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The Impact of Oil Prices on the Exchange Rate in South Africa

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ABSTRACT The aim of this paper was to investigate the impact of oil prices on the nominal exchange rate. The Generalized Autoregressive Conditional Heteroscedasticity (GARCH) test was performed to determine the impact of oil prices on nominal exchange rate using monthly time series data covering the period between 1994 and 2012. The results show that oil prices have a significant impact on nominal exchange rates. In addition, the findings reveal that an increase in oil prices leads to a depreciation of the rand exchange rate. This implies that oil prices are a very important variable in determining the strength of the currency and its volatility. The South African government should consider the impacts of oil prices when formulating and implementing economic policies especially the exchange rate policies.

INTRODUCTION

The import of oil represents an enormous part of the trade balance of an energy dependent country. The possible significance of oil prices for exchange rate movements have been noted by Oriavwote and Eriemo (2012), Basher et al. (2011), Nikbakht (2009), Aziz (2009) as well as Amano and van Norden (1998). Dawson (2004) explains that variability in oil prices has a huge impact on the relative values of the currency in the case of a small open economy. While much work has been done concerning the impact of oil prices on exchange rates in the oil exporting countries (Oriavwote and Eriemo 2012; Nikbakht 2009), there is less evidence on the same relationship on the case of energy importing countries. Thus, this paper uses the case of South Africa, an energy dependant small open economy with a floating exchange rate, to illustrate the connection between oil prices and nominal exchange rates.

Oriavwote and Eriemo (2012) assert that the exchange rate is one important variable in the growth process of any economy since its level and stability directly affect the tradable sector and investment. Although, the link between exchange rate and oil prices has been established before, particularly in the oil exporting countries, the findings cannot be generalised to cases of oil importing countries, given the dynamics in situations and environments. As such, the impact of oil prices on exchange rates in oil importing countries such as South Africa is worthy establishing. Moreover, oil prices are a vital global determinant of economic performance. This, therefore, calls for the governments to closely consider movements in the oil prices fluctuations in order to come up with policies to rein in the volatile exchange rate.

Currently oil consumption in South Africa is estimated to be approximately above 20 percent of the total energy usage (EIA 2013). South Africa has no known commercial oil deposits, resulting in its reliance mostly on imported crude oil for its energy requirements (Nkomo 2009). Available statistics show that South Africa depends much on oil imports and of the total imports, oil accounts for 6% (EIA 2013). In addition, South Africa imports more than 90% of its crude oil requirements (Nkomo 2009). Such substantial dependence on imported crude oil exposes South Africa to external shocks that either disrupts or leads to higher oil prices, thus, negatively affecting economic growth and development. The other cause for concern is that two of South Africa's key sectors; transport and agriculture are heavily dependent on oil products hence any movement in oil prices can greatly affect South Africa.

Oil prices affect exchange rates mainly through a two way transition mechanism which includes both supply and demand channels (Nikbakht 2009). On the supply side, oil price increases affect production negatively since oil is a basic factor of production. Any increase in

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the price of a factor of production leads to an increase of the cost of production of non-tradable goods. The ultimate result is an appreciation of the exchange rate resulting from increase in prices of non tradable goods. Contrarily, from the demand side, the exchange rate is indirectly affected through its relation with disposable income (Nikbakht 2009). Thus, a rise in oil prices reduces the consumers spending power. This will reduce the demand for non-tradables leading to a fall in their prices and ultimately depreciating the exchange rate. Given the above transition mechanisms, this paper seeks to inquire whether oil price fluctuations appreciate or depreciate exchange rates in South Africa.

The impact of oil prices on exchange rates has been studied to a greater extent in the oil producing countries but less has been done for oil-importing small open countries. In spite of the general acknowledgment that oil plays a significant role in most African economies, little evidence exists on the effects of oil prices on exchange rates in the African context. To fill this gap in literature this paper attempts to investigate the impact of oil prices on the exchange rate in South Africa. A highly volatile exchange rate can be recognised as a vexing problem that has challenged South Africa for more than a decade. In light of the highly volatile exchange rate over the years, the questions that basically arise concern the performance of the economy in relation to the exchange rate variability, and are as follows: Does oil prices affect the rand exchange? What effect do oil prices have on the rand exchange? What are the consequences of oil prices on the economy? This paper, therefore, seeks to provide answers to these questions by examining the impact of oil prices on the exchange rate in South Africa.

The objectives that translates from the above research questions are: to examine the impact of oil prices on the exchange rate in South Africa over the period 1994 to 2012; to review literature (both theoretical and empirical) on the impact of oil prices and exchange rate over the same period and to make policy recommendations based on the findings of the study. The paper employs monthly time series data from the Reserve Bank of South Africa for the period 1994-2012. The Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model to test the relationship between oil prices and exchange rates is used.

Literature Review

This section provides a discussion on the theoretical literature which gives an insight into the possible channels through which oil prices affect the exchange rate. It also focuses on the empirical literature which shows studies conducted by other researchers.

Theoretical Literature

The relationship between oil prices and exchange rate has followed two main channels. The first channel focuses on oil as one of the determinants of the terms of trade. Amano and van Norden (1998) propose a model with two sectors: the tradable and non-tradable goods. Each sector uses both a tradable input (oil) and a non-tradable one (labour). In this model, there are constant returns to scale for technology, moreover, inputs are mobile between the sectors. The model also assumes that the output price of the tradable sector is fixed internationally. As a result of this, the real exchange rate corresponds to the output price in the non-tradable sector. A rise in the oil price leads to a decrease in the labour price so as to meet the competitiveness requirement of the tradable sector. If the non-tradable sector is more energy intensive than the tradable one, its output price rises and real exchange rate appreciates. The reverse is true if the non-tradable sector is less energy intensive than the tradable one. Amano and van Norden (1998)'s approach neglects the fact that the tradable prices can rise worldwide following an oil price shock. Allowing for this possibility (while keeping the law of one price in the tradable sector) enables one to conclude that the effect of real oil price on real exchange rate will depend on the oil intensity of both the tradable and non-tradable sectors of the countries under review (Benassy-Quere et al. 2007).

A second strand of the literature focuses on the balance of payments and international portfolio choices (Aziz 2009). In this model, higher oil prices will transfer wealth from the oil importers (South Africa) to oil exporters (OPEC). The long run real exchange rate depends on the geographic distribution of OPEC imports, but no longer on OPEC portfolio choices. Assuming that oil-exporting countries have a strong preference for rand-denominated assets but not for South Africa goods, an oil price hike will

cause the rand to appreciate in the short run but not in the long run. On the contrary, if oil exporters do not have a strong preference for rand-denominated assets, an oil price hike will cause the rand to depreciate in the short run.

Thirdly the impact of oil prices on the exchange rate depends on the elasticity of imports. This is called the elasticity approach. The impact of oil prices on exchange rate depend on the elasticity of import demand of the importing country. The lower the response of domestic demand to price changes, the stronger the effect an oil price hike will have on the exchange rate. Price elasticity of demand is a measure of the responsiveness of quantity demanded to a change in price (Jehle and Reny 2011). If quantity demanded is highly responsive to a change in price, then demand is said to be relatively elastic. If quantity demanded is not very responsive to a change in price, then demand is said to be relatively inelastic. When a nation's commodities prices (oil) rise, they become relatively more expensive in the global market (Nkomo 2006). Hence, we would expect the import of oil by importing countries to decline. However, the elasticity of imports determines whether the imports will decline, stay the same or rise. It is therefore imperative to consider the responsiveness of imports to a change in the price of oil. For example, if import demand (of oil) is highly inelastic, a rise in oil prices will cause depreciation in the currency of the importing country. An increase in the oil price will mean that the importing country will require more of its currency to buy the same amount of oil it used to buy before. Hence there would be deprecation in the currency of the importing country. On the contrary, a decrease in the oil prices causes an appreciation in the currency of the importing country since it now requires less of its currency to buy the same amount of oil it used to buy before.

Empirical Literature

This section presents the various studies done, the methods used, the countries of research and the results obtained. The section helps in identifying the variables to be included in the model of this study.

Oriavwote and Eriemo (2012) examined the link between the real oil prices and the real exchange rate. The study employed Johansen cointegration test and the Granger Causality test using Nigerian time series data for the period between 1980 and 2010. Their findings from the GARCH test suggest persistence of the volatility between the real oil prices and the real effective exchange rate.

Nikbakht (2010) examined the link that exists between oil price and exchange rate using OPEC member states as a case study. The study employed monthly panel data of seven countries of OPEC membership from January 2000 to December 2007 to investigate the long run relationship. The findings of their study showed that oil prices are a dominant source of real exchange rate movements. The results also revealed that there is a long-run linkage between real oil prices and real exchange rates.

Turhan et al. (2012) investigated the role of oil prices in explaining the dynamics of selected emerging countries exchange rates. Using daily data, the findings indicated that oil price hikes leads to significant appreciation of emerging countries currencies against the US dollar. The generalized impulse response functions were employed to find the impact on three different times. The findings showed that oil price dynamics impact on exchange rate changes over time and the impact was more pronounced after the 2008 financial crises.

Ozturk et al. (2008) studied the link between international oil prices and the exchange rate in a small open industrial economy. The cointegration and Granger causality tests were used to analyse the relationship between the period of December 1982 to May 2006. They found out that the international real crude oil prices Granger cause the United States (USD)/ Turkish Lira (YTL) real exchange rate.

Akram (2002) explored the possibility of a non- linear relationship between oil prices and the Norwegian exchange rate. The results of the study revealed a negative relationship between oil prices and the value of the Norwegian exchange rate, and that it was relatively strong when oil prices were below 14 dollars and were falling.

Ferraro et al. (2012) investigated whether oil prices have a reliable and stable out-of-sample relationship with the Canadian/U.S dollar nominal exchange rate. They found little systematic relation between oil prices and the exchange rate at the monthly and quarterly frequencies. The main contribution is to show

the existence of a very short-term relationship at the daily frequency, which is rather robust and holds regardless of whether contemporaneous (realized) or lagged oil prices in the regression have been used.

Buetzer et al. (2012) investigated whether oil shocks matter for global exchange rate configurations. The paper was based on data on real and nominal exchange rates as well as on an exchange market pressure index for 44 advanced and emerging countries. Using VAR models, they found no evidence that exchange rates of oil exporters systematically appreciate against those of oil importers after shocks that raise the real oil price. However, oil exporters experienced significant appreciation pressures following an oil demand shock, which they tend to counter by accumulating foreign exchange reserves.

Mendez-Caebajo (2010) studied the impact of oil prices on floating exchange rate of the Dominican peso during the 1990-2008 period. The vector error correction model was employed in investigating the relationship. The findings showed that 10% rise in the price of gas coincides with a 1.2% depreciation of the peso in the long run and that the causality runs from gas prices to the peso.

Data Sources

The study adopts a time-series research design in examining the relationship between exchange rate and oil prices. The data was obtained from a secondary source; the South African Reserve Bank. Nominal exchange rate against the US dollar, oil prices (Bent crude oil prices) and South African interest rate for the period 1994 to 2012 were used for the analysis. The study used monthly data and the GARCH model was utilised to estimate data.

METHODOLOGY

Three analytical procedures are involved in estimating the model. First, the unit root test is carried out for each of the variables so as to ascertain the time series properties of the data set and obtain the stationary status. Next, the regression (GARCH) is performed in order to determine the relationship between the variables. Lastly, diagnostic tests were carried to ascertain the overall goodness of the model.

Model Specification

The study is going to follow Aziz (2009) to estimate the relationship between exchange rate and oil prices. Aziz (2009) used the following model to estimate the long run effects of real oil price and real interest rate differential on real exchange rate:

$$Q = F(ROIL, DRR) \quad \ldots\ldots 1$$

Where, the real exchange rate (Q) was a function of real price of oil (ROIL) and real interest rate differential (DRR). This study modifies Aziz (2009)'s model and comes up with the following model;

$$NEXC = f(OP, INT) \quad \ldots\ldots 2$$

Where, the nominal exchange rate (NEXC) is a function of oil prices (OP) and interest rates (INT). The model can be expressed in its linear form as:

$$NEXC = 0_0 + \beta_1 OP_t + \beta_2 INTt + \varepsilon_t \quad \ldots\ldots 3$$

Where ε_t is the error term. This model will examine how the selected variables (interest rates and oil prices) impact on the exchange rate using monthly data at levels.

RESULTS AND DISCUSSION

Unit Root

To examine the existence of stochastic non-stationarity in the series, the study establishes the order of integration of individual time series through the augmented Dickey-Fuller (ADF) test. The results are presented below in Table 1.

Table 1 show that all variables (NEXC, OP and INT) became stationary after being differenced once. In other words, all variables attained stationarity after the first differencing.

Table 1: Results from the Augmented Dickey Fuller Test

	ADF (Intercept)		*ADF (Trend and intercept)*	
Variables	*Level*	*1st difference*	*Level*	*1st difference*
INT	-1.016015	-6.803676	2.970121	-6.848988
P-value	0.7478	0.0000	0.1431	0.0000
NEXC	-2.041603	-10.35869	-2.059615	-10.38291
(P value)	0.2690	0.0000	0.5650	0.0000
OP	0.983040	-12.08048	3.16192	-12.05480
(P value)	0.7595	0.0000	0.0949	0.0000

The GARCH (1.1) model was carried out and the aim was to ascertain the effect of macroeconomic variables such as oil prices and interest

rates on the Rand/US exchange rate. The results of the tests for the GARCH (1.1) model are presented in Table 2.

Table 2: Results from the GARCH model

Variable	*Coefficient*	*Std. error*	*z-Statistic*	*Prob. L*
INT	-0.248083	0.019777	-12.54404	0.0000
LOP	0.118875	0.006961	17.0775	0.0000
C	2.084944	0.071778	29.04693	0.0000
Variance Equation				
C	0.001030	0.000353	2.913399	0.0036
RESID (-1)^2	1.181754	0.279234	4.232133	0.0000
GARCH-(1)	-0.134027	0.062612	-2.140594	0.0323

An evaluation of the LINT coefficients indicates that LINT appeared to be negative and also significant (p-value turned out to be 0.00). The results reveal that an increase in interest rates led to an appreciation of the rand. In other words, a rise in interest rates, led to the strengthening of the rand. A one percentage point increase in interest rates led to a 0.25 percentage point increase in the rand exchange rate. This is consistent with the economic theory which holds that increases in interest rates lead to an increase in return on assets for foreign investors. If interest rates rise in a certain country, investors see a possible increase in return. As such, they are attracted to invest in that country which raises the demand for that country's currency. Thus, an increase in the demand of the domestic country's currency will lead to an appreciation of its currency. Consequently, a positive relationship can be observed. This is also consistent with the findings of (Hnatkovska et al. 2008).

Oil prices were observed to be positively related to the rand exchange rate. The sign was positive (0.1189) and significant (p-value turned out to be 0.00). The results show that an increase in oil prices leads to a depreciation of the rand exchange rate. A one percentage increase in oil prices leads to a 0.12 percentage point depreciation of the rand exchange rate. Studies with findings similar to those revealed in this study include: Aziz (2009) as well as Mendez-Caebajo (2010). Findings from these studies pointed out that oil prices are positively related to exchange rates.

Diagnostic Tests

Three diagnostic tests were carried; the correlogram of squared residuals, Jarque- Bera type test of skewness and kurtosis and the ARCH test. The correlogram of squared residuals showed that the residuals are not auto correlated. The ARCH test also showed that the GARCH model managed to eliminate the problems of heteroscedasticity. The results from the ARCH test also revealed that the residuals were homoscedastic and the Jarque-Bera tests showed that the model is normally distributed.

Correlogram of Standardized Residuals – Q-statistics

The presence or absence of autocorrelation in the residuals was tested using the Q – statistic. The Q-statistic test was conducted to check if there was no correlation in the residuals and results from the test are presented in Table 3. Table 3 shows that there is no autocorrelation in

Table 3: Correlogram of standardized residuals – Q-statistics

	AC	*PAC*	*Q-Stat*	*Prob*
1	0.048	0.048	0.5161	0.473
2	-0.026	-0.029	0.6759	0.713
3	-0.035	-0.033	0.9646	0.810
4	0.063	0.066	1.8844	0.757
5	-0.009	-0.017	1.9035	0.862
6	0.036	0.040	2.2091	0.900
7	0.089	0.090	4.0515	0.774
8	-0.008	-0.020	4.0653	0.851
9	-0.061	-0.051	4.9337	0.840
10	0.064	0.072	5.9126	0.823
11	0.100	0.081	8.3183	0.685
12	0.046	0.039	8.8291	0.717
13	0.082	0.092	10.465	0.656
14	-0.022	-0.039	10.580	0.719
15	0.053	0.062	11.271	0.733
16	-0.052	-0.050	11.933	0.749
17	0.041	0.018	12.336	0.779
18	0.005	-0.009	12.342	0.829
19	0.150	0.144	17.905	0.529
20	-0.008	-0.020	17.921	0.593
21	0.007	0.010	17.932	0.653
22	0.037	0.040	18.283	0.689
23	-0.018	-0.058	18.363	0.737
24	0.074	0.080	19.755	0.711
25	0.026	-0.004	19.923	0.751
26	0.054	0.026	20.669	0.759
27	-0.051	-0.035	21.333	0.770
28	-0.038	-0.037	21.709	0.795
29	-0.022	-0.037	21.830	0.827
30	0.017	-0.020	21.907	0.857
31	-0.014	-0.023	21.958	0.884
32	0.024	-0.019	22.110	0.904
33	-0.060	-0.043	23.072	0.901
34	-0.029	-0.047	23.291	0.917
35	0.070	0.089	24.606	0.905
36	0.012	-0.027	24.645	0.924

the residuals. This is shown by the significant Q-statistics at all lags and this shows the absence of serial correlation in the residuals.

Normality Test

The normality of the residuals was tested and the test statistic used in this study is a Jarque- Bera type test of skewness and kurtosis. The results from the Normality test are presented in Table 4. Table 4 shows that the residuals are normally distributed. This is shown by the Jarque-Bera statistic which has a probability of 0.138477. In addition to this, the skewness is close to 0 (it is -0.224545) and the kurtosis is close to 3 (it is 2.9). This shows that the model is normally distributed.

Table 4: Normality Test

Skewness	0.224545
Kurtosis	2.89765
J.B	5.515388
(Probability)	0. 138477

Heteroscedasticity Test

To check for the presence of heteroscedasticity in the residuals, an ARCH test was conducted. Results from the ARCH test are presented in Table 5. The ARCH test indicates that there are no ARCH effects. In other words, there is no heteroscedasticity in the residuals; thus, the residuals can be said to be homoscedastic. This is shown by the insignificant p-value which stands at 0.4760.

Table 5: Heteroscedasticity test: ARCH

F-statistic	0.504570	Prob. F(1,222)	0.4782Obs
*R-squared	0.507962	Prob. Chi-square (1)	0.4760

CONCLUSION

The study sought to investigate the impact of oil prices on the exchange rate in South Africa. The imports of oil represent an enormous part of the trade balance of an energy dependent country. In light of this, it became imperative to investigate the effects of oil prices on exchange rate in South Africa. A survey of literature was consulted and it revealed that there is no consensus on the relationship between oil prices and exchange rate both in South Africa and in several other countries. The study employed the GARCH model and the results obtained indicated that oil prices have a significant effect on the exchange rate and this is consistent with findings from previous studies. The results also indicated that there is a positive relationship between interest rates and the rand exchange rate. This is consistent with theory and also in tandem with findings from previous studies. It is therefore concluded that the existing tools used by the SARB do not cater for the effects of oil prices.

IMPLICATIONS FOR POLICY

There are two main implications resulting from the findings of this research. Firstly, the SARB uses the interest rates among other tools to control inflation and the interest rate is not adjusted to control the exchange rate but rather to influence inflation. However successful inflation targeting should contribute to a stable rand exchange rate. As such, the SARB can use interest rates to achieve and maintain price stability and protect the value of the currency, the rand. The Central bank can use the interest rate in achieving a realistic rand exchange rate. A realistic rand exchange rate would result in the achievement of economic growth.

Secondly, the relationship between oil prices and exchange rates also has implications for SARB aiming to stabilise exchange rates. South Africa is a net oil importer and the fundamental economic relationship suggests that higher prices of oil cause upward pressure on the rand exchange rate. The changes caused by oil prices have implications on the value of the rand; they can cause a misalignment of the rand. Therefore, the SARB must be cautious about international developments (such as changes in global oil price shocks) as these developments have both positive and negative effects on the rand exchange rate. The Central Bank must put efforts to ensure that rand exchange rate is always rightly aligned. South Africa being as a net oil importer having no absolute power in the international oil price, its flexible exchange rate system can make the economy vulnerable to changes in oil prices. Therefore, the researchers suggest further research to look into the strategies and measures that can be employed by South Africa to reduce dependency on oil.

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