

OIL PRICE SHOCK, EXCHANGE RATE MISALIGNMENT AND DOMESTIC INVESTMENT IN NIGERIA: A SYNTHESIS EXAMINATION

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ABSTRACT

Maintaining the right exchange rate has become a very critical issue for developing countries, especially since it determines the both internal and external balance, hence economic growth. Failure to properly manage the real exchange rate induces distortions in consumption and production patterns particularly for an import dependent country. Unfortunately, crude oil export has been the dominant foreign exchange revenue earner for Nigeria and it accounts for over 90 percent of total revenue earned by the nation. Nigeria is not just a crude oil exporting country but also a petroleum product importing country, thus giving the country a dualistic trade in crude oil product. Fluctuations in oil prices internationally could result in swings in the prices of imported petroleum products, thus creating panic in the system which transmits to increase in the cost of production, since most productive industries depend on petroleum products as source of energy. This paper applies the Vector Autoregressive Model (VAR) and GARCH to examine the effect shocks in oil prices has on exchange rate fluctuation, domestic investment and economic growth in Nigeria. The results show that there exist a long-run relationship between oil price shocks and exchange rate fluctuation and the direction of causality runs from oil price shocks to exchange rate fluctuation. The study thus concludes that oil prices strongly determine fluctuations in real exchange rate, and that oil price shocks has a negative impact on domestic investment and economic growth in Nigeria. The paper recommends among other things that monetary authorities should appropriately forecast oil prices so as to reduce the effect of fluctuations, especially, since the nation's annual budget is often tied to expected accruals from oil revenue.

43 Keywords - Oil price shocks, exchange rate, openness of trade, macroeconomic stability, domestic
44 investment, economic growth

45 INTRODUCTION

46 There is increasing agreement among economists and policy makers that while stability in the
47 real exchange rate promotes economic growth and improved standard of living, misaligned real
48 exchange rate hinders export growth and generates macroeconomic instability (Chowdhury,
49 1999). It is generally acknowledged that maintaining the real exchange rate at its equilibrium
50 levels is an important condition for enhancing economic performance and macroeconomic
51 stability. According to Jordaan and Eita (2011) a real exchange rate not aligned with its
52 equilibrium level is perceived as being misaligned and this could increase economic instability
53 and distort investment decisions which may result in a decline of welfare and efficiency for a
54 country. Thus, getting the exchange rate right or maintaining relative stability becomes critical
55 for both internal and external balance and, hence growth in an economy particularly, for
56 developing countries. Failure to properly manage the real exchange rate induces distortions in
57 consumption and production patterns particularly for an import dependent country. Fluctuations
58 in real exchange rate have a destabilizing effect on the macroeconomy (Obadan, 2006;
59 Omojimite and Oriavwote, 2012). Real exchange rate misalignment affects economic activity in
60 developing countries primarily due to their over dependence on imported capital goods and
61 reduced level of trade on commodity exports. The right exchange rate policy therefore guides
62 investors in the best way they can strike a balance between their trading partners, and investing
63 at home or abroad (Balogun, 2007)

64 Nigeria has witnessed increasing incidence of depreciation which resulted in the
65 undervaluing of the country's currency in the face of the dollar. Nigeria in 1986, had devalued
66 the nations' currency through the advice of the IMF. It was hoped that the devaluing of the
67 currency will promote competitiveness of the country's export, reduce import dependency and
68 improve the country's terms of trade. However, despite the devaluation the country has
69 continued to experience fluctuations of the exchange rate. Fluctuations in exchange rate had
70 resulted to poor balance of payment; reduce export, continued increase reliance on import and
71 further depreciation of the Naira. For instance, the naira depreciated from N0.61 in 1981 to
72 N2.02 in 1986 and further to N8.03 in 1990. Although the exchange rate became relatively stable
73 in the mid 1990s, it depreciated further again to N120.97, N129.36 and N133.50 in 2002, 2003
74 and 2004 respectively (Obadan, 2006). Thereafter, the exchange rate began to exhibit some level
75 of appreciation from N132.15 to N128.65, N125.83 and N120.57 in 2005, 2006, 2007 and 2008
76 respectively (Central Bank of Nigeria, 2008). Comparatively, Nigeria's growth rate stood at -5

percent in 1984 prior to the Structural Adjustment Programme implemented in 1986 when the exchange rate stood at N0.80. Following the various reform programmes inherent in the SAP policy the growth rate rose to 9.91 percent in 1988 when exchange rate stood at N5.3 to a unit of dollar. The reason for this measure of growth could be attributed to the trade liberalization policies which opened up the economy to external trade. Thereafter, the growth rate began to slide from the 9.91 percent as noticed in 1988 to 1.25 percent evident in the year 2000. Exchange rate concurrently also depreciated from the N5.3 as noticed in 1988 to N100.80 evident in the year 2000. Nigeria economy since then has not experienced growth beyond 6.8 percent despite the fact that the country's exchange rate had remained stable at N128 for over a four year period despite the huge revenue earned from the export of crude oil. It is undoubted that several researchers have expounded on the significance of maintaining appropriate exchange rate balance necessary for achieving economic growth; however, scanty studies have been found relating to whether the price of crude oil exports has any relevance on determining exchange rate variation, particularly, in Nigeria. The study is deemed relevant given the central place crude oil export plays in determining even the nation's annual budget expenditure. Felix and Kurubo (2012) attempted to explore the relationship between oil prices and exchange rate fluctuation in Nigeria. The short coming of the author's research was the exclusion investment and technical progress as important variable in their model. This study intends to fill this very crucial and important gap in its analysis.

Statement of Problem

Nigeria's major foreign exchange is earned from the production and sales of crude oil. Oil revenue contributes about 90% of the total revenue in the country. Oil is such an important revenue earner in the country so much so that even the nation's budget is tied to the predictions of the oil price movement in the international market. A slump or an increase in the oil prices internationally resultantly evoke simultaneous increase or decrease in the prices of tradable and non tradable goods. Nigeria is not just oil producing economy, but also a petroleum importing country. Fluctuations in oil prices internationally also result in swings in the prices of imported petroleum products. Increase in the prices of imported petroleum products creates panic in the system which transmits to increase in the cost of production, since most productive industries depend on petroleum products as source of energy. According to Oriavwote and Eriemo (2012) an increase in oil price leads to a rise in the cost of production of non-tradable goods, which will also result to an appreciation of the RER.

The fluctuations in the real exchange rate in Nigeria have affected producers' revenues and costs; including their profit margin. Some of the factors that led to the instability in the real exchange rate in Nigeria include but not limited to: weak production base, import-dependent production structure, fragile export base and weak non-oil export earnings, expansionary monetary and fiscal policies, inadequate foreign capital inflow, excess demand for foreign exchange relative to supply, fluctuations in crude oil earnings, unguided trade liberalization policy, speculative activities and sharp practices (round tripping) of authorized dealers, over reliance on imperfect market, heavy debt burden, weak balance of payments (BOP) position and capital flight (Obadan, 2006).

Motivation and objective of study

Following the argument of the Balassa-Samuelson (1964) hypothesis that rapid economic growth is usually accompanied by real exchange rate appreciation due to differential productivity growth between tradable and non-tradable sectors, this research intends to find out if the hypothesis propounded by Balassa-Samuelson holds true for Nigeria, particularly, given Nigeria's dualism in trade as an oil economy. Nigeria exports crude oil and at the same time imports finished petroleum products. It is expected that revenue generated from crude oil exports is rubbed off through the importation of petroleum products. This paper therefore is investigating (1) the systematic relationship between RER misalignment and oil price fluctuations. (2) the direction of causality between exchange rate and oil price fluctuation (3) Measure the resulting effect of real exchange rate misalignment on investment, growth rate and export sector of Nigeria. The following questions will guide the study, (a) is there any relationship between exchange rate misalignment and oil price shocks in Nigeria? (b) Does oil price shocks significantly impact on domestic investment and economic growth in Nigeria? (3) Does there exist any long run relationship between oil price and exchange rate fluctuation in Nigeria?

Nigeria Oil Price and Exchange Rate fluctuation

Prior to the discovery of crude oil in Nigeria in the early 50s, non-oil export constituted the dominant foreign exchange revenue earner. According to Ezike and Ogege (2012) the discovery of oil and the realisation that foreign exchange could comparatively be easily derived wherefrom relegated attention to the non oil sector to the background. As at 1996, crude oil constituted about 97.4% of total export earnings while non oil exports accounted for only 2.6% (Yesufu, 1996). Recent trend in the international scene had ignited the volatility of the oil market. The crisis in the Middle East had worsened the volatility of the market which of course had

condensed to the unpredictability of the revenue earned from crude oil sales. The monolithic dependency of the economy had casted shadows on the reason for the implementation of SAP in 1986. Most worrisome is the reality that Nigeria is not just oil exporting country but also a petroleum product importing country. The implication of this trading relationship is that foreign exchange earned through crude oil sales is rubbed off through petroleum product importation. The price simulation of the petroleum product had been the subject of controversy, labour strikes and civil unrest in Nigeria. This is particularly so because the price of petroleum product assiduously determine the output prices of non-tradable goods in the country. According to Zhou (1995) fluctuations in RER could be attributed to shocks in factors that influence output, such as government expenditure, labour supply and/or productivity. Moreover, Cashin, et al. (2004) and Camarero et al. (2008) find evidence of long run dependence of the RER on prices of primary products (crude oil in Nigeria's case) for some developing countries, which explains the reason for RER misalignment, from the supply side. Coleman, Cuestas and Mourelle (2012) had shown that among the different sources of real disturbances, such as oil prices, fiscal policy, and productivity shocks, it has been shown that oil price fluctuations play a major role in explaining real exchange rate movements (also see examples Chaudhuri and Daniel, 1998; Amano and van Norden, 1995, 1998a, 1998b, and Camarero and Tamarit, 2002)

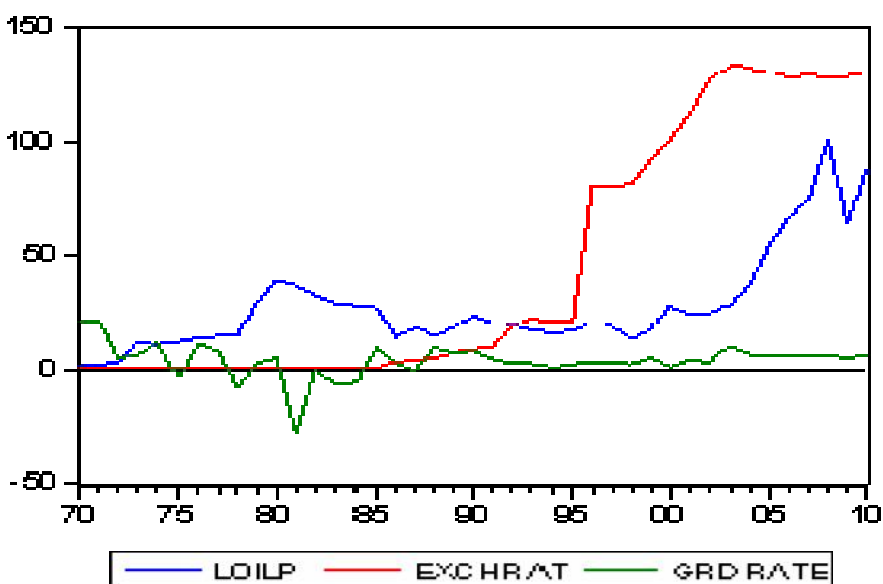


Figure 1 Effect of Nigeria oil prices on Growth Rate

It is evident in figure 1 above that the Nigerian economy does not respond to the Balasa-Samuel theory. For instance aggregate economic growth tipped at -5.09 even when the price of oil had peaked at \$28.9. RER had remained at a minimum value of 0.80. A rise in exchange rate correspondently also responds to a rise in oil prices. It therefore could be summarised that

movement/fluctuation in the price oil and exchange rate relatively affects the growth of the Nigeria economy. The diagram above supports KomainJiranyakul (2006) view that, a rise in oil prices shocks affects both the supply and demand side of the economy. On the supply side, a rise in price of oil makes it more costly for firms to produce goods since energy and capital are complementary. This implies that to run machines you need energy, and to run machines more intensively takes more energy. According to KomainJiranyakul, if energy becomes more expensive, firms may have to purchase new energy-efficient machines if they want to maintain profit. The profit of Firms stuck with less fuel-efficient machines suffers, and so they may invest less in capital and labour. These various investment factors slow the economy's rate of industrial output.

2.4.2 Terms of Trade and Economic Growth in Nigeria

As mentioned earlier prior to the upsurge in the production of oil in Nigeria in the early 70s, agriculture had remained the dominant contributor to the country's Gross Domestic product. The Dutch disease that was experienced in Nigeria as a result of the oil boom of the 1970s brought about tough competition for their export sectors, particularly the agricultural sector, thus weakening the economic performance of these sectors. Aliyu (2007) had resounded that exchange rate misalignments can be associated with worsening terms of trade, a fall in export competitiveness and stunted economic growth. A fall in the terms of trade arising from poor export competitiveness will decrease the purchasing power in the domestic economy, causing the demand for all goods to also fall. Resultantly, the price of non-tradables will fall whereas the price of tradables will remain the unchanged, resulting in equilibrium RER depreciation, a worsening condition of the domestic currency. According to Mapenda (2010) when a substitution effect is taken into account, an improvement in the terms of trade will increase the price of exportables and this will make consumers to shift from the consumption of exportables to the consumption of importables. When more imported goods enter the economy, the demand for non-tradable goods will fall resulting also in a fall in the price of non-tradables and finally RER depreciation.

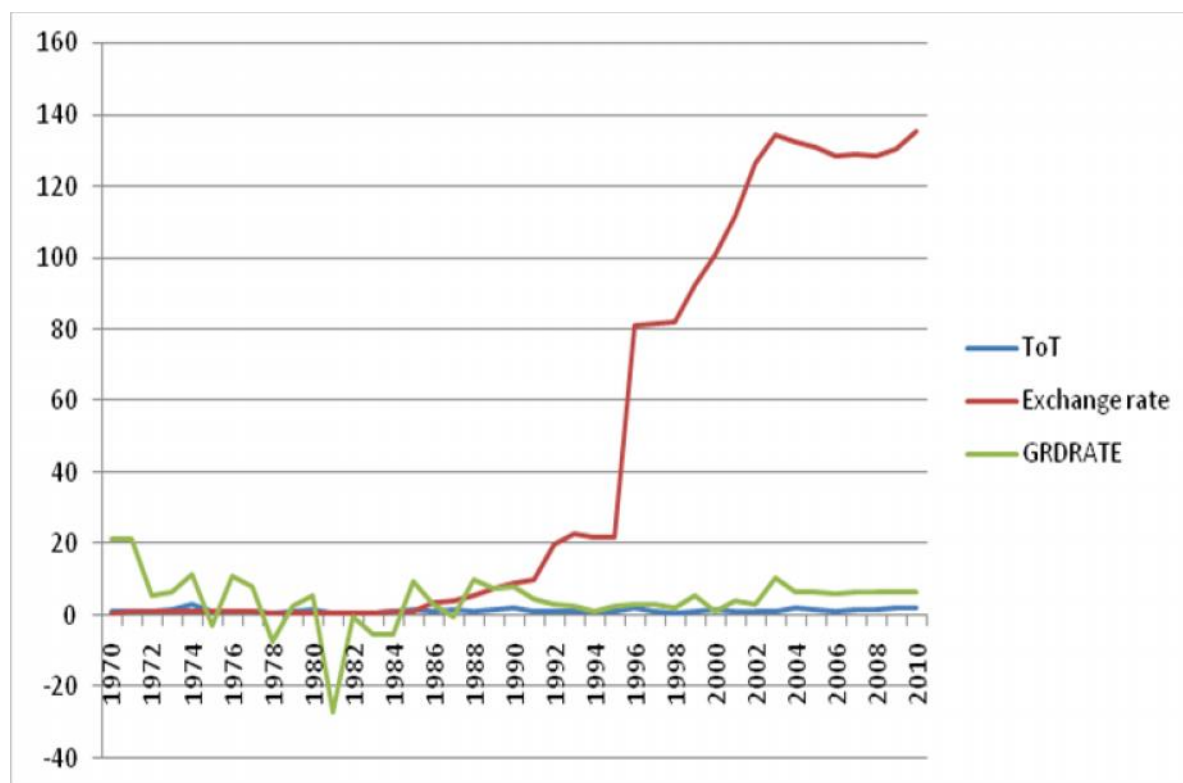


Figure 2 Nigeria's Terms of Trade and Economic growth

It is indicative in figure 2 above that an increase in exchange rate results in worsening terms of trade and ultimately a poor growth rate.

2.4.3 Openness of Trade and Economic Growth

Openness to trade is the summation of exports and imports divided by the country's GDP, and thus implies a reduction in exchange controls. According to Mapenda (2010) the effect of openness on the RER depends on whether the economy is a net importer or a net exporter. If the country's exports are greater than its imports, more foreign currency will enter the domestic economy hence the supply of foreign exchange increases resulting in an equilibrium real appreciation of the domestic currency. If on the other hand the country's imports are greater than its exports, there is an increase in the demand for foreign exchange. This will result in an equilibrium real depreciation of the domestic currency (Kemme and Roy, 2006)



Figure 3: Trend of Openness of the Nigerian Economy.

Nigeria's openness of the economy shows some element of improvement since from 1970. The economy had experienced on upward trend in her openness to trade until 1985 when it was observed to have dipped slightly. However, the introduction of the Structural Adjustment programme (SAP) in 1986, the economy began again to experience an upward surge in the openness level. Though it may appear so seemingly true that Nigeria experiences a continual improvement in her openness of the economy, but when compared with the level of growth of the economy, the level of openness becomes unappreciative.

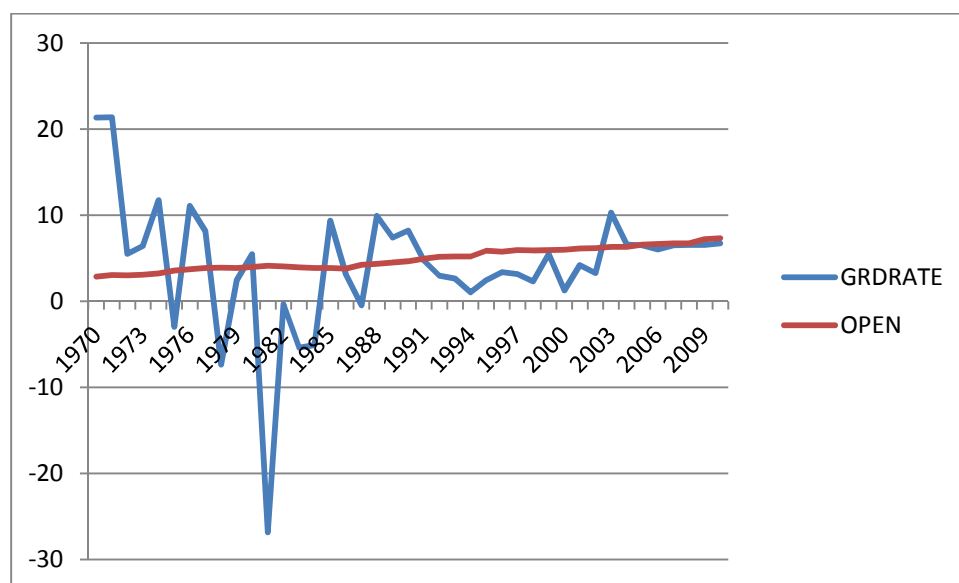


Figure 4: Comparative analysis of Nigeria trade openness and GDP growth rate

The reason for this non collaborative growth rate could be attributed to government failure to address the adverse effect of exposure to external distortions brought about by greater opening of

Nigeria economy to international commerce. This measures (often called the resilience measures) so be it adopted range from protectionism and excessive government control of economic activity to movement towards free market economy (Udah,2011)

Brief Literature Review

After the collapse of Gold standard in the 1930's and the subsequent emergence of the Bretton wood system of adjustment peg from the 1940's, through the espousal of flexible exchange rate given by the developing nation in 1970 and those carrying out structure reforms in the 1980's as well as in the wake of the currency crises in developing economies in the 1990's, exchange rate management has assumed increasing research issues amongst academics.

Countries in attempting to manage their exchange rates have shifted from fixed to flexible exchange rate regimes. The pegging or allowing the exchange rate to float is strongly dependent on the movement of the domestic currency as against the international currency of comparison (for instance the, the value of the Nigeria Naira to the American Dollar).

There exist quite a number of opinions regarding the effect of real exchange rate on economic performance amongst LDCs. The first opinion holds that positive exchange rate shock enhances international price competitiveness of locally made goods (tradable) which in turn improve BOP. With the improvement international competitiveness, net export raises and helps aggregate demand in the economy while appreciation/revaluation i.e. negative exchange rate shock hurts tradable performances which in turn decrease net export, and aggregate demand falls (Akinbobola and Oyetayo, 2010). Another argument considered that real devaluation/depreciation can cause a reduction in aggregate supply. A positive real exchange rate shock generates an increase in the cost of imported raw material which in turn reduces raw materials importation thereby reduces aggregate supply level (Cottanni, et al 1990; Papazoglou, 1999). Further empirical investigation suggested by Cottani, Cavallo, and Khan, (1990) revealed that real exchange rate stability and minimum exchange rate misalignment are the vehement condition for improvement of economic performance of small and open developing nations like that of Africa, Latin America and Asia.

Early studies on exchange rate misalignment and growth by Razin and Collins (1997) argued that the policy of keeping the real exchange rate depreciated is generally associated with competitive devaluation policies to stimulate a country's export sector. Empirical result shows that growth is higher in countries with more undervalued real exchange rates and the effect is linear and similar

for both under and overvaluation, implying that an overvalued real exchange rate hurts growth while an undervalued rate fosters growth. The magnitude and statistical significance of the estimated coefficient for real exchange rate undervaluation is higher for developing countries due to the fact that such countries are often characterized by institutional fragility and market failures. (Donald and Vieira, 2010)

Established that exchange rate misalignment affect growth, the possible channels through which the real exchange rate might have an impact on long-run economic growth was investigated by Eichengreen (2008). The author noted that a combination of depreciated real exchange rate and low volatility could be regarded as a favorable combination for developing and emerging economies, where a more dynamic export sector is usually an important part of the process for achieving higher and sustained economic growth rates. Thus a depreciated real exchange rate as long as this is not associated with higher exchange rate volatility could be responsible for higher growth.

Studies from African Countries

The effect of other macroeconomic variables on exchange rate misalignment was also investigated. According to Edwards (1994) macroeconomic induced misalignment occurs when inconsistencies between macroeconomic policies, particularly monetary policy, and the official nominal exchange rate cause the RER to depart from its equilibrium value. Ndhlela, (2010) noted that expansive monetary policy that is incompatible with the predetermined nominal exchange rate will cause domestic goods prices to rise faster than world inflation. This will effectively result in a RER appreciation. In structural misalignment, changes in the determinants of the equilibrium RER are not immediately translated into actual changes in the RER. As a result, temporary changes in fundamentals can lead to major deviations of the actual RER from its equilibrium.

The nexus between export competitiveness and economic growth was expounded by Ndhlela, (2010). The author demonstrated that domestic firms producing goods in competition with foreign firms incur higher costs than their foreign counterparts resulting in reduced profitability. Reduction of profitability, however, leads to declining investment and exports, thus hurting growth adversely.

DeGrauwe, Janssens and Lelianert (1984) as reported in Cham (2010) used cross-sectional data to investigate the effect of inflation and monetary disturbances on real exchange rate variability. Their result supports the proposition that an increase in inflation and monetary disturbances increases real exchange rate variability. While, DeGrauwe and Rosiers (1984) developed a model to include the degree of openness of an economy variable in addition to monetary disturbance. Their model predicted that both variables positively influenced the real exchange rate variability. Their findings supports the hypothesis that monetary disturbance increases real exchange rate instability.

Kuikou (2010) investigated the effect of long – run relationship between the real exchange rate and its “fundamentals” in Cameroon. The result thus shows that the coefficient on capital stock have the predicted sign, while the hypothesis of output convergence is not rejected since the adjustment coefficient in all cases is negative and statistically. Overall, the empirical result suggested that economic performance in Cameroon is adversely affected by the misalignment of the real exchange rate.

Ndhlela (2010) investigated the implications of real exchange rate misalignment on growth performance of Zimbabwe. The paper provides evidence in support of the hypothesis that RER misalignment has been a major factor behind the growth slowdown and, ultimately, the evolution of the macroeconomic crisis in Zimbabwe. The results confirm that RER misalignment is the most significant factor affecting growth in both the short and the long run. An increase in level of RER misalignment is found to negatively impact on growth performance, the results nevertheless indicate that an increase in overvaluation hinders growth while undervaluation promotes it. Overall, the empirical evidence provides reasonable support for the conclusion that keeping the RER at levels close to, or below, equilibrium will promote growth.

Limi (2006) undertook an analysis of Exchange Rate Misalignment in Botswana, while applying the Behavioral Equilibrium Exchange Rate (BEER) for the period 1985-2004. The empirical result found that the Botswana pula seems to have been undervalued in the late 1980s and overvalued by 5 to 10 percent in recent years, though the misalignment in the 1990s seems to have been very marginal. The result further revealed that the equilibrium real exchange rate increases with the domestic real interest rate and decreases with foreign interest rates. Thus, any increase in the relative prices of nontradables to tradables will results in a significant appreciation of the external real exchange rate. This, result conforms with the conventional

329 Balassa-Samuelson effect.

330

331 Sallenave (2010) investigated the link between real exchange rate misalignments and economic
 332 growth for a panel of countries including both emerging and industrial economies, while
 333 assessed their impact on economic growth using dynamic panel data techniques in order to
 334 address both the issue of unobserved country-specific effects and the possibility of endogeneous
 335 regressors. The result revealed a negative and significant relationship between growth and real
 336 exchange rate misalignments. This result further highlights that countries that pursue major and
 337 appropriate exchange rate reforms to reduce real exchange rate misalignment are very likely to
 338 record gains in real per-capita GDP. In other words, it should be relevant for countries, especially
 339 emerging countries, to maintain their real exchange rate at its appropriate level.

340

341 Ghura and Grennes (1993) as reported in Toulaboe (2010) based on pooled time series and cross-
 342 section data for 33 Sub-Saharan African countries, found a negative relationship between RER
 343 misalignment and economic performance. They concluded that inappropriate domestic
 344 macroeconomic, trade, and exchange rate policies appear to be one of the important factors that
 345 contributed to the economic distress in virtually all Sub-Saharan African countries. Klau (1998)
 346 found that one of the main causes of poor economic performance in the CFA zone from mid-
 347 1980s to early 1990s was the CFA franc overvaluation during that period.

348

349 Literatures from researchers in Nigeria have also attempted to expound on the effect of exchange
 350 rate on economic growth. Akinbobola and Oyetayo, (2010) showed that a wrong exchange rate
 351 policy can turn out to be harmful to an economy. An undervalued exchange rate result in excess
 352 in the current account of balance of payment (BOP); depresses the standard of living, while
 353 overvalued exchange rate artificially raises the standard of living above the productivity level.
 354 Obadan,(1994) have opined that excess in current account of BOP are financed by depleting
 355 foreign exchange reserve or incurring external debt. Thus, actual exchange rates and target real
 356 exchange rate deviation are results of a lack of adjustment to changes in economic fundamentals.

357

358 Omojimate and Oriavwote (2012) examine whether a link exists between the Naira real exchange
 359 rate and macroeconomic performance and tested for the existence of 'Balassa-Samuelson' (1964)
 360 hypothesis in Nigeria using data covering 1970 to 2009. The result of the Johansen cointegration
 361 test suggests that a long-run relationship exists among the level of technological productivity,
 362 foreign private investment, the ratio of government expenditure to Gross Domestic Product and

the real effective exchange rate in Nigeria. The result further indicates that both government's consumption and investment appreciates the real effective exchange rate. The author noticed that there seems to be a bias in the overall real exchange rate, because productivity advances tend to be concentrated on the tradable goods sector.

Akinbobola and Oyetayo (2010) undertook an econometric analysis of real exchange rate and domestic output growth in Nigeria using data from 1986 to 2004. Their study revealed that real exchange rate has positive impact on output growth after a considerable lag. The outcome of this result implies that revaluation or appreciation of real exchange rate might be growth enhancing provided that a realistic exchange rate policy can be ensured. Further analysis reveal that openness, financial development, inflation rate and government consumption are all together negatively related to output growth in Nigerian economy. The conclusion of their study noted that outcomes showed that output growth would be promoted if real exchange rate is allowed to appreciate so far it operates through aggregate supply channel and not aggregate demand channel.

Methodology of Research

Several models have been used by researchers to estimate the impact of real exchange rate misalignment on macroeconomic variables, particularly, in developing countries. Usman (2011) applied the Vector Error Correction Model (VECM) to empirically suggest the relationship between real Exchange Rate misalignment and Macroeconomic performance in Nigeria. This study will deviate slightly from previous studies by applying the Vector Autoregressive Model (VAR). This choice of this model is predicated on the premise that Vector Auto Regression model best captures the two-way relationship between exchange rate misalignment, oil prices and other variable using their related lags. What makes the VAR model unique according to Ojapinwa and Ejumedia(2010) is that an endogenous variable in one equation of the system appears in another equation as an explanatory variable thereby becoming stochastic and correlated with the disturbance term (Shock or impulse term) of the equation. Thus, the VAR model does not make distinctions between endogenous and exogenous variables.

Following the argument above the study adopts the autoregressive framework developed by Sims (1980) and thus specifies a VAR model of order p. The general form of a VAR model is given by the following unrestricted (reduced form) system

$$Z_t = \alpha + \sum_{i=1}^p \beta_i Z_{t-1} + U_t \text{ ----- } 1$$

Equation (1) above specifies a VAR (P) process, Where Z_t is a vector of stationary endogenous Variables, α is an $n \times 1$ vector of constants, β is an $(n \times n)$ matrix of coefficients, p is the number of lag, U_t is an $(n \times 1)$ vector of error term. In addition, u is an independently and identically distributed with zero mean, i.e $E(U_t) = 0$ and $E(U_{tk}, U_{sk}) = 0$ for $t \neq s$). The disturbance term, U_t also has a covariance.

Specifically, the study shall employ the unit root test to detect the order of integration of the variables using the Augmented Dickey Fuller (ADF) and the Philip Perrone (PP) test. The study shall also test for co-integration using the Johansen approach which is suitable for VAR model. Impulse response shall be performed to demonstrate how the dependent variables in a VAR system respond to the shocks of each of the explanatory variables. If there are n variables in the system, then n^2 impulse responses can be generated. This is achieved by expressing the VAR model as a vector moving average and if the system is stable the shock should generally die out.

The model to be estimated has the real exchange rate (REER), real oil prices measured by the domestic price of crude oil deflated by the Consumer Price Index, domestic investment, level of openness of the economy to trading partners measured by terms of trade and technological productivity measured by the index of industrial production.

3.2 Model Specification

The model could be linearly stated as:

$$REER_t = \alpha + \sum_{i=1}^{p-1} \beta_{ij} REER_{t-1} + \sum_{i=1}^{p-1} \delta_{ij} OILP_{t-1} + \sum_{i=1}^{p-1} \delta_{ij} INV_{t-1} + \sum_{i=1}^{p-1} \psi_{ij} TOTP_{t-1} + \sum_{i=1}^{p-1} \phi_{ij} TECP_{t-1} + \sum_{i=1}^{p-1} \theta_{ij} GDP_{t-1} + U_{it}$$

$$OILP_t = \alpha + \sum_{i=1}^{p-1} \beta_{ij} OILP_{t-1} + \sum_{i=1}^{p-1} \delta_{ij} REER_{t-1} + \sum_{i=1}^{p-1} \delta_{ij} INV_{t-1} + \sum_{i=1}^{p-1} \psi_{ij} TOTP_{t-1} + \sum_{i=1}^{p-1} \phi_{ij} TECP_{t-1} + \sum_{i=1}^{p-1} \theta_{ij} GDP_{t-1} + U_{it}$$

$$INV_t = \alpha + \sum_{i=1}^{p-1} \beta_{ij} INV_{t-1} + \sum_{i=1}^{p-1} \delta_{ij} OILP_{t-1} + \sum_{i=1}^{p-1} \delta_{ij} REER_{t-1} + \sum_{i=1}^{p-1} \psi_{ij} TOTP_{t-1} + \sum_{i=1}^{p-1} \phi_{ij} TECP_{t-1} + \sum_{i=1}^{p-1} \theta_{ij} GDP_{t-1} + U_{it}$$

$$TOTP_t = \alpha + \sum_{i=1}^{p-1} \beta_{ij} TOTP_{t-1} + \sum_{i=1}^{p-1} \delta_{ij} OILP_{t-1} + \sum_{i=1}^{p-1} \delta_{ij} INV_{t-1} + \sum_{i=1}^{p-1} \psi_{ij} REER_{t-1} + \sum_{i=1}^{p-1} \phi_{ij} TECP_{t-1} + \sum_{i=1}^{p-1} \theta_{ij} GDP_{t-1} + U_{it}$$

$$TECP_t = \alpha + \sum_{i=1}^{p-1} \beta_{ij} TECP_{t-1} + \sum_{i=1}^{p-1} \delta_{ij} OILP_{t-1} + \sum_{i=1}^{p-1} \delta_{ij} INV_{t-1} + \sum_{i=1}^{p-1} \psi_{ij} TOTP_{t-1} + \sum_{i=1}^{p-1} \phi_{ij} REER_{t-1} + \sum_{i=1}^{p-1} \theta_{ij} GDP_{t-1} + U_{it}$$

$$GDPP_t = \alpha + \sum_{i=1}^{p-1} \beta_{ij} GDP_{t-1} + \sum_{i=1}^{p-1} \partial_{ij} OILP_{t-1} + \sum_{i=1}^{p-1} \delta_{ij} INV_{t-1} + \sum_{i=1}^{p-1} \psi_{ij} TOTP_{t-1} + \sum_{i=1}^{p-1} \phi_{ij} REER_{t-1} + \sum_{i=1}^{p-1} \theta_{ij} TECPP_{t-1} + U_{it}$$

Where are β , δ , ψ , ϕ , ∂ , θ the unknown parameters, α is the constant, n is no of lags and REER (Real Exchange Rate), OILP (Domestic Oil Prices), INV (Domestic Investment represented by Gross Fixed Capital Formation), TOTP (Openness of Trade), TECP (Technological progress represented by the index of industrial production) and GDP (Gross Domestic Production)

Presentation of result

The result of the unit root is presented below

Table 1. Result of the unit root test

Variables	Level difference	1 st difference	Order of integration	Remark
Lopen	-0.29354	-3.24528	1(1)	Stationary
LGDP	-0.11779	-3.40514	1(1)	Stationary
LTECP	-1.8995	-4.02277	1(1)	Stationary
LINV	-0.6596.8	-5.92231	1(1)	Stationary
OILP	-2.26782	-5.24256	1(1)	Stationary
LREER	-1.49723	-3.88251	1(1)	Stationary

***significant at 5% level, ADF test > Critical value, then the variable is stationary**

ADF statistics was used to test for the existence of a unit root. The result in table 1 above rejected the hypothesis that a unit root exist at a critical value of -2.9665. The result therefore summarizes that all the variable were stationary after first differencing since their ADF test statistics were greater than the critical values.

The study further went to test for the existence of a long-run relationship between real exchange rate and the independent variables in the model using the Johansen's full information maximum likelihood.

476 Table 2: Result of the Cointegration Test

477

Series: LOPEN1 LGDP1 LMANSEC1 LGFCF1 OILP1 LREER1
Lags interval: 1 to 1

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.845870	126.7032	94.15	103.18	None **
0.582305	72.47447	68.52	76.07	At most 1 *
0.490414	47.15739	47.21	54.46	At most 2
0.398510	27.60688	29.68	35.65	At most 3
0.341577	12.86484	15.41	20.04	At most 4
0.025380	0.745514	3.76	6.65	At most 5

478 (***) denotes rejection of the hypothesis at 5%(1%) significance level. L.R. test indicates 2 cointegrating
479 equation(s) at 5% significance level

480 The Eigenvalue statistic and likelihood function p-values in table 2 revealed that there exist
481 cointegration at most 1 with at least 2 cointegrating equation among the variables at 5 per cent.
482 This is because their values exceed the critical values at the 0.05 level which implies that a long-
483 run relationship exists among the REER, OILP, INV, TECHP, GDP and OPEN.

484

485 Discussion of findings

486 Following the assumption that a long-run relationship exists between the variables, the study
487 proceeded to test for simultaneous independent relationship between each of the variables using
488 the VAR model specified previously. The result indicates that oil prices positively influences
489 Technical Progress (TECHP) and Gross Domestic Product (GDP). However, the magnitude of
490 the positive impact is quite small. For instance, Oil prices influence Technical Progress by 1
491 percent, while the influence of oil price on gross domestic product was just 2 percent. The result
492 empirically reveals that the price of crude oil does not translate to improvement in technical
493 progress of the industries as well as the gross domestic product in Nigeria. Thus, fluctuations in
494 the oil prices put the country at a worse-off position, especially as the country depends on the
495 predictions of oil prices to fix its domestic budgets.

496

497 The VAR and GARCH results reveal that real exchange rate fluctuations are significantly
498 influenced by oil price fluctuation. An increase in oil prices will increase real exchange rate
499 fluctuation in the previous two years. The result of the GARCH variance shows that real
500 exchange rate fluctuation depends on oil price fluctuation with GARCH coefficients and z-
501 statistics as 1.205145 and 3.93654. The p-value indicates the significance of the GARCH
502 statistics. Thus the result reveals that real oil price has statistically significant and positive effect
503 on real effective exchange rate. A rise in oil prices would translate to increase foreign exchange.

504

Table 3. Result of GARCH variance with LREER as the dependent variable

	Coefficient	Std.Error	z-statistics	Prob
ARCH(1)	-0.299265	0.409718	-0.730417	0.4651
GARCH(1)	1.205145	0.306143	3.936543	0.0001

It is interesting to note the revelation of the VAR result in table 3 that oil prices do not translate to positive influence on domestic investment in Nigeria. The result shows that oil price and real exchange rate are negatively related with gross investment in Nigeria. Fluctuations in real exchange rate and oil prices have a significant negative impact on investment in Nigeria. This result informs us that capital expenditure on investment is not finance from oil revenue in Nigeria. Investment on capital project such as roads, infrastructure, electricity, etc may have been made from other sources of revenue outside oil revenue. Furthermore, the result underscores the reason for appropriation of excess proceeds from crude oil among the tiers of government. The result shows that funds appropriated are often misguidedly spent on items that do not promote development and investment in Nigeria.

The study indicates that openness of the economy has a positive relationship with real exchange rate in the previous one year, but also exhibits a negative relationship in the next two previous years. A rise in export goods could make available more supply of foreign exchange.

The result of the granger causality test shows that there exists a unidirectional causality running from GDP and oil price (OILP). Also, the result further shows that there exists a unidirectional causality running from OPEN to GDP. There also exists a unidirectional causality running from GDP to INV in Nigeria. This result significantly reveals that oil price does not granger cause economic growth in Nigeria. However, importantly, the result reveals that GDP granger causes Investment in Nigeria. Significantly, the result reveals that there exist a unidirectional causality running from oil prices to real exchange rate.

Summary of Findings

The study proposed three hypothesis earlier in the study, viz that (a) there is no significant relationship between oil price shock and exchange rate fluctuation in Nigeria.(b) Fluctuation in oil prices significantly affects domestic investment and economic growth in Nigeria (c) Openness of the economy does not significantly influence exchange rate fluctuation in Nigeria. In order to test this hypothesis the study utilised the Vector Autoregressive Model (VAR) basically because it allows us to analyse and present the individual influence of each variable on the other. The VAR model also allows us to examine if a long run relationship does exist between the variables in the model. Before the application of the VAR model, the study tested

each variable for the existence of a unit root. The study rejected the existence of unit root in each variable since all the variables were integrated after their first differencing, i.e 1(1). The study further revealed that there exists a long run relationship between the variables in the model. That is to say, fluctuations in the short run could be corrected in the long run and equilibrium situation re-established.

The study also tested for granger causality between the variables in the model. The study summerised that there also exists a unidirectional causality running from GDP to INV in Nigeria. This result significantly reveals that oil price does not granger cause economic growth in Nigeria. Most importantly, the result reveals that there exist a unidirectional causality running from oil prices to real exchange rate. That is it say that oil price shocks determines the fluctuations in exchange rate in Nigeria.

Furthermore, the VAR and GARCH results reveal that real exchange rate fluctuations are significantly influenced by oil price fluctuation. An increase in oil prices will increase real exchange rate fluctuation in the previous two years. The result of the GARCH variance shows that real exchange rate fluctuation depends on oil price fluctuation with GARCH coefficients and z-statistics as 1.205145 and 3.93654. The p-value indicates the significance of the GARCH statistics. Also, the study indicates that openness of the economy has a positive relationship with real exchange rate in the previous one year, but also exhibits a negative relationship in the next two previous years. A rise in export goods could make available more supply of foreign exchange

Conclusion

This research shows how important oil price is in determining fluctuations in real exchange rate. The result reveals that oil price is the major source of fluctuation so experienced in exchange rate in Nigeria. The research shows that there exists a long-run relationship between exchange rate and oil price, that is to say, if appropriate policies are applied, deviations from real exchange rate equilibrium arising from oil price fluctuations could be corrected in the long run. There are three important implications of the findings of this paper. First, the paper finds that oil price plays a significant role both in determining the long-run equilibrium level and in the short-run adjustment process of the real exchange rate. Furthermore, the study reveals that the direction of the causality seems to be from real oil price to the exchange rate, implying that the policies should not concentrate on foreign exchange rates in the face of an oil price shock as they will

most likely to fail. Thus monitoring and appropriately forecasting the oil price will reduce the fluctuations and shocks that may possibly affect real exchange rate. Revaluation or appreciation of real exchange rate might be growth enhancing provided that a realistic exchange rate policy can be ensured. To this end, monetary authorities in Nigeria should be better equipped to stabilize the value of the currency given that there exists a long-run mechanism between both variables.

The study also revealed that oil prices do not translate to improvement in GDP and Investment in Nigeria. The possible reason for this could be related to (1) leakages in the revenue that accrue from crude oil and (2) incessant vandalisation of pipeline and oil installations in Nigeria which probably could lead to under production of crude oil product (3) Ethnic violence and youth restiveness, particularly, among the Niger Delta region of Nigeria. This action has often resulted to work stoppages and consequent vandalization of oil installations, which thus reduces crude oil export.

The study revealed that fluctuations in real exchange rate and oil prices has significant impact on reducing economic growth and investment in previous two years in Nigeria. This result puts to doubt Balassa-Samuelson's (1964) hypothesis that rapid economic growth is accompanied by real exchange rate appreciation due to differential productivity growth between tradable and non-tradable sectors. The reason for the contradictory accession could be related to dualism of Nigeria's oil trade pattern. Benefits from crude oil export that could have been utilized for domestic investment is rubbed off by the protracted importation of refined crude oil products, thus leaving the nation worse-off.

Recommendation

In the light of the discussion the following recommendation

1. Government should intensify effort at fighting oil subsidy scandal that engulfed the downstream sector. This will reduce the fictitious importation and plug leakages that drain out oil revenue in Nigeria.
2. Monetary authorities should appropriately forecast oil prices so as to reduce the effect of fluctuations. Wrong forecast of oil prices could generate endogenous shocks that could create room for exchange rate fluctuations, thus reducing revenue derived from exports of tradeable goods.

605 3. The government should ensure the prudent management of oil receipts. Particularly,
 606 revenue receipt should be directed towards capital investment activities. This apart from
 607 helping the economy become more productive in the long-run, it will also reduce
 608 volatility in fiscal policy which often leads to heavy domestic debt burden on the
 609 government.

610 4. Government should make concerted efforts at increasing investment and participation in
 611 the non-oil sector of the economy. This will strengthen the industrial base of the
 612 economy, promote production of more tradeable goods for export and increase economic
 613 growth.

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Cointegration Result

Date: 03/05/13 Time: 02:03

Sample: 1980 2010

Included observations: 29

Test
assumption:
Linear
deterministic
trend in the
data

Series: LOPEN1 LGDP1 LMANSEC1 LGFCF1 OILP1 LREER1

Lags interval: 1 to 1

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.845870	126.7032	94.15	103.18	None **
0.582305	72.47447	68.52	76.07	At most 1 *
0.490414	47.15739	47.21	54.46	At most 2
0.398510	27.60688	29.68	35.65	At most 3
0.341577	12.86484	15.41	20.04	At most 4
0.025380	0.745514	3.76	6.65	At most 5

*(**) denotes
rejection of the
hypothesis at
5%(1%)
significance
level
L.R. test
indicates 2
cointegrating
equation(s) at
5%
significance
level

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VAR Result

Date: 03/05/13 Time: 02:13

Sample(adjusted): 1982 2010

Included observations: 29 after adjusting endpoints

Standard errors & t-statistics in parentheses

	LTECHP1	LGDP1	OILP1	LREER1	LGFCF1	LOPEN1
LTECHP1(-1)	0.728463 (0.20398) (3.57131)	-0.175346 (0.32138) (-0.54561)	12.37779 (15.2397) (0.81221)	0.709171 (1.04976) (0.67556)	4.248447 (1.02908) (4.12840)	1.025116 (0.73325) (1.39804)
LTECHP1(-2)	-0.013247 (0.21814) (-0.06073)	0.233352 (0.34369) (0.67896)	-11.10313 (16.2976) (-0.68127)	0.290710 (1.12264) (0.25895)	-3.484407 (1.10052) (-3.16614)	0.535201 (0.78415) (0.68252)
LGDP1(-1)	0.480259 (0.14713) (3.26422)	1.049756 (0.23181) (4.52852)	-8.016713 (10.9924) (-0.72930)	0.462063 (0.75719) (0.61023)	-0.466445 (0.74227) (-0.62840)	1.006123 (0.52889) (1.90232)
LGDP1(-2)	-0.259836 (0.13983) (-1.85823)	-0.100268 (0.22031) (-0.45512)	10.96361 (10.4471) (1.04944)	-0.118998 (0.71963) (-0.16536)	1.816767 (0.70545) (2.57532)	0.066461 (0.50266) (0.13222)
OILP1(-1)	0.001237 (0.00335)	0.002180 (0.00528)	-0.147226 (0.25044)	0.009796 (0.01725)	-0.008633 (0.01691)	-0.001671 (0.01205)

	(0.36888)	(0.41275)	(-0.58786)	(0.56784)	(-0.51050)	(-0.13863)
OILP1(-2)	0.000471 (0.00338) (0.13936)	-0.001723 (0.00533) (-0.32346)	-0.198276 (0.25258) (-0.78500)	0.022927 (0.01740) (1.31776)	0.001350 (0.01706) (0.07916)	-0.002275 (0.01215) (-0.18717)
LREER1(-1)	0.034158 (0.03971) (0.86015)	0.081547 (0.06257) (1.30333)	-4.703058 (2.96696) (-1.58515)	0.405998 (0.20437) (1.98654)	-0.354732 (0.20035) (-1.77058)	0.161502 (0.14275) (1.13133)
LREER1(-2)	0.007981 (0.04177) (0.19106)	-0.045780 (0.06581) (-0.69561)	-1.225171 (3.12084) (-0.39258)	0.459020 (0.21497) (2.13523)	0.149448 (0.21074) (0.70916)	0.038398 (0.15016) (0.25572)
LGFCF1(-1)	0.018927 (0.03304) (0.57290)	-0.092717 (0.05205) (-1.78121)	3.157658 (2.46832) (1.27927)	-0.057835 (0.17003) (-0.34015)	0.444589 (0.16668) (2.66737)	-0.007384 (0.11876) (-0.06217)
LGFCF1(-2)	4.56E-05 (0.03242) (0.00141)	0.084197 (0.05108) (1.64841)	-2.422881 (2.42210) (-1.00032)	-0.477071 (0.16684) (-2.85941)	-0.524278 (0.16356) (-3.20550)	-0.056899 (0.11654) (-0.48824)
LOPEN1(-1)	-0.050426 (0.07000) (-0.72032)	0.290147 (0.11030) (2.63059)	-2.139135 (5.23027) (-0.40899)	0.341658 (0.36028) (0.94832)	-0.672699 (0.35318) (-1.90469)	0.074251 (0.25165) (0.29506)
LOPEN1(-2)	-0.204831 (0.08237) (-2.48683)	-0.266371 (0.12977) (-2.05258)	6.745668 (6.15382) (1.09618)	-0.291129 (0.42390) (-0.68679)	0.537625 (0.41555) (1.29378)	-0.252006 (0.29609) (-0.85112)
C	0.476653 (0.42531) (1.12071)	0.085338 (0.67011) (0.12735)	-32.48826 (31.7765) (-1.02240)	-2.196974 (2.18887) (-1.00370)	-4.121623 (2.14575) (-1.92083)	-3.374235 (1.52891) (-2.20695)
R-squared	0.813679	0.997166	0.619556	0.970321	0.970616	0.987624
Adj. R-squared	0.673939	0.995040	0.334223	0.948061	0.948579	0.978342
Sum sq. Resids	0.028522	0.070803	159.2097	0.755438	0.725965	0.368573
S.E. equation	0.042221	0.066522	3.154458	0.217290	0.213009	0.151776
F-statistic	5.822794	469.0731	2.171345	43.59131	44.04332	106.4037
Log likelihood	59.25429	46.07047	-65.84165	11.74321	12.32024	22.14927
Akaike AIC	-3.189951	-2.280722	5.437355	0.086675	0.046880	-0.630984
Schwarz SC	-2.577025	-1.667796	6.050281	0.699601	0.659806	-0.018058
Mean dependent	2.133795	6.041192	3.280161	1.707887	3.971133	5.455074
S.D. dependent	0.073940	0.944526	3.865987	0.953440	0.939347	1.031326
Determinant Residual		4.79E-11				
Covariance						
Log Likelihood		97.65546				
Akaike Information Criteria		-1.355549				
Schwarz Criteria		2.322005				

GARCH Result

Dependent Variable: LREER1

Method: ML - ARCH

Date: 03/05/13 Time: 03:36

Sample: 1980 2010

Included observations: 31

Convergence achieved after 40 iterations

	Coefficient	Std. Error	z-Statistic	Prob.
C	-4.569983	3.394954	-1.346110	0.1783
LOPEN1	1.094723	0.590552	1.853727	0.0638
LGDP1	-0.188379	0.646648	-0.291316	0.7708
LMANSEC1	0.669800	1.570237	0.426560	0.6697
OILP1	-0.047379	0.029491	-1.606558	0.1082
LGFCF1	0.031474	0.275468	0.114256	0.9090
Variance Equation				
C	0.008456	0.009247	0.914439	0.3605
ARCH(1)	-0.299265	0.409718	-0.730417	0.4651
GARCH(1)	1.205145	0.306143	3.936543	0.0001
R-squared	0.905374	Mean dependent var		1.600204
Adjusted R-squared	0.870964	S.D. dependent var		1.011039
S.E. of regression	0.363181	Akaike info criterion		0.889637
Sum squared resid	2.901809	Schwarz criterion		1.305956
Log likelihood	-4.789376	F-statistic		26.31170
Durbin-Watson stat	1.278747	Prob(F-statistic)		0.000000

Result of Granger Causality test

Pairwise Granger Causality Tests

Date: 03/05/13 Time: 02:18

Sample: 1980 2010

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
LGDP1 does not Granger Cause LOPEN1	29	2.05631	0.14987
LOPEN1 does not Granger Cause LGDP1		9.13778	0.00112
LMANSEC1 does not Granger Cause LOPEN1	29	1.95106	0.16402
LOPEN1 does not Granger Cause LMANSEC1		0.58389	0.56545
LGFCF1 does not Granger Cause LOPEN1	29	1.30360	0.29010
LOPEN1 does not Granger Cause LGFCF1		6.33990	0.00616
OILP1 does not Granger Cause LOPEN1	29	0.93284	0.40724
LOPEN1 does not Granger Cause OILP1		2.20973	0.13157
LREER1 does not Granger Cause LOPEN1	29	2.15289	0.13805
LOPEN1 does not Granger Cause LREER1		1.42092	0.26109
LMANSEC1 does not Granger Cause LGDP1	29	1.68270	0.20707
LGDP1 does not Granger Cause LMANSEC1		2.41019	0.11121
LGFCF1 does not Granger Cause LGDP1	29	0.73940	0.48796
LGDP1 does not Granger Cause LGFCF1		14.5660	7.2E-05
OILP1 does not Granger Cause LGDP1	29	0.55030	0.58388
LGDP1 does not Granger Cause OILP1		3.11061	0.06292
LREER1 does not Granger Cause LGDP1	29	1.72431	0.19966
LGDP1 does not Granger Cause LREER1		1.24984	0.30454
LGFCF1 does not Granger Cause LMANSEC1	29	0.73639	0.48935
LMANSEC1 does not Granger Cause LGFCF1		2.07414	0.14761
OILP1 does not Granger Cause LMANSEC1	29	0.01923	0.98097
LMANSEC1 does not Granger Cause OILP1		0.09554	0.90923
LREER1 does not Granger Cause LMANSEC1	29	0.56471	0.57590

UNDER PEER REVIEW

LMANSEC1 does not Granger Cause LREER1		1.15280	0.33263
OILP1 does not Granger Cause LGFCF1	29	0.70477	0.50417
LGFCF1 does not Granger Cause OILP1		2.78788	0.08153
LREER1 does not Granger Cause LGFCF1	29	2.50167	0.10308
LGFCF1 does not Granger Cause LREER1		3.48543	0.04689
LREER1 does not Granger Cause OILP1	29	0.95790	0.39789
OILP1 does not Granger Cause LREER1		3.59716	0.05835

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