.356500	1.592754	0.1816	11.40800	0.1796
res2*res2	0.422439	2.102828	0.0781	13.51804	0.0952
res3*res3	0.431115	2.178745	0.0689	13.79568	0.0872
res4*res4	0.571120	3.828509	0.0054	18.27584	0.0193
res2*res1	0.226393	0.841358	0.5767	7.244583	0.5105
res3*res1	0.294878	1.202310	0.3406	9.436103	0.3069
res3*res2	0.097101	0.309187	0.9547	3.107225	0.9274
res4*res1	0.417178	2.057897	0.0841	13.34970	0.1004
res4*res2	0.622552	4.741945	0.0016	19.92167	0.0106
res4*res3	0.224723	0.833352	0.5829	7.191139	0.5162

Figure (2): Variance Decomposition

