

STATISTICAL STUDY ON EXCHANGE RATE AND TRADE BALANCE IN SUDAN (1987-2017)

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ABSTRACT

Sudan belongs to low-income countries and facing several domestic and international economic challenges, major macroeconomic imbalances include: (exchange rate fluctuation, low gross domestic product, and high inflation).

According to Unit Root Test (Augmented Dickey-Fuller) exchange rate and exports are stationary in the second difference, the variable imports stationary in the first difference at ($\alpha = 0.05$). Additionally, there is no cointegration between the variables based on Johansen Co-integration Test.

The causal relationship in the long run between exchange rate and independent variables was detected through the residual correction model (Engel-Grange Method). Moreover, there is no causal relationship between the exchange rate and (exports, imports) at 0.05 significant levels in the short run according to Granger's causality test.

Particularly, the model of simple linear regression indicates there is a weakly positive correlation ($R = 48\%$) between exchange rate and exports. In addition, the fluctuations of 23% from exchange rate due to exports and the value of the correlation ($R = 57\%$) between exchange rate and imports are acceptable positive. Therefore, imports explain (33%) of the changes in exchange rate.

KEYWORDS: *Co- integration, Devaluation, Exports, Imports, Official Exchange Rate, Trade Balance, Sudan Economy*

Article History

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INTRODUCTION

Traditionally, the exchange rate has played a very important role in international trade, especially in such a great open world economy. Many countries pursue a development strategy using the exchange rate as a main intervention, which is called the export-led growth model.

Sudan belongs to low-income countries and facing several domestic and international economic challenges, major macroeconomic imbalances include: (exchange rate fluctuation, low gross domestic product, and high inflation. As well as weak policies, internal conflicts and sanctions imposed by the United States, sanctions and the cutoff of banking correspondence are an impediment to trade, investment and growth. However, lack of progress towards debt relief leads to limited access to formal external financing.

Nevertheless, the impact of changes in the exchange rate on Sudan trade flows is still unclear. Therefore, this paper aims to deal with the question of the effectiveness of exchange rate movements on trade flows. In more details, how trade flows interact to shocks of an exchange rate. These shocks can arise from either administration decisions or market's fluctuations.

The problem of the study is that the relationship between the exchange rate and the trade balance affects the sustainability of economic growth and the stability of foreign trade in Sudan. Most imbalances in the trade balance are due to the instability of exchange rates and other factors, the importance of stability of the trade balance, its relation to economic growth and trade movement. All this encourages the author to study the relationship between the exchange rate and the trade balance in terms of quantity to be described and analyzed using modern statistical methods.

Notably, the data of the variables (exchange rate, exports, and imports) have been collected from annual reports in central bank of Sudan. The study assumes that there is no statistically significant relationship ($\alpha = 0.05$) between the exchange rate and components of the trade balance in Sudan (exports and imports). However, there is no causal relationship between the exchange rate and the trade balance in Sudan. The last hypothesis said that, no long-term relationship between the exchange rate and trade balance in Sudan.

The main objectives of this paper, therefore, aims (a) recognize to study the impact of exchange rate behavior on the trade balance in Sudan, and (b) determines the effectiveness of the exchange rate system in addressing the trade imbalance in Sudan, and (c) identify the most important tests used in the econometric literature to determine causal relationships. The rest of the paper is structured as follows: Section 2, there will have a review of literature. Section 3 will be the theoretical framework, section4 data, and methodology. Section 5 will be the discussion of results and finally in Section 6 will be the conclusion of this study.

LITERATURE REVIEW

There is a wide range of literature focusing on investigating the impact of exchange rate on the trade balance. Most of the evidence provided is in favor of the theory, that is, a depreciation of exchange rate leads to higher exports and positively affect the trade balance (Rasha Sedige, 2013) using the impact of the reduction of the exchange rate on exports and imports and its ability to remedy the deficit in the balance of trade in the short and long term. Meanwhile, the devaluation of the exchange rate increases exports and reduces imports in Sudan during 1970-2010. In 2016 (Sayma and Samera) found that there is no relationship between the exchange rate and the trade balance in Iraq. Therefore, recommended the necessity of carrying out structural reforms that would ensure a balance of the trade balance, the most important of which is to focus on the sectors of agriculture, industry, and oil.

Rubana Hassan& Shampa Chakraborty & Nasrin Sultana & Md. Makhlesur Rahman (2016): The main findings of the study demonstrate that the REER has a significant impact on real export earnings in the long run while it has no effect in the short run. The study shows that appreciation in the REER has a negative impact on real export earnings in Bangladesh. This study has policy implications in designing a monetary framework to influence the REER in other developing economies as well as in Bangladesh.

In 2011 (Idris Ali) examining the impact of the exchange rate in the trade balance during 20016-2011 in Sudan and concluded that there is a negative relationship between the exchange rate and the trade balance in Sudan. In addition, the positive relationship with exports and the negative relationship with imports. The study recommended the need to

reduce imports, to encourage not to link the national currency to one currency and to focus on importing goods that increase the gross product.

It can be seen that there is a lot of studies about the exchange rate and the trade balance, but this paper tries to analyze the impact of exchange rate fluctuation with exports and with imports all at once during the study period. Also, this paper used a long time series data from 1987 until 2017. Moreover, in this period Sudan testified many economic changes in terms of macroeconomic policies as well as changes in monetary and financial policies. However, the gap between the official exchange rate and the parallel market price. Hence, this study aims to be a difference by these evidence.

Theoretical Framework

Trader Performance

The balance of trade is one of the most important items in the balance of payments and the important economic indicators of countries, referring to the production capacity of countries and the level of labor force operation, as well as the nature of the production structure of the country. So the balance of trade performance is calculated from the important issues and necessary to maintain the integrity of the local economy from economic crises. Therefore, achieving balance in the trade performance through several policies, but the most important is the foreign exchange rate policies, which is discussed in this study.

The trade balance represents the net import and export revenues of the country, as export prices are in local currency while import prices are in foreign currency. Notably, the trade balance can be written mathematically in the formula:

$$\text{Trade balance} = \text{Total exports of the country (X)} - \text{Total imports of a country (M)}$$

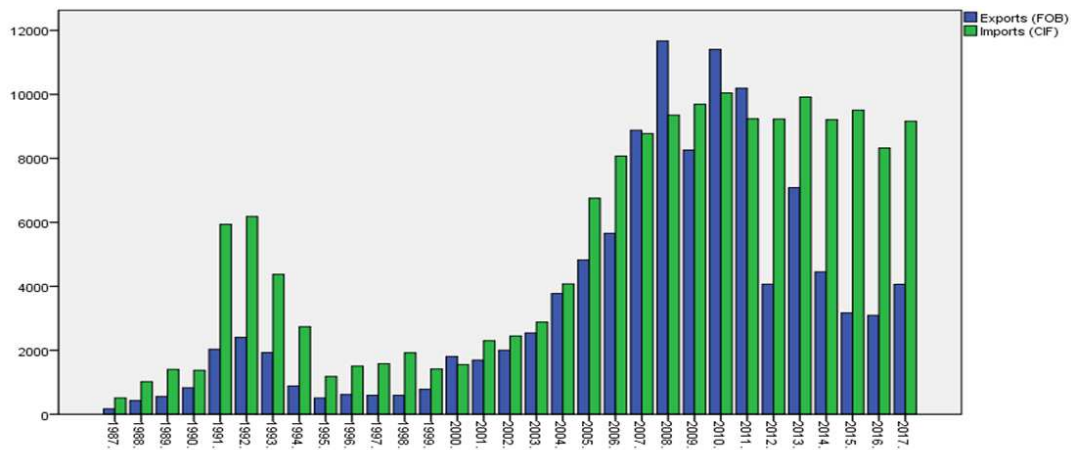


Figure 1: Imports and Exports Performance in Sudan 1987 - 2017

During the period of 1987 – 2017, both exports and imports are decreasing year by year in a Sudan economy except in 2007, 2008, 2010 and 2011 during the signing of peace in southern Sudan and the export of oil and its derivatives, but import volume is usually higher than export volume, resulting in a trade balance deficit, except for the four years from 2007, 2008, 2010 and 2011 when there was a trade balance surplus. Notably, the improvement in trade performance is due to improved export performance, as world oil prices increased during this period.

In 2009, the deficit in the trade balance of Sudan economy returned and the main reason for this was the declining in oil prices globally after the global financial crisis in mid-2008.

The period 2011-2015 witnessed a large trade deficit following the secession of southern Sudan and the regression of oil from the Sudanese export structure. Moreover, large trade deficit status still running down in 2016-2017.

Exchange Rate Regime

The foreign exchange rate is defined as the rate at which one currency is exchanged (Al -Sarbiti, 2009). The exchange rate can also be defined as the number of units of a particular currency to be paid for one unit of another currency (Ltrash, 2007). Meanwhile, it is the value of one unit of foreign currency estimated in national currency units (Hmzawy, 2004).

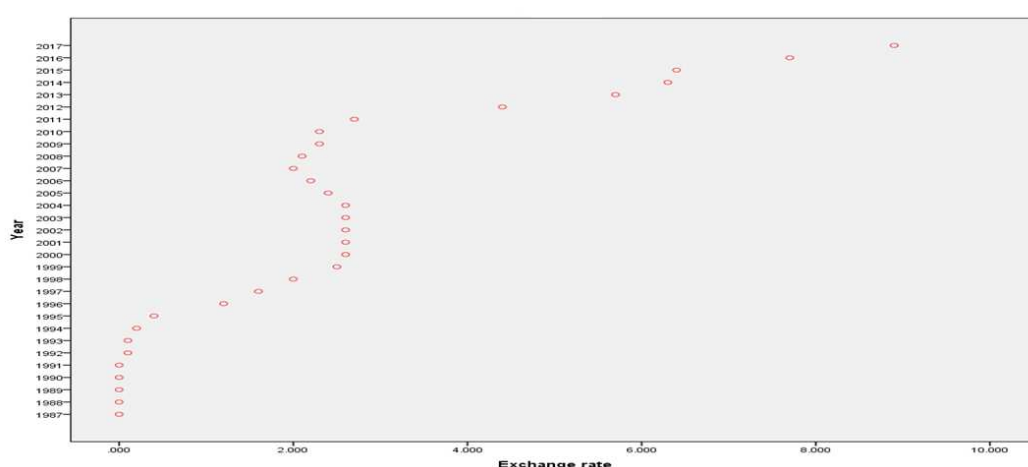


Figure 2: The Exchange Rate in Sudan 1987-2017

During the period 1987-1990, changes in exchange rate policies did not lead to positive results in improving the trade balance in Sudan economy. However, in 1992, the policies of economic reform and structural adjustment were announced in the framework of macroeconomic guidelines or the comprehensive national strategy for the period 1992-2002, which incorporated the guidelines of the economic rescue program 1990-1993. The strategy aimed at addressing the economic structural imbalances and distortions that faced the economy and limited from the start and work to contain the extent of their effects and gradual removal and reverse to positive conditions.

As a result of the declaration of economic liberalization policies in February 1992, the official market system and the free banking market were abolished, instead of establishing a free market to deal with foreign exchange. In addition, the Sudanese pound exchange rate was unified and floating against foreign currencies.

Besides, from figure 2 it can be seen that the exchange rate remained unstable during the period 1993-1999. In 2000, as a result of the large inflows of foreign exchange resources associated with the extraction and exportation of petroleum, the exchange rate witnessed great stability and the foreign exchange market was completely consolidated and there was one exchange rate. This stability continued in 2001-2003 (central bank of Sudan, 2005).

During the period 2008-2013, the global crisis negatively impacted the Sudanese economy through the decline in the global demand for oil, which directly affected the decline in prices and consequently the significant decrease in the

proceeds of oil, which led to the reduction of the ability of the central bank to meet the demand for foreign exchange and imbalance between the available resources and demand for foreign exchange, which led to higher exchange rates in the parallel market.

This status was still continuous till 2017 as can be seen in figure 2. Moreover, there was no any progress in the exchange rate regime in Sudan. Thus, there was no prosperity in the trade performance position.

Data and Methodology

Data

So in order to implement the study, a number of variables are considered, including exchange rate, imports, and exports. Data series are collected from the central bank of Sudan (annual reports) during the period 1987– 2017. The variables imports and exports, expressed in millions of dollars.

Model Specification

The statistical model of the exchange rate and trade balance components can be written as:

$$Ex = f(Imp, Exp) \text{ where:}$$

Ex = official exchange rate in Sudan, Imp = imports in Sudan, Exp = exports in Sudan.

Methodology

This study was followed by a number of approaches. The historical approach was used to describe the developments in the study variables during the period under study. However, the descriptive approach to analyzing and studying developments in study variables. In addition, the econometric methods were used to determine the causal relationship between the variables under study. Therefore, the Granger methodology was used to test causal relationships. In order to analyze the data by (e-views program), the authors are based on the following steps:

- Test the stationary of the time series by the unit root using (Ducky –Fuller Test).
- The test of cointegration through (Johansen Co-integration Test).
- Determine the causal relationship, in the long run, using the error correction model.
- Determine the causal relationship in the short term using the Granger's causality test.

Meanwhile, the authors used (SPSS) program to analyze the linear relationship between exchange rate and trade balance components in Sudan based on regression models.

RESULTS AND DISCUSSIONS

E-Views Results

As a first step, the stationary of time series for the variables was tested to ensure that they are free of the general trend problem by testing the unit root using the augmented Dickey-Fuller test under hypothesis:

$$H_0: \text{the variables have unit root}, H_A: \text{the variables have not unit root}$$

Table 1: Results of Unit Root Test (Augmented Dickey-Fuller)

Variable	ADF Statistics	Critical Value 5%	First Difference		Second Difference	
			ADF Statistics	Critical Value 5%	ADF Statistics	Critical Value 5%
Exchange Rate	-3.36	-3.59	-2.73	-3.57	-5.74	-3.58
Imports	-2.15	-3.57	-3.9	-3.57	-	-
Exports	-2.93	-3.58	-1.86	-3.58	-10.04	-3.58

From table 1, the results show that accepting the null hypothesis which indicates that the variables have a unit root. However, the variables (Ex) and (Exp) are stationary in the second difference, the variable (Imp) stationary in the first difference at ($\alpha = 0.05$).

The second step, it is the test of cointegration through (Johansen Co-integration Test) for the possibility of more than one vector of cointegration where the model contains more than one independent variable. The results can be seen in the following table :

Table 2: Results of Johansen Co-integration Test

Critical Value5%	Trace statistics	Hypothesized No. of CE(s)
29.79	15.03	None
15.49	5.67	At most 1
3.84	1.58	At most 2

From table 2, the trace test indicates no co-integration between the variables at the 0.05 level.

Meanwhile, the third step is important to determine the causal relationship in the long run, using the residual correction model through (Engel-Grange Method), which can be seen as follows:

The causal relationship between (Ex and Exp) to long run:

Table 3: Results of Unit Root Test for Residual

Variable	ADF Statistics for Residual - u	Critical Value 5%	Stationary Level
Ex To Exp	-3.46	-2.96	First difference
Exp To Ex	-6.11		First difference

The results in table 3, explained the residual of the regression equation do not contain unit root which indicates that there is a cointegration between the exchange rate and exports in Sudan economy.

The causal relationship between (Ex and Imp) to long run:

Table 4: Results of Unit Root Test for Residual

Variable	ADF Statistics for Residual - u	Critical Value 5%	Stationary Level
Ex To Imp	-6.83	-3.58	Second difference
Imp To Ex	-7.04		Second difference

The results in table 4, explained the residual of the regression equation do not contain unit root which indicates that there is a cointegration between the exchange rate and imports in Sudan economy. In other words, the two variables are moving together with time.

The last step (step four) coming to determine the causal relationship between the variable in the short term using the Granger's causality test, which can be performed as:

H_0 : There is no causal relationship between Ex and Exp in the short term

H_A : There is a causal relationship between Ex and Exp in the short term

The results can be shown in table 5:

Table 5: Results of Granger's Causality Test Between Ex and Exp

Null hypothesis	Prob.	Comment
Exp does not Granger Cause Ex	0.3475	Accept null hypothesis
Ex does not Granger Cause Exp	0.6639	Accept null hypothesis

The above table indicates there is no causal relationship between exchange rate and exports at the 0.05 level.

On the other hand, the causal relationship between Ex and Imp in the short term can be tested as:

H_0 : There is no causal relationship between Ex and Imp in the short term

H_A : There is a causal relationship between Ex and Imp in the short term

The results can be shown in table 6:

Table 6: Results of Granger's Causality Test Between Ex and Imp

Null hypothesis	Prob.	Comment
Imp does not Granger Cause Ex	0.1250	Accept null hypothesis
Ex does not Granger Cause Imp	0.5681	Accept null hypothesis

From table 6, the results show there is no causal relationship between imports and exchange rate at ($\alpha = 0.05$).

SPSS Results

In this section, the authors need to explain the linear relationship between the exchange rate as dependent variable and exports in Sudan economy using the simple regression method. Notably, we took the natural logarithm of the export variable so that the values of the variables in the model homogeneity. The results are as follow:

Table 7: Simple Regression (Exchange Rate, Log Exports)

Variables	Mean	Std. Deviation	R	R-square	Sig.
Exchange rate	2.46	2.36	0.48	0.23	0.006
Log (exports)	3.33	0.48			

From the above table, we can see that there is a weakly positive correlation (48%) between the exchange rate and exports during the study period. Therefore, experts explain (23%) of the changes in exchange rate. The estimated equation can be written as:

$$Ex = -5.3 + 2.3 \log exp$$

On the other hand, it is important to know if this model represents the relationship between the variables or not. Therefore, we put the hypothesis:

H_0 : The model is not suitable, H_A : The model is suitable

To test these hypotheses, we interesting in the value of (Sig.) which indicates that accepted the alternative hypothesis and we can say that the model is suitable.

Table 8: Simple Regression (Exchange Rate, Log Imports)

Variables	Mean	Std. Deviation	R	R-Square	Sig.
Exchange rate	2.47	2.36	0.57	0.33	0.001
Log (imports)	3.57	0.38			

From table 8, we can see that there is an acceptable positive correlation (57%) between the exchange rate and imports during the study period. Therefore, imports explain (33%) of the changes in the exchange rate. The estimated equation can be written as:

$$Ex = -10.03 + 3.5 \log imp$$

Notably, it is important to know if this model represents the relationship between the variables or not. Therefore, we put the hypothesis:

$$H_0: \text{The model is not suitable}, H_A: \text{The model is suitable}$$

To test these hypotheses, we are interested in the value of (Sig.) which indicates that accepted the alternative hypothesis and we can say that the model is suitable.

CONCLUSIONS AND RECOMMENDATIONS

According to the statistical study, conclude the variables have a unit root. However, the variables exchange rate and exports are stationary in the second difference, the variable imports stationary in the first difference at ($\alpha = 0.05$). In addition, the indicators explain there is no cointegration between the variables. The results show there is a causal relationship in the long run between the exchange rate and the independent variables based on the residual correction model. Moreover, there is no causal relationship between the exchange rate and (exports, imports) in the short term at 0.05 significant levels.

Notably, there is a weakly positive correlation ($R = 48\%$) between the exchange rate and exports during the study period. In addition, the fluctuations of 23% from exchange rate due to exports. Also, there is an acceptable positive correlation ($R = 57\%$) between the exchange rate and imports during the study period. Therefore, imports explain (33%) of the changes in the exchange rate.

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