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Sudanese Economy Performance Analysis According to Keynesian Multiplier (1977-2016)

Yousif Monaha

Assist. Professor of Administration and Economy, Community College, Najran University, KSA

ABSTRACT: *The present study is an attempt to analyze the performance of Sudanese Economy based on Keynesian Multiplier, and to identify the effect of this Multiplier and the procedures and actions adopted by Sudanese Government to increase the value of the Multiplier. The study utilized the descriptive method, Econometrics and EViews software. The data of the study is the time series (1977-2016) collected from Central Bureau of Statistics, Sudan. Stationarity of the data examined depending on Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) unit roots tests, as well as Johansen test to identify variables co-integration. It found that variables are co-integrated in the long run. The multiplier value calculated for each year, its mean value (0.52). Using Ordinary Least Squares (OLS) method, R^2 for Goss Domestic Product (GDP) equation (0.98) indicates that dependent variable affected by (98%) of independent variables. The variables of lag consumption, lag investment and lag government expenditure are significant at the standard error of 10%. However, the variable of lag trade payment deficit has no significant impact, may be because of recession and fluctuation in the pattern of international demand. All parameters are consistent with the economic theory, but the small size of parameters indicates to the insignificant impact of independent variables on GDP decisions. The study findings show that average value of the multiplier is (0.52190). It indicates that the more the aggregate demand increased by 100 Unit, the more the GDP increased by 52 Unit. It is a minor impact on Sudanese economy. This result is consistent with Hasan, Kawaz and Salah studies which conclude that the multiplier does not work in developing countries, however; its impact is transmitted to foreign countries through importation. It is confirmed by high MPT. The study concludes that the Keynesian multiplier (K) has an insignificant impact on Sudanese economy. Moreover, the feature of multiplier as a not-working concept in developing countries is entirety applicable on Sudanese economy. The Sudanese economy characterized by immaturity and does not comply with the operative economic theory as a result of instability, lack of free competition conditions, insignificant production mechanism and also, it cannot be controlled by supply and demand. However, Sudan can improve its production increase, economic activity level and total economic balance through intervention in economics and creating new exports to increase its investment spending. The study recommends establishing and developing an industrial base to encourage exports and constrain imports. In addition, encouraging investment and contribution to the GDP and elevating the efficiency of production mechanism. And finally, finding the appropriate mechanisms for the application of the principle of competitiveness and developing and activating the helpful plans to reduce trade payment deficit.*

KEYWORDS: Sudanese Economy Performance, Keynesian Multiplier

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INTRODUCTION

The Keynesian theory is one of the first comprehensive and integrated macroeconomic theories aimed at identifying the level of income, production and cash economy. (Abdel Moneim & Nazar, 2004) It focuses on the concept of aggregate demand and its importance in achieving economic growth. Economy expands by increasing public demand through increase in sales and services spending and consumption which increases demand for employment and business. Accordingly, recession is a result of decrease in the aggregate demand reducing production and national output. Thus, the government shall increase consumption through monetary Policy and tax. (Al-Kawaz, 2011) Because of his theories and contributions in macroeconomics, John Maynard Keynes is considered to be one of the most prominent economists. During the great depression (1936), he proposed his theory and new concepts in his book, "The General Theory of Employment, Interest and Money". He contrasted his approach to classical economics, as he proves the invalidity of many of its concepts and inability to interpret the recession of 1929. (Edgman, 1988). Keynesian Economics or Keynesianism is a new revolutionary school of Economics. It developed new concepts about the effectiveness of aggregate demand, consumption, and interest rates on Economy. (Mustafa, et.al, 2000). The study aims at exploring the concept of "Keynesian Multiplier" which many countries adopt as its economic policy to stimulate economic growth and create employment opportunities.

Keynesian Multiplier (K):

Income increase does not result in equal spending increase, any change in government spending and investments allows a further change in total production. Keynesian multiplier means that the final output resulting from government spending and investment is a multiple of their total (Albermani, 2008). The Keynesian multiplier is the consequence of economic variable in response to factor change (Mahdi, 2008). On the other hand, the assumptions of Keynesian multiplier do not work in developing countries in spite of the increase in marginal propensity to consume (MPC). The inability of the productive sector or non-availability of industrial base prevents the expansion of production in response to the new demand, resulting in increasing prices. (Khaled & Ahmad, 1999)

Multiplier importance:

The multiplier enables decision makers to identify the future of the economic situation and policy development.

Multiplier Work in Developing Countries:

It is noted that, the assumptions of Keynesian multiplier do not work in developing countries in spite of the increase in MPC. The inability of the productive sector or non-availability of industrial base prevents the expansion of production in response to the new demand, resulting in

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increasing prices. Moreover, under-developing countries begin to import more goods to meet the aggregate demand, resulting in the working of multiplier in foreign countries.

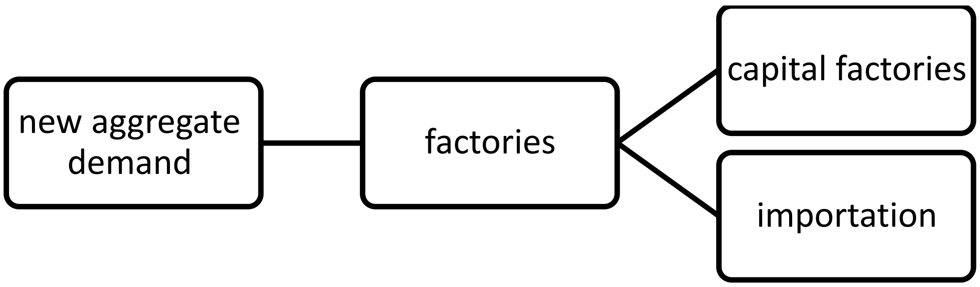

Figure (1) illustrates the industrial ability of developed and under-developed countries.
Source: prepared by the researcher.

Figure (1) shows that, in the case of developed countries, the new aggregate demand directed to factories which in turn require machines and raw materials from capital factories, thus expansion in capital factories happens. In under-developed countries, the new aggregate demand directed to factories which ask for raw materials from capital factories, which in turn incapable of expansion and demand directed to importation.

Statement of the Problem:
The problem of the study is the scarcity or lack of surplus directed to investments in Sudan and the dependence of Sudanese economy on importation.

Study Questions:

1. Does Keynesian multiplier affect the performance of the Sudanese economy?
2. Can Keynesian multiplier work in developing economies?
3. Is the state able to maintain the level of economic activity and macroeconomic equilibrium through intervention in economics?

Hypotheses:
The study assumes the following:

1. The effect of Keynesian Multiplier on the performance of the Sudanese economy is insignificant.
2. Aggregate demand components have not a significant positive impact on GDP.
3. The state can maintain the level of economic activity and macroeconomic equilibrium through its intervention in economics.
4.

Study Objectives:
The study aimed to analyze the performance of the Sudanese economy using Keynesian theory and the effect of the Keynesian multiplier.

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METHODOLOGY

The study adopts the descriptive approach, econometrics and EViews software. It depends on scientific sources, references, books and papers that dealt with the subject.

Collecting Data:

Data collected according to the time series (1977-2016) obtained from the Central Bureau of Statistics, Sudan as represented in available income, national output, consumption, investment, exports and imports at current prices. They are converted to fixed values by standard consumer price. Moreover, the exchange rate utilized to convert the price of imports. The data used to identify the size of the multiplier and then to calculate the national income equilibrium.

Time limitation: the time series (1977-2016).

Spatial limitation: Sudan.

Previous Studies:

Many previous studies have dealt with the same subject from different perspectives. Hassan (1960) assumes that in developing countries the elasticity of GDP reduced for investment, because any increase in the investment does not result in increasing output. Thus, the multiplier does not work in developing countries, but its effect is transmitted to the developed countries through importation. Mehdi (2008) aimed to measure and analyze the effectiveness of multiplier and accelerator on Iraqi economy, supposing recession of the Iraqi economy. The study concluded that general income value reduction reflects the transfer of the impact of Multiplier to foreign countries through importation. In addition, the reduced differences between the values reflect the relative stability of the productive structure and insignificance of the dynamic state of the productive structure of the various sectors. Syed, et.al (2011) aimed to identify the effect of Keynesian multiplier on Pakistani economy. They proposed a method to enable the government increasing the value of the multiplier which positively affects the national income. Al-Kawaz (2011) suggested that the Keynesian theory has a limited effect in solving the problems of developing countries, since it is related to short run, while the problems of these countries related to long run.

Theoretical framework

The concept of Multiplier came from the notion of MPC. It indicates to the consequences of the economic variable in response to factor change. The concept developed by the economist R. F. Kahn in his article, *The Relation of Home Investment to Unemployment*, published in 1931. He investigates the relation between increase in investment and increase in full employment. In other

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words, increase in investment leads to multiplying full employment. (Ma'touq, 1989). Depending on the concept developed by Kahn, Keynes studied the effect of investment on total income. He concluded that initial increase in investment leads to multiplying the national income $\Delta Y = k\Delta I$. The relation between change in investment and change in total income shown as follows (1):

$Y = C + I$

$C = \alpha_0 + \alpha_1 Y_d$

$Y_d = Y$

$\Delta C = \alpha_1 \Delta Y$

$\Delta Y = \Delta C + \Delta I$

$\Delta Y = \alpha_1 \Delta Y + \Delta I$

$\Delta Y - \alpha_1 \Delta Y = \Delta I$

$\Delta Y(1 - \alpha_1) = \Delta I$

Equation [1] indicates that K equals one by one minus MPC.

$$K = \frac{\Delta Y}{\Delta I} = \frac{1}{1 - \alpha_1} \dots . [1]$$

Since the total of MPC and MPS equals one (MPC + MPS = 1), it can be said that the Multiplier equals inverted MPS $K = \frac{1}{MpS}$. Then, the multiplier equals one if the MPC equals zero. Multiplier equals ∞ if the MPC equals one, i.e. the value of the multiplier confined between $(I(K(\infty)$.

By the above mentioned formula, the multiplier can be calculated in case the economy consisted of two sectors. If the public sector added, the income changes by the change in investment, government spending and taxes.

Tax Multiplier:

Tax Multiplier is income change in response to tax change by one unit. The tax can be fixed, relative or dual. Fixed tax multiplier calculated as follows (6):

$$\Delta Y = -\frac{b\Delta T}{1 - b}$$

$$\frac{\Delta Y}{\Delta T} = -\frac{b}{1 - b\,(1 - t)}$$

This means that the more the tax rises, the more the income reduced by the multiplier and vice versa. The relative tax multiplier is less than the fixed tax multiplier and calculated as follows:

$$\frac{\Delta Y}{\Delta T} = -\frac{b}{1 - b\,(1 - t)}$$

Government Expenditure Multiplier

Government spending Multiplier is the multiplied change in income in response to changes in government spending by one unit, its value equals investment Multiplier:

$$\Delta Y = \frac{1}{1 - b}\,\Delta G$$

$$\frac{\Delta Y}{\Delta G} = \frac{1}{1 - b}$$

This means that whenever the government spending changed by one unit, the income changed by the multiplier in the same direction.

Foreign Trade Multiplier

Foreign trade multiplier is the initial change in exports (or imports) resulting in multiplied increase (or multiplied decrease) in income. Foreign trade multiplier can be measured by the change in the national income and the change in exports (or imports). There are various factors responsible for initial changes in exports (or imports) including: change in consumers taste, the conditions of production, transportation expenses or trade policy.

Multiplier affected by MPS, MPT and MPM, it can be derived as follows:

$$Y = C + I + G + X - M$$

$$Y = \alpha + b(Y - T_0 - tY) + I + G + X - m_0 - m_1 Y$$

$$Y - bY + tY + m_1 Y = \alpha - T_0 + I + G + X - m_0$$

$$Y(1 - b + t + m_1) = \alpha - T_0 + I + G + X - m_0$$

$$Y = \frac{1}{1 - b + t + m_1} * \alpha - T_0 + I + G + X - m_0$$

$$K = \frac{1}{MPS + MPT + MPM}$$

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In existence of the outside world, the value of the multiplier is lower than the case of a closed economy by marginal propensity to import.

Study Procedures:

The Model:

Keynes model identifies income equilibrium on the level of two, three and four sectors. Based on the Keynesian model in the case of four sectors (Zine, 1999 & Syed et.al (2011) and the characteristics of Sudanese economy, the model of the study is developed according to the following formula:

$$Y = \alpha_0 + \alpha_1 CT_{t-1} + \alpha_2 I_{t-1} + \alpha_3 G_{t-1} \alpha_4 TB_{t-1} + u_1 \qquad [2]$$

Where:
Y: real GDP,

CT_{t-1}: lag consumer spending,

I_{t-1}: lag total investment,

G_{t-1}: lag government spending,

TB_{t}-1: lag trade payment.

Equation [2] is a behavioral equation describing the behavior of real GDP based on external variables

Model variables:

$$Y = f(CT_{t-1}, I_{t-1}, G_{t-1}, TB_{t-1})$$

Internal variables:

Where;

Y: Real GDP, the total sum of goods and services fully produced during the year. It called domestic production in case of excluding capital depreciation, and domestic income when evaluated with cash.

External variables:

CT_{t-1}: Consumption, the lag spending of individuals on goods and services.

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I_{t-1}: Real investment, the lag increase in fixed capital.

G_{t-1}: Government spending, the lag spending of a state on goods and services.

TB_{t-1}: trade payment, it measures the total difference between exports and imports of goods and services in a state.

Mathematical Formation:

In order to identify the best form for the model, the following formulas have been examined:

Linear formula:

$$Y = \alpha_0 + \alpha_1 CT_{t-1} + \alpha_2 I_{t-1} + \alpha_3 G_{t-1} \alpha_4 TB_{t-1} + u_1 \qquad [3]$$

Non-linear formula:

$$Y = e^{\alpha_0 + \alpha_1 CT_{t-1} + \alpha_2 I_{t-1} + \alpha_3 G_{t-1} \alpha_4 TB_{t-1} + \alpha_{t-1} u_1} \qquad [4]$$

This can be converted to a linear formula as follows:

$$Log\ (Y) = \alpha_0 + \alpha_1 CT_{t-1} + \alpha_2 I_{t-1} + \alpha_3 G_{t-1} \alpha_4 TB_{t-1} + u_1 \qquad [5]$$

Exponential formula:

$$Y = a_0 * CT_{T-1}\, a^1 * I_{t-1}\, a^2 * G_{t-1} a^3 TB_{t-1}\, a^4 * e^{u1}$$

Converted to a linear formula by algorism as follows:

$$\ln(Y) = In\ a_0 + a_1 \ln(CT_{t-1}) + a_2 \ln(I_{t-1}) + a_3 \ln(G_{t-1}) + a_4 \ln(\ TB_{t-1}) + u_1$$

1. **Identifying expected signs of parameters:**

Expectations for the signs and the values of function parameters on which the given estimations for the parameters of the model can be evaluated. According to the economic theory, the signs of parameters are as follows:

a_0 : The previous year difference (domestic product in the current year is bigger than the same of the previous year (expected to take positive sign $a_0 < 0$.

a_1: Lag consumer spending coefficient, the domestic product increased by the increase in the real consumer spending, expected to take positive sign $a_1 > 0$.

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a_2: lag investment coefficient, the gross domestic increased by the increase in the real investment, expected to take a positive sign $a_2 < 0$.

a_3: Lag government spending coefficient, the gross domestic increased by the increase in the government spending, is expected to take a positive sign $a_3 > 0$.

a_4: lag trade payment coefficient, the gross domestic product increased by the increase in the real net exports, expected to take a positive sign $a_4 > 0$.

Table (1)

It shows the data of the study consisted of the time series (1977-2016)

year	CPI	GDP	G	C	i	E	Im	Ex	Yd	Tax	TB
1977	0.002	.6375	0.159	.4005	.0896	.1234	0.135	0.003	.5938	18.5	-4230
1978	0.002	.752	.141	.5433	.0761	.1258	.1342	0.003	0.702	25.8	1196.5
1979	.002	.8968	.1655	.611	.1052	.1513	.1362	0.003	.8307	25.8	-11,392.5
1980	0.003	1.2462	.1805	0.846	.2293	.1671	.1767	0.003	1.1304	25.8	-25,002.3
1981	0.004	1.5108	.2078	1.1707	.265	.1835	.3162	0.003	1.3705	43.3	-45,932.5
1982	0.004	1.8481	0.236	1.3407	.4275	.2064	.3625	0.003	1.6721	43.3	-32,596.3
1983	0.004	2.3396	.2783	1.827	.3997	.2301	.3955	0.003	2.1197	51.6	-29 489
1984	0.005	2.8826	.3307	2.3794	.4137	.2182	.4594	0.004	2.6174	59.3	-29,128.2
1985	0.005	3.2539	.407	2.6058	.4314	.2569	.4472	0.005	3.0838	87.8	-43 866
1986	0.009	3.972	.5009	3.481	0.379	.3946	.7835	0.005	3.8929	117.9	-62,143.8
1987	0.011	4.9507	.6482	4.5046	.2413	.5544	.9978	0.009	4.8079	141.3	-58,081.6
1988	0.014	7.0401	.7587	5.6993	1.606599	.6849	1.7094	0.013	6.6119	209.3	-75,925.9

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1989	0.018	9.5919	.8799	8.566	1.5303	.9675	2.3518	0.013	8.695	272.8	-58,445.5
1990	0.024	11.8074	1.1478	9.9257	1.627	1.3002	2.1933	0.025	10.7279	301.9	-36,129.2
1991	0.035	15.3572	1.474	14.4729	.6931	0.9974	2.2802	0.025	14.4874	319.9	-43,704.2
1992	0.045	20.2181	1.8081	17.5545	2.403	1.1722	2.7197	0.025	18.7577	469.6	-16,028.4
1993	0.055	36.4798	2.0352	30.5172	4.7283	1.4931	2.294	0.045	33.9524	654.4	-20,485.9
1994	0.081	46.7911	3.5746	37.915	7.1626	2.4332	4.2943	0.045	43.4402	922.7	-31,839.3
1995	.142	82.562	5.4282	68.7891	11.0004	3.4222	0.078402	0.045	78.1209	1685.7	-15,281.5
1996	0.235	10.1107	0.781999	93.4503	10.266	4.6578	6.0462	0.045	102.8961	2809.5	-6,229.76
1997	.516	92.6605	0.471299	164.6981	25.8889	2.5484	0.946202	0.045	179.1872	6859.5	-16,416.3
1998	1.324	421.818	43.8824	318.882	73.0523	15.832	29.8307	0.1	414.2706	6859.5	-56 460
1999	3.726	9948.448	55.736	781.007	187.96	42.34	118.595	.1328	910.456	4164.3	-383.197
2000	7.992	881.289	102.544	1557.825	426.439	90.189	95.7081	.216	1751.573	8344.4	-321.589
2001	13:15	1049.739	255.76	3170.933	894.0459	53.9584	24.9584	0.4	8870.076	6607.7	-203.636
2002	27.59	10478.14	70.5139	9119826	1409.082	577.396	398.681	1.2464	9613.9	20009.5	-285.264
2003	40.96	16137.37	912.59	14404.05	2842.937	813.128	835.337	1.5765	15170.6	32972.9	-439.664
2004	48.61	21935.91	041.255	18646.99	5751.375	029.534	533.249	1.9945	20982.9	45793.9	-629.53
2005	57.8	27058.81	128.014	23792.74	4424.508	022.913	4309.36	2.516	25948.4	5232.39	-359.433
2006	62.28	33770.6	1845.12	29054.32	3887.617	4902.73	919.214	2.5714	29813.9	8138.97	99.68112
2007	65.03	40658.6	2615.1	32625.5	6787.474	417.068	786.578	2.587	37203	12196.25	-32.0406
2008	69.51	47756.1	2915.6	37466.7	10426.39	369.986	422.574	2.6334	44158.1	14172.29	-69.3949
2009	73.85	55733.8	3334	45466.4	9880.14	5703.19	750.923	2.6082	51106.1	17231.79	-101.537

2010	80.89	68721.4	5862.3	53190.2	13069.63	868.953	2006.71	2.5826	63381.1	21338.8	-110.044
2011	87.84	85707.1	7916.9	65,566	16756.35	2028.44	0989.85	2.4358	78390.3	95100	-685.295
2012	94.16	98291.9	606.505	74271.1	25275.87	2718.39	3579.91	2.1715	89257.4	9512.39	-768.566
2013	100	119,837.3	9635.2	81253.4	27235.39	8664.78	3606.57	2.0159	106 271	10970	-122.514
2014	114.3	135,511.7	10810.8	96434.2	27900.23	5422.04	25034.6	2.0913	110,860.9	88527.46 *	-109.114
2015	127.2	141 010	12106.9	105,797.9	29845.1	19119.5	5859.41	2.2217	126 354.6	9669.95 *	-141.756
2016	143.7	162,203.9	13532.4	115,152.4	39191.4	20,758	26430.3	2.3051	153 539	23055.8 *	-100.549

Source: reports from the Central Bureau of Statistics and Sudanese Bank 2016.

Time Series Stationarity Test

The stationarity of the time series (1977-2016) of the model checked separately and then the full series is checked using the following tests:

1- Unit Roots Test:

Based on null hypothesis that the time series is non-stationarity, ADF and PP tests conducted in case of constrain only or constrain and trend. The lag determined according to standard Schwartz Info Criterion for ADF test and three lags by Newey-West Criterion for PP Test. The test values compared to the corresponding critical values for 5% as follows:

- **ADF Test**

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Table (2): ADF Test

variable	test value constrain	test value Constrain and trend	Stationarity Level
Y	-3.610894	-3.799042	First
CT t-1	-2.936230	-2.938449	First
I t-1	*	-4.279773	First
G t-1	-3.705890	-4.106836	First
Tb t-1	-5.718231	-5.819920	First

Source: Prepared by the researcher through analyzing the data of Table (1).

Table (2) indicates that all the Stationarity of variables occurs at the first difference.

- **PP test**

Table (3): PP test

variable	test value constrain	test value Constrain and trend	Stationarity Level
Y	-5.216941	-5.271489	First
CT t-1	-5.654628	-5.595281	First
I t-1	8.473113	5.069793	level
G t-1	-6.577165	-7.183556	First
Tb t-1	-8.058001	-8.135955	First

Source: Prepared by the researcher through analyzing the data of Table (1).

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Table (3) shows that all variables inhabited at the first difference, except the variable of investment which inhabited at the level. Through these findings, ADF results can be approved on which the co-integration test can be conducted.

2- Co-Integration Analysis

Johansen test used to test the stationarity of all the variables together in the long turn. Table (4) shows the results of the test.

Table (4): Johansen test

Eigenvalue	Likelihood Ratio	5Percent Critical Value	Percent Critical Value	Hypothesized No.of CE (s)
0.368232	48.42793	47.21	54.46	None *
0.340423	30.51782	29.68	35.65	At most 1 *
0.249422	14.28770	15:41	20:04	At most 2
0.07636 6	3.098147	3.76	6.65	At most 3

*(**) Denotes rejection of the hypothesis at 5% (1%) significance level.
L.R. test indicates 2 co-integrating equation (s) at 5% significance level.

Source: Prepared by the researcher through analyzing the data of Table (1).

Table (3) displays the results of trace and maximum of Johansen test. It is noted that the null hypothesis has no trend for co-integration at 5% significance level. The value calculated to test the likelihood ratio in the second column (48.42793) is more than the critical value (0.368232) in the first column at 1% significance level. Therefore, we reject the null hypothesis that there is no trend for co-integration and accept the alternative hypothesis that there is a single trend for co-integration. The value calculated to test the likelihood ratio in the second column (30.51782) is more than the critical value (0.340423) in the first column at (5% & 1%) significance level. Therefore, we reject the null hypothesis that there is no trend for co-integration and accept the alternative hypothesis that there is more than one trend (two trends) for co-integration. We conclude from these results that there is a balance between variables in the long run, i.e. they are not go far away from each other. Since the variables are co-integrated, the equation is estimated using original variables.

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Calculating Multiplier

Depending on Zind model (1999), the multiplier of four-sector economy calculated by modifying the model as the data estimated for the time series (1977-2016). In four-sector economy, the aggregate demand is determined by: consumption, investment, government spending and the trade payment, according to the following formulas:

$$E = Y = C + I + G + X - M$$

$$C = a_0 + a_1 Y_d$$

$$I = a_2 - a_3 Y$$

$$T = a_4 + a_4 Y$$

$$G = G_0$$

$$X = X_0$$

$$IM = a_6 + a_7 Y$$

$$T = Y - Y_d$$

Whereas,

E: total spending.

Y: National income

C: Total consumption.

I: Total investment.

Y_d : available income.

r: The cost of funding rate .

In this case, the Multiplier can be formulated as follows:

$$K = \frac{1}{MPS + MPT + MPM} \qquad [6]$$

MPS: Marginal propensity to save,

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MPT: Marginal propensity to tax,

MPM: Marginal propensity to imports.

From equation [6], MPS, MPT and MPM calculated by the following formulas:

$$MPS = \frac{\Delta S}{\Delta T}$$

$$MPT = \frac{\Delta T}{\Delta Y}$$

$$MPM = \frac{\Delta IM}{\Delta Y}$$

Table (5)

Multiplier calculation

obs	MPS	MPT	MPM	K
1977	0.42137	0.000115	0.88399	0.766005
1978	0.37176	0.000128	0.85882	0.81254
1979	0.27753	0	0.88103	0.86314
1980	0.31869	0	0.89875	0.821396
1981	0.32114	-0.00046	0.85821	0.848258
1982	0.22511	0	0.72094	1.057027
1983	0.27455	0.000068	0.73847	0.987081
1984	.2191	-0.00092	0.77461	1.007261
1985	0.17456	0.000384	0.80079	1.024869
1986	0.19918	-0.00014	0.86256	0.941978
1987	0.12362	0.00268	0.64494	1.296613
1988	0.09011	0.001288	0.75366	1.183351

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1989	0.19045	0.002115	0.73851	1.074027
1990	0.10695	-0.00071	0.66051	1.304208
1991	0.15937	-0.00034	0.82167	1.019678
1992	0.05758	0.014238	0.79213	1.157477
1993	0.13174	0.000864	0.75787	1.122997
1994	0.16345	-0.00313	0.92314	0.922972
1995	.1897	0.203217	.8348	0.81452
1996	0.16682	-0.00996	0.76768	1.081615
1997	0.15131	-0.04255	0.71325	1.21653
1998	0.14514	0	0.40803	1.807763
1999	0.24403	0.042083	0.06368	2.858834
2000	0.17654	-0.21826	-2.50831	-0.39215
2001	0.17194	-0.02393	-4.8158	-0.21423
2002	.217	0.186614	-3.26151	-0.34991
2003	0.12963	0.913018	-1.9548	-1.09631
2004	0.10741	0.223813	-3.56497	-0.30924
2005	0.14993	-2.40262	-4.03669	-0.159
2006	.1207	0.040168	-2.65865	-0.40036
2007	.1369	0.047889	-3.25887	-0.3253
2008	0.19757	0.031969	-2.57756	-0.42589
2009	0.21546	0.045225	-3.65529	-0.29459
2010	0.18422	0.043288	-3.90251	-0.27211

2011	.226	-0.09377	-5.04793	-0.20343
2012	0.235	0.000033	-7.8317	-0.13164
2013	0.24765	0.015885	-9.35734	-0.10996
2014	0.28736	-0.0066	-9.27052	-0.11124
2015	0.22611	-0.01562	-9.98046	-0.10235
2016	0.22012	0.01333	-9.91369	-0.1033

Source: prepared by the researcher depending on the data of Table (1).

Table (5) shows that most of the multiplier values are less than one, which can be ascribed to sharp economic fluctuations. The value of the Multiplier can be positive or negative depending on the economic situation.

Table No. (6)

The average value of the multiplier

Variable	K
Average value	0.521906

Source: prepared by the researcher

Table (6) indicates that the average value of the multiplier is 0.52190. Thus, when the aggregate demand increased by 100 unit, GDP increased by 52 unit. This result is consistent with Hassan and Mahdi studies that the multiplier does not work in developing countries. However, its impact is transmitted to foreign countries through importation. This result can be observed through the increase in MPM.

Effective elements on the multiplier values include:

- Aggregate demand decrease
- Lack of exports competition.
- Economic blockade policies.
- Recession.

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Parameters Estimation

Linear function is the most suitable mathematical formula for the model. Three criteria are utilized to obtain the estimated parameters: OLS method to identify the significance of the estimated parameters, the economic theory to identify the match between parameters signs and economic theory and econometrics to assure that the model has no measurement problems.

Estimation by OLS Method

Statistical criteria determined by statistics aimed to estimate the significance of the estimated parameters of the model. Among the used criteria:

- **0998607765 R^2 T test**

It measures the estimated explanatory variables of the model which is a statistical number calculated from the sample data. It shows the percentage of the total variation in the approved variable due to changes in the explanatory variables.

From the equation:

Table (7): **R^2 T test**

Equation / testing	Y
R-squared	0.918340
Adjusted R-squared	0.909007

Source: prepared by the researcher by analyzing the data of Table (1) using EViews software

Table (7) indicates R-squared (0.918), thus external variables explain 92% of change in the interior variable and the other (8%) is due to non-included variables. Adjusted R-squared (0.909), thus external variables explain 91% of change in the interior variable and the other (9%) is due to non-included variables.

- **Estimations Significance**

T-Statistic and F-statistic utilized to estimate the significance of independent variables. T-Statistic is applied to check the parameters separately. If the parameter is statically significant, its accompanying variable affects the dependent variable, so it is retained in the model.

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Table (8):T-Statistic

	t-Statistic	Prob.
C	1.888878	.0672
CTt-1	6.466133	0.0000
It-1	2.001210	.0532
Gt-1	1.994073	.0540
TBt-1	1.446189	.1570

Source: prepared by the researcher

Table (8) shows that, all P-values of t-Statistic are significant at standard error 10%. It means that each external variables has a real impact on internal variables. Except for the P-value of trade payment which can be significant at standard error 16 %.

F-statistic applied to estimate the significance of the parameters of the model as a whole. If F-statistic is significant, it means that explanatory variables have a real impact on the dependent variable.

Table No. (9): F-statistic

F-statistic	98.40124
Prob (F-statistic)	0.000000

From table (8), we find that the independent variables have a real impact on the dependent variable.

Estimation by Economic Theory

Estimation according to fixed economic theory (98.26), GDP in the current year is bigger than the output in the previous year, so the estimation is positive.

$$Y = 98.26 + 0.898 * CT_{t-1} + .0067 * I_{t-1} + 1.261 * G_{t-1} + 0.00099 * TB_{t-1} + 0.48AR$$

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The sign of lag consumer spending coefficient is positive. The more lag consumer spending increased, the more domestic product in the current period increased. Positive sign is consistent with the economic theory. The consumer spending multiplier is less than one.

The sign of lag investment coefficient is consistent with the economic theory. The more lag investments increased, the more GDP in the current period increased. Investment Multiplier is less than one. It indicates to the insignificant impact of investment on GDP.

The sign of lag Government spending coefficient is consistent with the economic theory. The more lag government spending increased, the more the GDP in the current period increased. The Government spending multiplier is less than one.

The positive sign of lag trade payment deficit coefficient is consistent with the economic theory. The more the lag trade payment deficit increased, the more the imports increased, and accordingly the output decreased. The multiplier of trade payment deficit is less than one. The small size of parameters refers to the insignificant impact of the factor on the GDP.

Estimation by Econometrics

Econometrics is applied to identify the availability of the wanted characteristics of unbiasedness, consistency and efficiency. If the estimation does not meet econometrics method hypotheses, it loses its wanted characteristics or the statistical standards become invalid. Therefore, the significance of these estimators cannot be determined by these standards.

- **Autocorrelation Problem**

Through estimation, there is no autocorrelation problem in the model. It evidenced by the value of Durbin Watson test (1.60). Also, Breusch–Godfrey test demonstrates the absence of autocorrelation problem in the model, since the P-value of F-statistic (.154), i.e. bigger than 5%.

- **Contrast Difference Problem**

There is no contrast difference problem in the model through Arch test as the P-value for F-statistic is (0.66). The P-value for F-statistic (0.70).

- **Linear Correlation Problem**

Simple linear correlation matrix is utilized for the detection of the problem of linear correlation between the independent variables. As a general rule, there is a sharp linear correlation problem,

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if the value of the correlation coefficient between the two independent variables within the equation is bigger than 0.7.

Correlation Matrix for IS equation

Table (10): Linear correlation between variables

	CTt-1	Gt-1	It-1	TBt-1
CTt-1	1.000000	0.570868	0.850710	0.190413
Gt-1	0.570868	1.000000	0.578609	-0.012260
It-1	0.850710	0.578609	1.000000	0.439362
TBt-1	0.190413	-0.012260	0.439362	1.000000

Source: prepared by the researcher using EViews software.

Table (10) indicates that there is a strong correlation between investment and consumer spending.

Linear correlation between the two variables in the model does not represent a problem, since:

In a linear relation, any independent variable can be replaced by another independent variable, for example the production function can be replaced by machines instead of workers. According to the economic theory, the variables of the model cannot replace each other.

If digital correlation between variables is not supported by the economic theory, it does not represent a multi linear correlation problem and does not have a signification.

If the economic theory concludes that the model should contain independent variables with linear correlation, omitting some of these variables as a solution to the problem of linear correlation leads to descriptive error or descriptive bias.

THE RESULTS

The study concludes that:

1. ADF and PP tests conducted to verify the stationarity of variables. According to ADF test, all the variables stabilized at the first difference. PP test results show the stationarity of all the variables at the first difference, but the variable of

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investment stabilized at its level. Therefore, the results of ADF test can be used to conduct co-integration.

2. As a result of stationarity of all the variables in the first difference, Johansen test to verify the integrity of variables over time. It has been found that there is a balance between variables in the long run. Since the variables are co-integrated, the equation estimated by the original variables.

3. The average value of the multiplier is (0.52190). It indicates that the more the aggregate demand increased by 100 Unit, the more the GDP increased by 52 Unit. It has an insignificant impact on Sudanese economy. This result is consistent with Hasan, Kawaz and Salah studies which conclude that the multiplier does not work in developing countries, however; its impact is transmitted to foreign countries through importation. It is confirmed by high MPT.

4. The model is initially estimated by OLS method to check the data and detect measurement problems. It showed that there are no problems of measurement in the model.

5. The value of the adjusted R-squared (0.909) indicates that 91% of the change in the interior variable explained by external variables and the other (8%) is due to non-included variables.

6. All p-values of T-Statistic are statically significant at standard error of 10% indicating that all the variables have an impact on GDP. However, the p-value of trade payment can be significant at a high standard error (16%), it is consistent with Syed study.

7. Fixed amount (98.26), i.e. GDP in the current year is bigger than the output in the previous year. The more lag consumer spending increased, the more output increased, so its sign is positive.

8. The Sign of the current GDP coefficient is positive and consistent with the economic theory. However, the small size of the multiplier indicates to its insignificant effect. Increase in investments in the previous period results in increase in the economic GDP decisions. This is applicable to all the variables of the model.

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9. The Sign of investment coefficient is compatible with the economic theory.
10. The Sign of trade payment deficit coefficient is consistent with the economic theory. The more the trade payment deficit increased, the more the demand for import increased. Thus, the current domestic product increases to meet the aggregate demand.
11. Table (11) below shows the results of the analysis using the EViews software.

Dependent Variable: (Y)

Dependent Variable: YY

Method: Least Squares

Date: 08/29/12 Time: 02:12

Sample (adjusted): 1977-201 6

Included observations: 40 after adjusting endpoints

Table (11)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	98.26256	52.02166	1.888878	.0672
CT (-1)	0.897657	0.138824	6.466133	0.0000
G (-1)	1.261390	0.630313	2.001210	.0532
I (-1)	0.006677	0.003349	1.994073	.0540
TB (-1)	0.000997	0.000690	1.446189	.1570

R-squared	0.918340	Mean dependent var	572.4607
Adjusted R-squared	0.909007	SD dependent var	250.1266
SE of regression	75.45076	Akaike info criterion	11.60131

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Sum squared resid	199,248.6	Schwarz criterion	11.81242
Log likelihood	-227.0261	F-statistic	98.40124
Durbin-Watson stat	1.604960	Prob (F-statistic)	0.000000

Source: prepared by the researcher to illustrate the results using EViews software.

CONCLUSION

The study concludes that Keynes multiplier (K) has an insignificant effect on Sudanese economy. In addition, the feature of multiplier as a not-working assumption in developing countries is entirety applicable on Sudanese economy. The Sudanese economy characterized by immaturity and does not comply with the operative economic theory as a result of instability, lack of free competition conditions, insignificant production mechanism and it cannot be controlled by supply and demand. However, Sudan can increase its production, economic activity level and total economic balance through intervention in economics and creating new exports to increase its investment spending. The study recommends to establish and develop an industrial base to encourage exports and constrain imports. In addition to encouraging investment and contribution to the GDP and elevating the efficiency of production mechanism. And finally, finding the appropriate mechanisms for the application of the principle of competitiveness and developing and activating the helpful plans to reduce trade payment deficit.

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