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# Sensitivity of Exchange Rate against Oil Seeds and Mineral Export Empirical Study from Sudan in the Period 1995 – 2015

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## ABSTRACT

*The study aims at examining the sensitivity of the exchange rate against oil seeds and minerals exports in Sudan during the period 1995-2015, using statistical analytical method via the EViews. The study reached several results that reveal the existence of a long-term relationship among the variables of study, positive effect of both exports of minerals and oil seeds on the exchange rate, in addition to a decrease in the exchange rate in the short term. The error correction terms indicates that two years are needed to correct the imbalance. Finally, the study recommends expanding the production of oilseeds and extraction of minerals, and improves the quality of exports.*

**Keywords:** *Exchange Rate, Minerals, Oil Seeds, Imbalance, Quality of Exports*

## INTRODUCTION

The relationship between exchange rate and export has been investigated thoroughly for instance (Wondemu and Potts 2016, Vigy and Paresh 2015,Gentc and Arter 2014,Zakaria 2013,Sandu and Ghipa 2011, Kemal and Qadir 2005). Exchange rate is envisaged to influence export in two way depreciation and volatility Fank, Lai and Miller 2005).

Depreciation affects competitiveness positively while volatility influences exports negatively. On the other hand, the exchange rate is influenced by exports. Export is the main source of foreign currency. Less developed countries including Sudan depends mainly on exports primary goods.

Until the first quarter of 1999, nonoil exports constituted the bulk of exports. Since then their role has been shrinking whereas oil has the share of exports. The demand for primary goods is determined by the consumers and not by the supplier. The importance of studying the sensitivity of the exchange rate of exports of oil grains and minerals in the Sudan because of their effective role in increasing the rates of development and diversification of economic conditions.

Thus, it focuses on the sensitivity of the exchange rate towards exports of oil seeds and minerals in Sudan. These exports are considered as the main element in the financial and international economies.

The main question of the study is whether the sensitivity of the exchange rate of the affects exports of oil seeds and minerals in the short and long term and stem from this question or vice versa. We postulate that there is mutual effect between the exchange rate and exports, which will be investigated by statistical methods via EViews.

The motivation behind this study is to take insight the other side of relationship between exchange rate and exports since most studies concentrate on the influence of exchange rate on exports this study is different, looks at the effects of exports on exchange rate. The study is organized as follows: previous studies follow the introductory section, then theoretical background, methodology and data, empirical results, discussion, and conclusion.

## PREVIOUS STUDIES

Gondaliya and Dave (2015) examined the impact of India's export and import on the sensitivity of exchange rate using data from January 2006 to October 2015. They positive relationship between export and exchange but negative relationship between import and exchange rate, also export influences Rupee against Euro, Pound Yen and Dollar contrary to import.

Genc and Atar (2014) aimed at investigating the impact of exchange rate on imports and exports in developing countries. They applied panel co integration method for the period 1985 – 2012. They found co integration relationship between export and effective exchange rates in emerging countries.

Ahmed (2014) identified the effect of exchange rate fluctuations on the balance of payments in Pakistan's economy using monthly data from January 2007 to October 2013. He performed Dickey and Granger tests. The study found a positive relationship between the exchange rate and the balance and concluded that exchange rate stability would encourage investment and thus improve the balance of payments.

Zakaria (2013) examined the relationship between exchange volatility and export using Malaysian monthly data from January 2000 to August 2012 using GARCH model. He found negative Relationship between exchange rate volatility and trade.

Abdullah (2010) analyzed the balance of payments performance in the period 1970-2009 using descriptive statistical methods to explain the components of the balance of payments and the main factors that determine the size and depth of the deficit in the external sector. He recommended development and exploitation of oil and gold mining, which are the main sources of foreign exchange.

Sandu and Ghiba (2011) analyzed the exchange rate influence on exports volume in Romania via vector autoregressive using quarterly data 2003Q2 – 2011Q1. Variance decomposition shows weaker influence less than 10 percent.

Sandu, Carmen and Ghiba, Nicolae (2011) the Relationship between Exchange Rate Exports in Romania Using Vector Autoregressive Model Annual Universitatis Series 2013A Kemal and Qadir (2005) found high correlation between real exchange rate and exports and imports, in addition to long-run relationship, sudden movements of exchange rate do not affect exports and imports.

Huchet and Korine () examined the impact of exchange rates and their volatility on trade flows in China, the Euro zone and the United States in the agriculture and mining sector.

That the exchange rate fluctuations on trade flow on both metals and agglomerates are more detrimental to exports than their long-term effects on import.

The study of the effect of the exchange rate imbalance on the variables of a structural model for the Algerian economy for the period (1970 to 2012). The study aims to develop the exchange rate behavior from 1970 to 2012, by studying the effect on variables of the structural model of the geological economy, and predict its behavior by conducting simulation on the variable to see the effect of its deviation on the rest of the variables of the model.

The impact of the exchange rate policy on the Algerian trade balance for the period (1970-2004). This study dealt with the effect of the change in the exchange rate in the Algerian trade balance and aimed at estimating the function of foreign demand on exports, domestic demand on imports and the current account using the normal lower squares method, based on the joint integration test.

The study concluded that domestic income and global income had no effect on the current account, and devaluation meant increasing the quantity of exports and improving the current account in the short term only.

Oladipupo & Onotaniyohuwo () aimed to know the impact of the exchange rate on the balance of payments assuming that there was a significant impact on the balance of payments. They used OLS correcting autocorrelation by Cochrane Orcutt method.

They concluded that the exchange rate reduction leads to an improvement in the balance of payments under the fiscal discipline. The exchange rate policy should be used as a variable and the exchange rate, the quantity of money in circulation, as independent variables. Along with fiscal and monetary policy, and diversification of exports

## THE MOST IMPORTANT FEATURES OF THIS STUDY AND THE PREVIOUS STUDIES

The study of the sensitivity of the exchange rate of exports of oil grains and minerals in the Sudan has not been discussed previously - as seen from the previous studies, as it revolves around the effect of the exchange rate on the balance of output and trade balance and exchange rate volatility and its impact on the foreign trade of some countries.

The researcher pointed out that the current study is distinguished from its predecessors in its specialties, exports of oil grains and minerals in the long and short term and its effect on the Sudanese economy. This study serves the results

that will be revealed by the authorities responsible for economic policy plans

## THEORETICAL BACKGROUND

### Exchange rate

There are two way to price currencies direct pricing i.e. the number of units of foreign currency to be paid for one unit of the national currency or indirect pricing that is the number of units of the national currency to be paid for one unit of foreign currency. Most countries in the world use this method of pricing, including Sudan. There are many types of exchange rates: nominal exchange rate that is a currency measure of one of the countries that can be exchanged for the value of another country's currency.

Currency exchange or buying and selling of currencies is carried out at the exchange rate of the currencies between them. The nominal exchange rate of a currency is determined by demand and supply at the exchange market.

The real exchange rate reflects the number of units of foreign goods required to purchase one unit of domestic goods, thus measuring competitiveness. Actual exchange rate i.e. the effective exchange rate reflects the index, which measures the average change in the exchange rate of a currency for several other currencies in a given period.

The real effective exchange rate in fact, the actual exchange rate is a nominal price because it is an average of several bilateral exchange rates.

In order for this indicator to be relevant to the country's competitiveness abroad, this nominal rate must be corrected by removing the effect of relative price changes.

Exchange rate influence exports (national goods and services that are sold to other countries) since it represents the price of exports in foreign currency.

### Products Include both Oilseeds and Minerals

Exports play a significant role in economic growth through the optimal utilization of available resources and capacities, as well as the rebalancing of the balance of payments. Exports are national goods and services that are sold to other countries. Products include both oilseeds and minerals.

Oilseeds include groundnuts, which contribute a large proportion of the total output of oilseeds, and Sudan follows the United States of America in terms of groundnut exports, and increased interest in peanut yield for many industries.

Sesame, where the sesame leaves rose due to the increase in international prices of sesame and the high demand for the Sudanese crop after the amount shown in the global markets for sesame damage in the People's Republic of China as a percentage of climate change.

Metals in general and gold in particulars contributes a lot to Sudanese exports. The extraction of gold is practiced by big companies and by private endeavors. Other mineral include chrome,

## METHODOLOGY AND DATA

### Model Specification

The construction of economic models is one of the modern methods that enable economic units to appreciate and predict the interlinked and interrelated economic variables, especially in light of the availability of data and statistics. In this study, we used EVIEWS to estimate the error correction model.

$$E = f(m, s) \qquad (3.1)$$

Where the dependent variable E is the exchange rate, m is the minerals exports and s is the oil seeds exports. The specification of the error correction model is as follows:

$$A(L)\Delta y_t = \gamma B(L)\Delta x_t + \alpha(y_{t-1} - \beta_0 x_{t-1}) + v_t \qquad (3.2)$$

Where y is the dependent variable and x's is the independent variables.

To estimate a linear regression model we have data on exchange rate sensitivity as a dependent variable and exports of both oil grains and minerals in Sudan from 1995 to 2015 as independent variables.

### Empirical Results

To estimate a linear regression model we have data on exchange rate sensitivity as a dependent variable and exports of both oilseeds and minerals in Sudan from 1995 to 2015 as independent variables. Unit root test was done for the exchange rate data series at the level before the first differences were made using the augmented Dickey Fuller procedure where the calculated value was 00063722 less than the tabular values at a significant level of 10%. This confirms the series none-stationary, after the first difference of the exchange rate series and

the unit root test show the calculated value of 7068817 was greater than the initial value of 1%, which confirms the exchange rate series stationary

**Table1.** *Unit Root Tests*

| Variable | Augmented Dickey Fuller | | | Philips-Peron | | |
|---|---|---|---|---|---|---|
| | Level | Ist Diff | 2nd Diff | Level | Ist Diff | 2nd Diff |
| Exchange Rate | 0.9531 | 0.2533 | 0.0701* | 0.0000*** | | |
| Oil Seeds | 0.0386** | | | 0.0372** | | |
| Minerals | 1.000 | 0.7752 | 0.0020*** | 1.000 | 0.7752 | 0.0019*** |

*, **. *** *indicates significance at 10%, 5% and 1%*

## Oil Seeds

### *Unit root test*

The unit root was tested for the oil seeds exports data series at the level (before the differences) using the augmented Dickey Fuller (ADF) procedure where the calculated value of -10430522 was less than the tabulated values at a significant level of 10%. After the first difference of the oil seeds export series the unit root unit test revealed that the calculated value of 5954664 was greater than the tabulated value at 1% level of significance. This confirms the stationary of the oil seeds export data series.

## Minerals

Unit root test the unit root of the minerals export data was tested at level (before the difference) using the ADF procedure where the calculated value was 19582 less than the table values at a significant level of 10%. This confirms the none-stationary of the series. After making the first difference of –the minerals export series unit root test revealed that, the calculated value of 625 was greater than the initial value of 1%. This confirms the stationary of the minerals series.

**Table2.** *Co integration Results*

| | | | | |
|---|---|---|---|---|
| Date: 03/11/18 Time: 22:29 | | | | |
| Sample (adjusted): 1997 2014 | | | | |
| Included observations: 18 after adjustments | | | | |
| Trend assumption: Linear deterministic trend | | | | |
| Series: EXC MINERAL SEEDS | | | | |
| Lags interval (in first differences): 1 to 1 | | | | |
| Unrestricted Co integration Rank Test (Trace) | | | | |
| Hypothesized | | Trace | 0.05 | |
| No. of CE(s) | Eigen value | Statistic | Critical Value | Prob.** |
| None | 0.68081 | 27.82965 | 29.79707 | 0.0829 |
| At most 1 | 0.311 | 7.274198 | 15.49471 | 0.546 |
| At most 2 | 0.031114 | 0.568953 | 3.841466 | 0.4507 |
| Trace test indicates no co integration at the 0.05 level | | | | |
| * denotes rejection of the hypothesis at the 0.05 level | | | | |
| **MacKinnon-Haug-Michelis (1999) p-values | | | | |

*The co integration test revealed three co integrating equations therefore; the model will be estimated via the error correction model.*

From the previous table, oil seeds and minerals have a positive effect on the exchange rate in the long term and the effect of mineral exports is greater than that of oilseeds (increases in exports of minerals and oil seeds lead to an improvement in the exchange rate). The long-term constant coefficient is negative, which means that the exchange rate is declining. In the short term, the effect of oil seeds and minerals is positive on the exchange rate and the effect of mineral exports is greater than the effect of oil seeds, i.e. an increase in the exports of minerals or oil seeds leads to an improvement in the exchange rate. The coefficient of speed adjustment is -00476625 are statistically significant. It confirms that the equilibrium relationship between the exchange rate and the exports of minerals and oil seeds if they deviate from their position will return to the equilibrium situation after two years and two months.

## Impulse Responses

A shock to the $ith$ variable not only directly affects the $ith$ variable, but is also transmitted to

all of the other endogenous variables through the dynamic (lag) structure of the VAR. An impulse response function traces the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables.

**Table3.** *Error Correction Model Estimates*

## Error Correction Model

| Vector Error Correction Estimates | | | |
|---|---|---|---|
| Date: 03/11/18 Time: 22:30 | | | |
| Sample (adjusted): 1998 2014 | | | |
| Included observations: 17 after adjustments | | | |
| Standard errors in ( ) & t-statistics in [ ] | | | |
| CointegratingEq: | CointEq1 | | |
| EXC(-1) | 1 | | |
| MINERAL(-1) | 9.77E-11 | | |
| | -5.30E-11 | | |
| | [ 1.82901] | | |
| SEEDS(-1) | -2.41E-09 | | |
| | -1.30E-10 | | |
| | [-18.1143] | | |
| Error Correction: | D(EXC) | D(MINERAL) | D(SEEDS) |
| CointEq1 | -0.31408 | 8.05E+08 | 1.11E+08 |
| | -0.06336 | ######## | ######## |
| | [-4.95737] | [ 0.55371] | [ 0.35193] |
| D(EXC(-1)) | 0.426146 | ######## | ######## |
| | -0.18374 | ######## | ######## |
| | [ 2.31929] | [-1.19695] | [-0.61262] |
| D(EXC(-2)) | -0.06782 | 1.48E+09 | 1.95E+08 |
| | -0.08007 | ######## | ######## |
| | [-0.84702] | [ 0.80478] | [ 0.49132] |
| D(MINERAL(-1)) | 3.30E-11 | 0.385963 | 0.004997 |
| | -1.60E-11 | -0.36419 | -0.07884 |
| | [ 2.07818] | [ 1.05979] | [ 0.06339] |
| D(MINERAL(-2)) | -1.70E-11 | 0.002352 | -0.00202 |
| | -2.00E-11 | -0.45361 | -0.09819 |
| | [-0.86061] | [ 0.00518] | [-0.02054] |
| D(SEEDS(-1)) | -6.01E-10 | 4.144949 | -0.25973 |
| | -1.50E-10 | -3.40526 | -0.73714 |
| | [-4.04996] | [ 1.21722] | [-0.35234] |
| D(SEEDS(-2)) | -4.06E-10 | 0.265931 | 0.140901 |
| | -1.50E-10 | -3.3585 | -0.72702 |
| | [-2.77359] | [ 0.07918] | [ 0.19381] |
| R-squared | 0.883389 | 0.616524 | 0.261234 |
| Adj. R-squared | 0.813422 | 0.386439 | -0.18203 |
| Sum sq. resids | 4.10E-09 | 2.16E+12 | 1.01E+11 |
| S.E. equation | 2.03E-05 | 464786.3 | 100612.6 |
| F-statistic | 12.62582 | 2.679545 | 0.589347 |
| Log likelihood | 164.1134 | -241.45 | -215.435 |
| Akaike AIC | -18.4839 | 29.22944 | 26.16884 |
| Schwarz SC | -18.1408 | 29.57253 | 26.51193 |
| Mean dependent | -2.18E-05 | 235834.9 | -621.959 |
| S.D. dependent | 4.69E-05 | 593368.4 | 92542.01 |
| Determinant resid covariance (dof adj.) | | 5.13E+11 | |
| Determinant resid covariance | | 1.05E+11 | |
| Log likelihood | | -288.032 | |
| Akaike information criterion | | 36.70968 | |
| Schwarz criterion | | 37.88598 | |
| Number of coefficients | | 24 | |

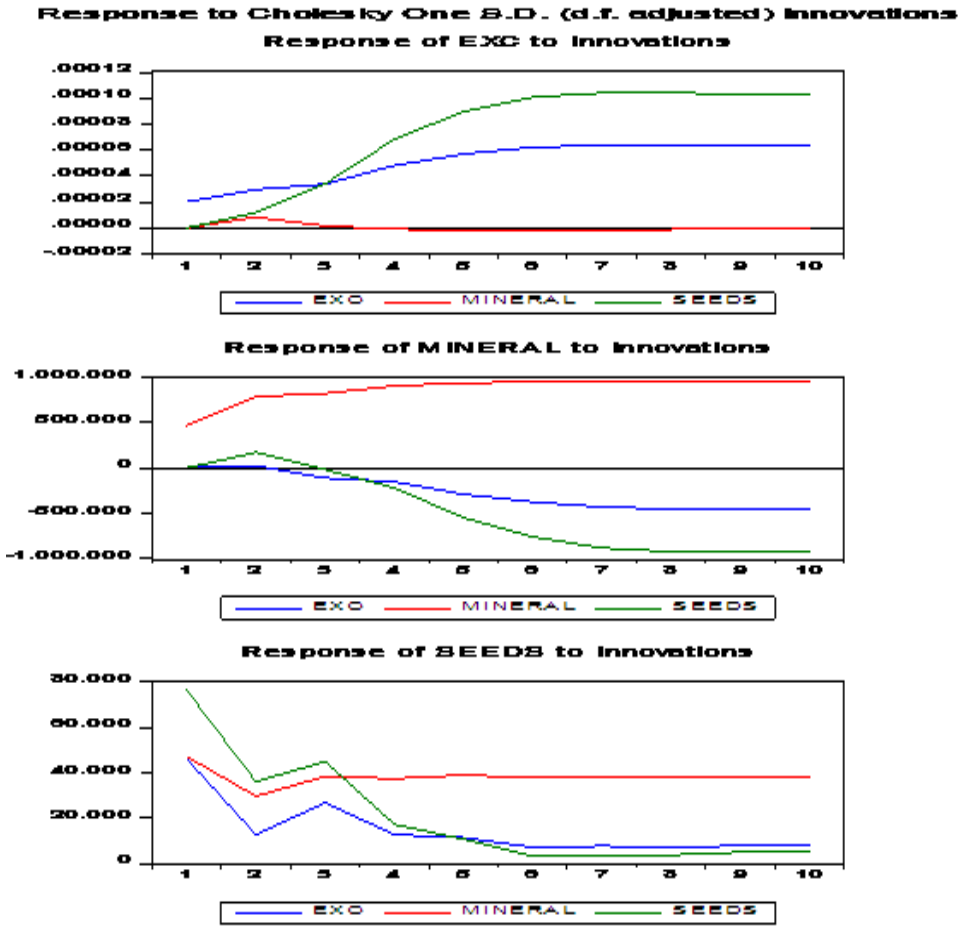
## DISCUSSION

There is significant difference between the means of oil seeds and minerals. There is no co-movement between the oil seeds and minerals since the probability is (0.21) which means we accept nonexistence of co-movement. On the

other hand, the correlation coefficient between minerals and oil seeds is week (0.289) and insignificant which is reflected on the response of one- time shock discussed below. A one-time shock to the exchange rate leads to a continuous increase of the dollar against the Sudanese pound; it affects in the same fashion the oil seeds, while mineral barely affected by this shock.

A one-time shock to minerals leads to a continuous increase in minerals, appreciation of the exchange rate and decrease in oil seeds proceeds. This can be attributed to the fact that minerals are valuable than oil seeds.

A one-time shock to oil seeds has negligible effect on minerals, while leading to an appreciation of the exchange rate.




## CONCLUSION

- The sample data series of the study was none -stationary at the level and after the first difference, they were stationary
- There is a long - term equilibrium between the variables of the study
- Exports of minerals and oilseeds affect the exchange rate positively and the impact of exports of minerals is greater than the impact of oilseeds
- The exchange rate decreases automatically as showed by the results of the short and long run
- Any deviation from the equilibrium relationship between the study variables it will return to its equilibrium state within two years and two months.

## RECOMMENDATIONS

- Expanding the export of minerals beside their diversification
- Improving the quality of oilseeds exports to compete in the world market
- The study recommends introducing new variables that explain the exchange rate.

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