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Real Exchange Returns and Real Stock Price Returns in Nigeria: An Econometrics Analysis of the Direction of Causality

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Abstract

This paper examined the causal relationship between real exchange rate returns and real stock price returns in Nigeria from January 1985- June 2017. For the investigation the VAR/pair-wise granger causality test and Sims-causality test were applied. From the evidences shown, there exist a unidirectional causal relationship between real exchange rate returns and real stock price returns. Causality running from Real exchange rate returns to real stock price returns. Thus, the past values of REXR can influence/predict the present value of RSPR. This confirms the findings of Olugbenga (2012) and the proposition of the flow oriented model. Also, evidences from the sims-Causality test show that there is uni-directional causality running from Real exchange rate returns to real stock price returns. Thus, the present value of REXR can influence/predict the future values of RSPR. Therefore, it is important for the monetary authority of Nigeria to put into due consideration the exchange rate policy in its conduct of monetary policy internally. Investors could also use these findings as an effective tool in stock trading. As movement in the foreign exchange market (real exchange rate returns) could have a great impact on the present and future movement of stock exchange market (real stock price returns) in Nigeria.

Keywords: Real exchange rate returns; Real stock price returns; VAR/pair wise causality test; Sims-causality test flow oriented model; Exchange rate policy; Monetary policy; Monetary authority; Stock trading; Foreign exchange market; Stock exchange market.

1. Introduction

The emergence of the interactions among Economies of the world has led to increased interest in the empirical relationship between stock price returns and exchange rate returns in both the developed and developing economies of the world. Theoretical evidence shows that there exists a causal relationship between these variables; the direction of causality however, is inconclusive as different theories suggest causality running from different channels (Branson, 1983; Dornbusch and Fisher, 1980). Although theories suggest the existence of causality, empirically, both in developing and developed economies of the world, the relationship between stock price returns and exchange rate returns is mixed. Some studies found the relationship channel to be from exchange rate to stock price (Khalid, 2012; Lean *et al.*, 2011; Olugbenga, 2012; Pan *et al.*, 2007) others observed the relationship running from stock price to exchange rate (Adebiyi *et al.*, 2010; Mutiu *et al.*, 2012; Yusuf and Rahman, 2012). Interestingly, some studies observed both variable to be endogenous in the system (Aliyu, 2009; Dong *et al.*, 2005), that is, the channel of movement could be from both ends, while some other authors such as Zia and Rahman (2011) showed that both variables are exogenous in the system. Thus, there is yet no consensus about the direction of causality which makes generalization impossible.

The mixed and inconclusive result compels the re-examination of the relationship between real exchange rate returns and real stock price returns using Nigeria as a case study. The study is different from other studies in the following ways. Firstly, most empirics on the causality of exchange rate-stock price have used methodology that only consider the predictive ability of past values of the variables i.e. pair wise granger causality, VAR granger causality etc. Thus, this study attempts to examine not only the predictive ability of past values but also the forecast ability of each of the variable i.e. using the current to predict the future. Secondly, the study employs monthly data over a long period of time. This would help improve the significance and robustness of the result obtained. Thirdly, to the best of our knowledge no recent study has used the real returns in examining the direction of causality between the variables. Only very few have used the real values of the variable but not the real Returns i.e. real stock price and real exchange rate and not real exchange rate and real stock price returns. And where returns were used they were not used in their real values. In the Light of these additions, the study seeks to determine the predictive ability of the past values of real exchange rate returns on real stock price returns and vice-versa and also the forecast ability of Real exchange rate returns on Real Stock price returns and vice-versa.

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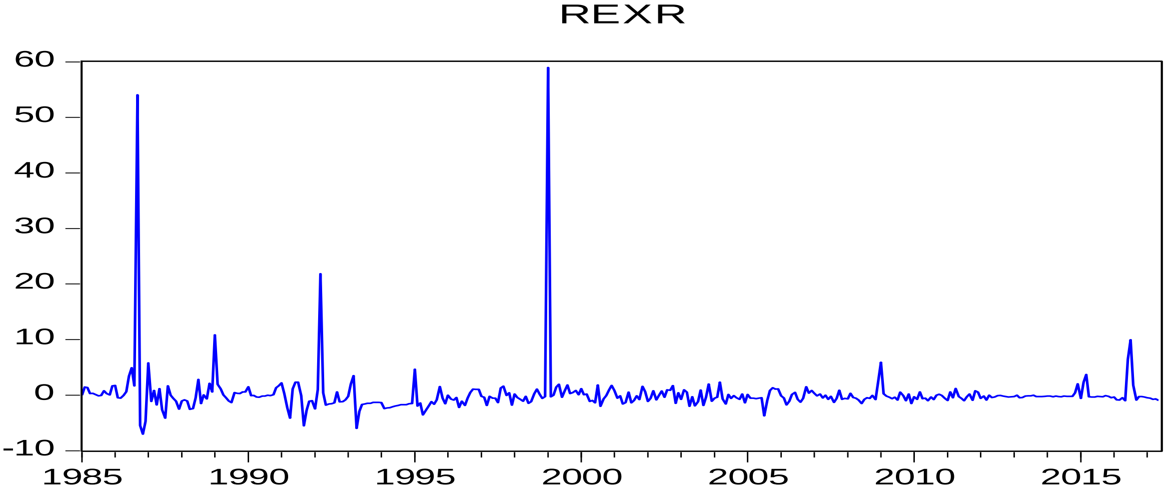
The rest of the paper is structured as follows; Section 2 contains a trend analysis of real exchange rate returns and real stock price returns in Nigeria. Section 3 contains a succinct review of the literature on the direction of causality between real exchange rate returns and real stock price returns Section 4 presents the methodology and model specification. The results are presented and discussed in section 5. Section 6 concludes with implication for policy analysis.

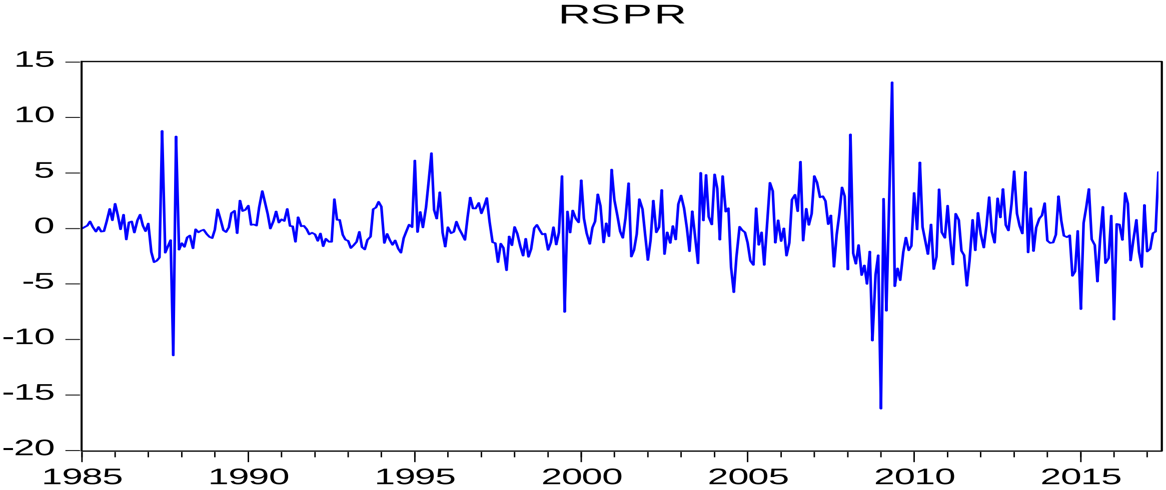
2. Trend Analysis of Real Exchange Rate Returns and Real Stock Price Returns

The study adopts a regime specific analysis of the movement of real exchange rate returns and real stock price returns over the study period, effectively splitting the data into 6 regimes on the criteria that a regime lasts at least up to two years to be put into consideration. The first regime period commences from 1985 and terminates in 1993 (General Ibrahim Babangida military regime). Real exchange rate returns over the regime change by an average 0.5392% on a monthly basis over the period constituting the first regime with a standard deviation of 6.1767%, a minimum value of -6.9997 in November 1986 and a maximum value of 54.07685 in September 1986. Real stock price returns in the same period changed by a mean value of 0.02776% and a standard deviation of 2.0556%, a minimum value of -11.4275% and a maximum value 8.8011%. The second regime encompasses the Shonekan interim regime and Abacha/Abdulsalam military Regimes from September 1993 to May 1999. Real exchange returns in this period changed by an average of 0.1614% while real stock price returns changed monthly by an average of 0.0914% and standard deviations of 7.3067% and 1.9356% for real exchange rate returns and real stock price returns respectively. The third regime comprise the Olusegun Obasanjo from May 1999 to May 2007. Real exchange rate returns and real stock price returns changed on the average by -.0.1424% and 0.6378% monthly respectively, with respective standard deviations of 1.0602% and 2.5070% respectively. The fourth and fifth regimes cover a time period of May 2007 to May 2015, and cover the Yar'adua and Jonathan's presidency. The values of real exchange rate returns and real stock price returns changed monthly on an average by -0.1279% and -0.5558% respectively, with a standard deviations of 0.9858 and 3.6468 respectively. The sixth regime, the Buhari regime from May 2015 to July 2017 real exchange rate returns and real stock price returns changed monthly by mean values of 0.2846% and -0.5911% respectively with standard deviations of 2.4915% and 2.9386% respectively.

The trend of the real exchange rate returns and real stock price returns is highlighted in figure 1.

Figure-1. Monthly Trend of REXR and RSPR in Nigeria





Both series show wild fluctuations from the mean values over the study period in the six regimes under consideration. The high standard deviation values of the series for the two series in the six regimes attest to the fact that deviations of the series from their mean values is highly noticeable and easily corroborated by the trend lines of the variables under consideration.

3. Review of Literature

3.1. Theoretical Review

Two basic theories are usually considered when considering the relationship between real exchange rate returns and real stock price returns. The flow oriented model and the portfolio balance approach.

Flow oriented model proposed by Durnbusch and Fisher (1980), postulate that real exchange rate movements cause movements in real stock prices. This approach is built on the macroeconomic view that because stock prices represent the discounted present value of a firm's expected future cash flows, then any phenomenon that affects a firm's cash flow will be reflected in that firm's stock price if the market is efficient as the efficient market hypothesis suggests. The model asserts that there exist positive relationship between real exchange rate and real stock price; it explains that depreciation of real exchange rate (increase in real exchange rate) will increase the export competitiveness of the firms in terms of lower prices and will increase their sales to other country. More exports will lead to more profits for the firms. This will increase the values and stock prices of the firms. Hence, depreciation of real exchange rate (increase in real exchange rate) will increase real stock price whilst appreciation of real exchange rate (decrease in real exchange rate) will decrease real stock price. (See Afees and Tirimisiyu (2015)). Thus causality runs from real exchange rate returns to real stock price returns.

The portfolio balance model by Branson (1983) states that movements in real stock prices can cause changes in real exchange rate negatively through capital account transactions. That is, a bull stock market will attract inflows of capital from abroad for investment in the stock market. This will increase demand for stocks in the stock market. This implies that a higher demand for the stocks will increase stock prices and the inflows of capital from abroad for investment in the stock market will appreciate real exchange rate (decrease in exchange rate). Moreover, increase in stock prices will lead to increase in the net-worth of the firms. The firms will expand their production and sale. This will increase aggregate demand in the economy, which will increase interest rate and attract more inflows of capital from abroad. Conversely, a bear stock market will lead to depreciation of real exchange rate (increase in exchange rate). (See Afees and Tirimisiyu (2015)). This version agrees that causation runs from real stock price to real exchange rates.

3.2. Empirical Review

A large amount of research has been done to examine the causal relationship between Exchange rate returns and stock price returns in Nigeria and around the globe. Some found a unidirectional relationship i.e. from exchange rate to stock price or stock price to exchange rate, Bi-directional relationship i.e. from exchange rate to stock price and vice versa and some others found no link between both variables. Studies that found direction of causality running from exchange rate to stock prices includes Khalid (2012); Olugbenga (2012); Pan *et al.* (2007); Lean *et al.* (2011); Abdalla and Murinde (1997), while those that found direction of causality running from stock price to exchange rate are Mutiu *et al.* (2012); Adebiyi *et al.* (2010); Okpara and Odionye (2012); Yusuf and Rahman (2012); Erbaykal and Okuyan (2007) etc. Some other empirical studies found causality running from exchange rate to stock price and vice-versa. These studies includes those of Dong *et al.* (2005); Ramasamy and Yeung (2005); Erbaykal and Okuyan (2007); Aliyu (2009) etc Also, some studies found no causal relationship between the variable. They include Yusuf and Rahman (2012); Rahman and Uddin (2009); Zia and Rahman (2011); Nieh and Lee (2001); etc.

3.3. Methodological Review

Different authors have attempted to examine the causal relationship between stock price returns and exchange rate returns using different estimation techniques. Some have used co-integration and Granger causality test (Adebiyi *et al.*, 2010; Aliyu, 2009; Khalid, 2012; Nieh and Lee, 2001; Olugbenga, 2012; Rahman and Uddin, 2009; Zia and Rahman, 2011). Standard Granger, T-Y (Toda-Yamamoto), and instantaneous causality tests (Gideon, 2015). Multivariate Vector Autoregressive (Adaramola, 2012; Mutiu *et al.*, 2012; Yusuf and Rahman, 2012). Other studies in Nigeria like (Mbutor, 2010; Okpara and Odionye, 2012; Osamwonyi and Evbayiro-Osagie, 2012). use mostly the pair wise Granger causality to test for the direction of causality.

4. Methodology and Model Specification

4.1. Data Description

This study uses Monthly data on exchange rate (EX) for Foreign exchange market (FX) and stock price index (SP) for stock market (SM) for Nigeria. The data were obtained from the database of the Central Bank of Nigeria and the Federal Reserve Bank, St. Lious. They cover for the period of January 1985-June 2017.

Exchange rate (EX) is measured as the home currency (Naira) per unit of US Dollars while the stock index is calculated from weighted stock prices. To further suit this study the EX and SP are measured in real values and returns. Real exchange rate (REX_t) is real bilateral exchange rate which is expressed as;

$REX_t = EX_t x \frac{CPI_{us,t}}{CPI_{d,t}}$ (See Wong (2015)) Where, EX_t is the domestic exchange rate against US dollars exchange rate. $CPI_{us,t}$ is the US composite consumer price index for all items (CPI) and $CPI_{d,t}$ is the domestic composite consumer price index for all items (CPI). The real exchange rate is used to evaluate the competitiveness of a country in terms of prices and cost at the international market. Real stock prices (RSP_t) is the real domestic stock prices, expressed as $RSP_t = \frac{SP_t}{CPI_{d,t}}$ where, SP_t is the domestic stock price index.

The returns for FX ($REXR_t$) and SM (RSR_t) are computed using the Log-returns formula in financial econometrics. They are expressed in percentage as follows;

$$REXR_t = \left(log\left(\frac{REX_t}{REX_{t-1}}\right)\right) * 100.$$

Further simplification gives $REXR_t = (\Delta log(REX_t)) * 100.$

$$RSR_t = \left(log\left(\frac{RSP_t}{RSP_{t-1}}\right)\right) * 100.$$ And further simplification gives;

$RSR_t = (\Delta log(RSR_t)) * 100.$ (See Afees and Tirimisiyu (2015))

4.1.1. Descriptive Statistics

Table 1 (Appendix) shows the results of the summary of descriptive statistics of real stock returns (RSPR) and real exchange rate returns (REXR) in their level form. An observation of table shows that given the acceptance/rejection criteria for normality test, the variables are not normally distributed since the probability values computed for Jacque Bera Chi-square distribution are significant at 1% level of significance; therefore the null Hypothesis of Normal distribution is rejected. The mean based coefficient of skewness and kurtosis are the statistics put together to check the normality of all the variables. Skewness also measures the direction and degree of symmetry and it shows that RSPR is negatively skewed while REXR is positively skewed. The standard deviation enables the discovery of the most volatile variable. From the table it is observed that REXR has higher standard deviation and hence the most volatile of the variables. However, it is important to note that the normality assumption doesn't affect the nature of our analysis for this study.

4.2. Methodology

4.2.1. Test for Stationarity

This study takes into consideration the problem of non-stationarity. We say a time series is stationary when its mean and variance remain the same at every point in time. As such, our time series data were checked or tested to ascertain if they are stationary or non-stationary i.e. to investigate the mean reversion status of the variables. To do this, we employed augmented Dickey–Fuller (ADF) tests for the variables in consideration. For robustness and the reliability of the result we further employ Phillips-Perron (PP) and Kwiatkwoski-Phillips-Schmidt-Shin (KPSS) for unit root test.

4.2.2. Co-Integration Test

When variables are found to be non-stationary at level, one option in order to get the short run dynamic is to estimate by differencing variables if their differences are stationary. However, this method will result in a considerable loss of long run properties of the data. Alternatively, economic variables may be combined together in levels provided that they are co-integrated. The issue of co-integration applies when two series are integrated after first difference I(1), but a linear combination of them is stationary at level I(0); in this case, the regression of one on the other is not spurious, but instead tells us something about the long-run relationship between them. Non-stationary economic series are said to be co-integrated if they can be transformed into a single series that exhibit stationarity (Engle and Granger, 1987). As a result, the key variables in the model are also subjected to co-integration test. Here in this model, a system equation co-integration test would be employed i.e. Johansson co-integration test.

4.2.3. Causality Test

4.2.3.1. Granger Causality Test

By Causality in econometrics we mean the ability of one variable to predict (and therefore cause) the other. According to Granger (1969), "a variable Y_t is said to Granger-cause X_t, if X_t can be predicted with greater accuracy by using past values of variable Y_t, rather than not using such variables all other terms remaining unchanged". If two variables Y_t and X_t affect each other with distributed lags, the relationship between both variables can be captured with a VAR model. In this case it is possible to have: (i) Y_t causes X_t, (ii) X_t causes Y_t (iii) Bi directional feedback, X_t causes Y_t and vice versa (iv) And Both variables being independent (Granger, 1969). Thus it is important to find an appropriate procedure that allows us to test and detect the direction of causality between the variables.

4.2.3.2. Sims- Causality Test

Sims (1980) proposed an alternative test for causality making use of the fact that in general notion of causality it is not possible for the future to cause the present. The new approach here is that apart from the lagged values of X_t and Y_t, there are also leading values of X_t and Y_t included in the specified VAR model.

According to Sims (1980), examining the model, if Y_t causes X_t, we would expect that there is some kind of significant relationship between Y_t and the leading values of X_t. Thus instead of testing for the lagged values of X_t we test for the leading value of X_t. Thus, if we reject the restrictions causality runs from Y_t to X_t since the future cannot cause the present. Ordinary Least square method (OLS) would be used to estimate the VAR model before the Wald test would be applied to test for the significance of the leading values.

4.3. Model Specification

4.3.1. Granger Causality Test

Following Gujarati (2009), we consider a Bi-variate VAR (k) model to test for causality between REXR and RSPR. The specification is rendered below:

$$REXR_t = \alpha_0 + \sum_{i=1}^{k} \alpha_{1i} REXR_{t-i} + \sum_{i=1}^{k} \alpha_{2i} RSPR_{t-i} + \varepsilon_{1t}$$

$$RSPR_t = \beta_0 + \sum_{i=1}^{k} \beta_{1i} RSPR_{t-i} + \sum_{i=1}^{k} \beta_{2i} REXR_{t-i} + \varepsilon_{2t}$$

K denotes the optimal lag length. This is determined by the usual information criteria such as AIC and SIC and ε_{1t} *and* ε_{2t} are the white noise error term which are identically and independently normally distributed with mean zero and constant variance.

This model is considered because we expect both series to be stationary; that is, they are I(0) series given the nature of their computations.

The direction of causalities can be determined from the following:

- Unidirectional causality from RSPR to REXR is indicated if $\sum_{i=1}^{k} \alpha_{2i}$ is significant and $\sum_{i=1}^{k} \beta_{2i}$ is insignificant.
- Unidirectional causality from REXR to RSPR exists if is statistically significant $\sum_{i=1}^{k} \beta_{2i}$ and $\sum_{i=1}^{k} \alpha_{2i}$ is statistically insignificant.
- There is bi-directional causality between RSPR and REXR when $\sum_{i=1}^{k} \alpha_{2i}$ and $\sum_{i=1}^{k} \beta_{2i}$ are statistically significant in both regressions.
- There is no causal relationship or independence between RSPR and REXR when $\sum_{i=1}^{k} \beta_{2i}$ and $\sum_{i=1}^{k} \alpha_{2i}$ are statistically insignificant in both regressions.

4.3.2. Sims Causality Test

Following Sims (1980), we consider the following VAR (k) model;

$$REXR_t = \alpha_0 + \sum_{i=1}^{k} \alpha_{1i} REXR_{t-i} + \sum_{i=1}^{k} \alpha_{2i} RSPR_{t-i} + \sum_{i=1}^{k} \alpha_{3i} RSPR_{t+i} + \varepsilon_{1t}$$

$$RSPR_t = \beta_0 + \sum_{i=1}^{k} \beta_{1i} RSPR_{t-i} + \sum_{i=1}^{k} \beta_{2i} REXR_{t-i} + \sum_{i=1}^{k} \beta_{3i} REXR_{t+i} + \varepsilon_{2t}$$

K denotes the optimal lag length. This is determined by the usual information criteria such as AIC and SIC and ε_{1t} *and* ε_{2t} are the white noise error term which are identically and independently normally distributed with mean zero and constant variance.

The direction of causalities can be determined from the following:

- Unidirectional causality from REXR to RSPR is indicated if $\sum_{i=1}^{k} \alpha_{3i}$ is significant and $\sum_{i=1}^{k} \beta_{3i}$ is insignificant. This is so since the future cannot cause the present. This applies for other decisions as well.
- Unidirectional causality from RSPR to REXR exists if $\sum_{i=1}^{k} \beta_{3i}$ is statistically significant and $\sum_{i=1}^{k} \alpha_{3i}$ is statistically insignificant.
- There is bi-directional causality between RSPR and REXR when $\sum_{i=1}^{k} \beta_{3i}$ and $\sum_{i=1}^{k} \alpha_{3i}$ are statistically significant in both regressions.
- There is no causal relationship or independence between RSPR and REXR when $\sum_{i=1}^{k} \alpha_{3i}$ and $\sum_{i=1}^{k} \alpha_{3i}$ are statistically insignificant in both regressions.

5. Results and Discussion

5.1. Test for Stationarity and co-integration Analysis

Before testing for co-integration, unit root test was applied to verify the order of integration of real stock price returns and real exchange rate returns. To achieve this, Augmented Dickey Fuller, Kwiatkowski and Phillips-Perron were employed. The result of the unit root test is presented in table 2 below:

Table-2. Summary of the Unit Root Test

	REXR			**RSPR**		
	Level	First Diff.	I(d)	Level	First Diff.	I(d)
ADF	-19.29245^{a*}		I(0)	-6.833005^{a*}		I(0)
PP	-19.29245^{a*}		I(0)	-17.49075^{a*}		I(0)
KPSS	0.064131^{a*}		I(0)	0.060293^{a*}		I(0)

Source: author's computation. Note: *, ** and *** imply statistical significance at 10%, 5% and 1% levels respectively. Also, *b* denotes model with constant, *a* model with constant and trend and *n* is model without constant and trend.

The ADF statistics show that the null hypothesis of unit root is rejected at 1% level of significance. This is further confirmed by the PP statistics and KPSS statistics. Thus, the real exchange rate returns and real stock price returns are integrated at order zero i.e. I(0) which then implies that they are stationary in their level form. The next question is whether both series have long run equilibrium relationship.

Economically speaking, two variables will be co-integrated if they have a long run equilibrium relationship between them. After establishing the stationarity of data, Johansen co-integration test is applied. A summary of the result is shown in Table 3 below:

Table-3.

Included observations: 382					
Series: REXR RSPR					
Data Trend:	**None**	**None**	**Linear**	**Linear**	**Quadratic**
Test Type	No Intercept	Intercept	Intercept	Intercept	Intercept
	No Trend	No Trend	No Trend	Trend	Trend
Trace	2	2	2	2	2
Max-Eig	2	2	2	2	2

Source: author's computation *Critical values based on MacKinnon *et al.* (1999) at 5% level of significance

The results of the Johansen tests in Table 3 reveal that there are two long-run equilibrium relationships between real stock price returns and real exchange rates returns for Nigeria at different data trend and model type. The test result is implied by the trace and Max-Eigen statistics at 5% level of significance.

5.2. Test for Causality

5.2.1. VAR/Pair-wise Granger Causality

After determining the stationarity test and co-integration which is necessary to assert the presence of causality, the analysis was further extended to include the test for causality between both series using VAR/pair-wise Granger-sims causality test. The Lag length of 6 was selected using Akaike information criterion (AIC) (see Table 4 Appendix). However, the optimum lag was reviewed upward to 10 because of the observed presence of serial correlation. The result of the estimation is presented in Table 5 below:

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Table-5.

VAR Granger Causality/Block Exogeneity Wald Tests Included observations: 379			
Dependent variable: REXR			
Excluded	**Chi-sq**	**Df**	**Prob.**
RSPR	1.388988	10	0.9992
All	1.388988	10	0.9992
Dependent variable: RSPR			
Excluded	**Chi-sq**	**Df**	**Prob.**
REXR	18.52758	10	0.0467
All	18.52758	10	0.0467
VAR Granger Causality/Block Exogeneity Wald Tests Included observations: 380			
Dependent variable: RSPR			
Excluded	**Chi-sq**	**Df**	**Prob.**
REXR	18.28641	9	0.032
All	18.28641	9	0.032
Dependent variable: REXR			
Excluded	**Chi-sq**	**Df**	**Prob.**
RSPR	1.433515	9	0.9976
All	1.433515	9	0.9976

Source: author's computation

The table shows that we fail to reject the null hypothesis that RSPR does not granger cause REXR at 5% level of significance at lag length 9 & 10. However, we reject the null hypothesis that REXR doesn't granger cause RSPR at 5% level of significance. This implies that there is a unidirectional causality running from real exchange rate returns (REXR) to real stock price returns (RSPR). This means that present day RSPR is influenced by past values of REXR. This also implies that REXR can be taken as an exogenous variable in the system. It should be noted that the lag length from 1-8 shows no direction of causality between the variables.

Therefore, for robustness, the lag length is extended to ensure consistency of result. Extending the lag length from 9-15 further proves that the direction of causality only runs from REXR to RSPR at 1%,5% and 10% level of significance. This is shown in table 6 (Appendix).

Furthermore, an attempt to use pair-wise granger causality gave similar result. Table 7 (appendix) shows that from lag length 1-8 there is no causality between both variables. However, extending the lag length from 9-15 shows a unidirectional causality from REXR to RSPR at 1%, 5% and 10% level of significance (see Table 7 appendix). That is, we reject the null hypothesis that REXR doesn't granger cause RSPR.

Thus, the past values of REXR could predict the present value of RSPR. This is in line with the findings of Olugbenga (2012) and the propositions of the flow oriented model.

5.2.2. Sims-Causality

Table 8 (appendix) shows the results of the OLS estimation of REXR and the lead values of RSPR with a lag length of 10. The Joint test of the lead values of RSPR using wald test shows that they are jointly significant at 5% level of significance (see Table 9 appendix). This result implies that the present value of REXR can influence the future values of RSPR.

Conversely, Table 10 (appendix) shows the results of the OLS estimation of RSPR and the lead values of REXR with a lag length of 10. A joint test of the lead values of REXR using wald test shows that they are insignificant at 5% level of significance (see table 11 appendix). Meaning that we fail to reject the null hypothesis of $\sum_{i=1}^{k} \beta_{3i} = 0$. Thus, there is a unidirectional causality running from REXR to RSPR. That is, the present values of the REXR can be used to predict/ forecast the future values of RSPR and not vice-versa.

5.2.3. Diagnostic Test

The most important diagnostic test needed for this study is the serial correlation test. The Autocorrelation LM test was applied for the VAR/pair-wise causality test while the serial correlation LM test was applied for the Sims-Causality test. The results show that the null hypothesis of no serial correlation is not rejected (See table 12 & 13 appendix).

6. Conclusions and Policy Implications

This paper examined the causal relationship between real exchange rate returns and real stock price returns in Nigeria from January 1985- June 2017. For the investigation the VAR/pair-wise granger causality test and Sims-causality test were applied. From the evidences shown, there exist a unidirectional causal relationship between real exchange rate returns and real stock price returns. Causality running from Real exchange rate returns to real stock price returns. Thus, the past values of REXR can influence/predict the present value of RSPR. This confirms the findings of Olugbenga (2012) and the proposition of the flow oriented model. Also, evidences from the sims-Causality test show that there is uni-directional causality running from Real exchange rate returns to real stock price returns. Thus, the present value of REXR can influence/predict the future value of RSPR.

Therefore, it is imperative for the monetary authority to put into due consideration the exchange rate policy in its conduct of monetary policy internally. Also, these findings serve as an effective tool for investor in the stock exchange market. As movement in the foreign exchange market (real exchange rate returns) could have a great impact on the present and future movement in stock exchange market (real stock price returns) in Nigeria.

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Appendix

Table-1.

	RSPR	REXR
Mean	0.005861	0.124374
Median	-0.142348	-0.305339
Maximum	13.16518	58.98058
Minimum	-16.23162	-6.9997
Std. Dev.	2.703698	4.523585
Skewness	-0.382487	10.38686
Kurtosis	8.836336	127.9241
Jarque-Bera	561.5865	259942.3
Probability	0.000000	0.000000
Sum	2.280071	48.38141
Sum Sq. Dev.	2836.274	7939.575
Observations	389	389

Source: author's computation

Table-4.

VAR Lag Order Selection Criteria
Endogenous variables: REXR RSPR
Included observations: 379

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2033.043	NA	158.1047	10.73901	10.75979*	10.74726*
1	-2030.357	5.329784	159.2048	10.74595	10.80828	10.77068
2	-2025.908	8.779033	158.8291	10.74358	10.84747	10.78481
3	-2022.832	6.039298	159.6059	10.74845	10.89390	10.80617
4	-2018.861	7.752887	159.6321	10.74861	10.93561	10.82282
5	-2012.94	11.49875	158.0242	10.73847	10.96703	10.82917
6	-2008.59	8.401919	157.7358*	10.73662*	11.00674	10.84382
7	-2008.389	0.386184	160.9345	10.75667	11.06835	10.88036
8	-2007.706	1.303950	163.7828	10.77417	11.12741	10.91435
9	-2001.127	12.49790*	161.5768	10.76057	11.15536	10.91724
10	-2000.477	1.229156	164.4678	10.77824	11.21459	10.95140

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: author's computation

Table-6.

VAR Granger Causality/Block Exogeneity Wald Tests			
Included observations: 378			
Dependent variable: RSPR			
Excluded	**Chi-sq**	**Df**	**Prob.**
REXR	18.74043	11	0.0659
All	18.74043	11	0.0659
Dependent variable: REXR			
Excluded	**Chi-sq**	**Df**	**Prob.**
RSPR	1.441423	11	0.9997
All	1.441423	11	0.9997
VAR Granger Causality/Block Exogeneity Wald Tests			
Included observations: 377			
Dependent variable: RSPR			
Excluded	**Chi-sq**	**Df**	**Prob.**
REXR	19.82754	12	0.0704
All	19.82754	12	0.0704
Dependent variable: REXR			
Excluded	**Chi-sq**	**Df**	**Prob.**
RSPR	1.408482	12	0.9999
All	1.408482	12	0.9999
VAR Granger Causality/Block Exogeneity Wald Tests			
Included observations: 376			
Dependent variable: RSPR			
Excluded	**Chi-sq**	**Df**	**Prob.**
REXR	26.68021	13	0.0138
All	26.68021	13	0.0138
Dependent variable: REXR			
Excluded	**Chi-sq**	**Df**	**Prob.**
RSPR	1.486610	13	1.0000
All	1.486610	13	1.0000
VAR Granger Causality/Block Exogeneity Wald Tests			
Included observations: 375			
Dependent variable: RSPR			
Excluded	**Chi-sq**	**Df**	**Prob.**
REXR	32.45105	14	0.0035
All	32.45105	14	0.0035
Dependent variable: REXR			
Excluded	**Chi-sq**	**Df**	**Prob.**
RSPR	1.784135	14	1.0000
All	1.784135	14	1.0000
VAR Granger Causality/Block Exogeneity Wald Tests			
Included observations: 374			
Dependent variable: REXR			
Excluded	**Chi-sq**	**Df**	**Prob.**
RSPR	3.374923	15	0.9992
All	3.374923	15	0.9992
Dependent variable: RSPR			
Excluded	**Chi-sq**	**Df**	**Prob.**
REXR	33.40696	15	0.0041
All	33.40696	15	0.0041

Source: author's computation

Table-7.

Pairwise Granger Causality Tests			
Lags: 8			
Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**
REXR does not Granger Cause RSPR	381	1.23677	0.2763
RSPR does not Granger Cause REXR		0.10554	0.999
Pairwise Granger Causality Tests			
Lags: 9			
Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**
REXR does not Granger Cause RSPR	380	2.03182	0.0351
RSPR does not Granger Cause REXR		0.15928	0.9975
Pairwise Granger Causality Tests			
Lags: 10			
Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**
REXR does not Granger Cause RSPR	379	1.85276	0.0507
RSPR does not Granger Cause REXR		0.13890	0.9992
Pairwise Granger Causality Tests			
Lags: 11			
Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**
REXR does not Granger Cause RSPR	378	1.70368	0.0708
RSPR does not Granger Cause REXR		0.13104	0.9997
Pairwise Granger Causality Tests			
Lags: 12			
Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**
REXR does not Granger Cause RSPR	377	1.65229	0.0759
RSPR does not Granger Cause REXR		0.11737	0.9999
Pairwise Granger Causality Tests			
Lags: 13			
Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**
REXR does not Granger Cause RSPR	376	2.05232	0.0164
RSPR does not Granger Cause REXR		0.11435	1.0000
Pairwise Granger Causality Tests			
Lags: 14			
Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**
REXR does not Granger Cause RSPR	375	2.31793	0.0046
RSPR does not Granger Cause REXR		0.12744	1.0000
Pairwise Granger Causality Tests			
Lags: 15			
Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**
REXR does not Granger Cause RSPR	374	2.22713	0.0055
RSPR does not Granger Cause REXR		0.22499	0.9991

Source: author's computation

Table-8.

Dependent Variable: REXR				
Included observations: 369 after adjustments				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.123536	0.243866	0.506573	0.6128
REXR(-1)	0.043957	0.054389	0.808198	0.4195
REXR(-2)	-0.021882	0.054773	-0.399497	0.6898
REXR(-3)	-0.002557	0.055244	-0.046288	0.9631
REXR(-4)	0.065311	0.055506	1.176649	0.2402
REXR(-5)	-0.053622	0.055276	-0.970074	0.3327
REXR(-6)	0.026142	0.055087	0.474559	0.6354
REXR(-7)	-0.038427	0.055753	-0.689235	0.4911
REXR(-8)	0.076538	0.055876	1.369788	0.1717
REXR(-9)	-0.032594	0.055701	-0.585162	0.5588
REXR(-10)	-0.006746	0.055974	-0.120521	0.9041
RSPR(-1)	-0.083953	0.102517	-0.818911	0.4134
RSPR(-2)	0.091131	0.101526	0.897612	0.37
RSPR(-3)	-0.040817	0.103604	-0.393969	0.6939
RSPR(-4)	0.048076	0.101459	0.473851	0.6359
RSPR(-5)	-0.057528	0.10094	-0.56992	0.5691
RSPR(-6)	-0.025936	0.099796	-0.259895	0.7951
RSPR(-7)	-0.05836	0.098803	-0.590665	0.5551
RSPR(-8)	0.042659	0.099807	0.427418	0.6693
RSPR(-9)	-0.054008	0.098085	-0.550623	0.5823
RSPR(-10)	-0.005999	0.097616	-0.061457	0.951
RSPR(1)	0.025126	0.102386	0.245404	0.8063
RSPR(2)	-0.00624	0.101562	-0.061442	0.951
RSPR(3)	-0.019377	0.10397	-0.186375	0.8523
RSPR(4)	-0.027811	0.103304	-0.269212	0.7879
RSPR(5)	0.258744	0.103167	2.507996	0.0126
RSPR(6)	-0.295065	0.101175	-2.916394	0.0038
RSPR(7)	-0.052584	0.100289	-0.524327	0.6004
RSPR(8)	-0.132739	0.100262	-1.323915	0.1864
RSPR(9)	0.321904	0.097237	3.310515	0.001
RSPR(10)	-0.092644	0.096239	-0.962644	0.3364
R-squared	0.069998	Mean dependent var		0.134504
Adjusted R-squared	-0.012546	S.D. dependent var		4.642143
S.E. of regression	4.671173	Akaike info criterion		6.000968
Sum squared resid	7375.112	Schwarz criterion		6.329518
Log likelihood	-1076.179	Hannan-Quinn criter.		6.131484
F-statistic	0.848006	Durbin-Watson stat		1.99876
Prob(F-statistic)	0.698869			

Source: author's computation

Table-9.

Wald Test:			
Equation: Untitled			
Test Statistic	**Value**	**df**	**Probability**
F-statistic	2.189566	(10, 338)	0.0181
Chi-square	21.89566	10	0.0156
Null Hypothesis: C(22)=C(23)=C(24)=C(25)=C(26)=C(27)= C(28)=C(29)=C(30)=C(31)=0			
Null Hypothesis Summary:			

Source: author's computation

Table-10.

Dependent Variable: RSPR				
Included observations: 369 after adjustments				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-0.005675	0.137198	-0.041364	0.967
RSPR(-1)	0.11835	0.0543	2.179559	0.03
RSPR(-2)	0.153985	0.053898	2.856952	0.0045
RSPR(-3)	0.115035	0.054628	2.105786	0.036
RSPR(-4)	-0.198757	0.054995	-3.614116	0.0003
RSPR(-5)	0.178616	0.05546	3.220644	0.0014
RSPR(-6)	0.056881	0.054924	1.035623	0.3011
RSPR(-7)	-0.028159	0.05435	-0.518105	0.6047
RSPR(-8)	-0.046931	0.054992	-0.853417	0.394
RSPR(-9)	0.100052	0.054294	1.842799	0.0662
RSPR(-10)	0.040499	0.054275	0.74618	0.4561
REXR(-1)	-0.008526	0.029656	-0.28749	0.7739
REXR(-2)	0.00642	0.029815	0.215318	0.8296
REXR(-3)	-0.002092	0.029895	-0.069967	0.9443
REXR(-4)	0.012311	0.029853	0.412396	0.6803
REXR(-5)	0.039201	0.029895	1.31129	0.1906
REXR(-6)	-0.077907	0.029974	-2.599184	0.0098
REXR(-7)	-0.009844	0.030251	-0.325419	0.7451
REXR(-8)	-0.021009	0.030244	-0.694664	0.4877
REXR(-9)	0.084087	0.030299	2.775239	0.0058
REXR(-10)	-0.024516	0.030576	-0.801808	0.4232
REXR(1)	-0.009216	0.029661	-0.310693	0.7562
REXR(2)	0.003614	0.029661	0.121826	0.9031
REXR(3)	-0.004466	0.029672	-0.150522	0.8804
REXR(4)	0.001204	0.029656	0.040592	0.9676
REXR(5)	0.00032	0.029772	0.01076	0.9914
REXR(6)	-0.010604	0.029785	-0.356005	0.7221
REXR(7)	-0.011205	0.029774	-0.376337	0.7069
REXR(8)	0.002534	0.029875	0.084827	0.9324
REXR(9)	-0.028934	0.029778	-0.971674	0.3319
REXR(10)	-0.002281	0.037825	-0.060309	0.9519
R-squared	0.15776	Mean dependent var		-0.007413
Adjusted R-squared	0.083005	S.D. dependent var		2.737565
S.E. of regression	2.621488	Akaike info criterion		4.845632
Sum squared resid	2322.803	Schwarz criterion		5.174182
Log likelihood	-863.0191	Hannan-Quinn criter.		4.976148
F-statistic	2.110361	Durbin-Watson stat		1.991959
Prob(F-statistic)	0.000827			

Source: author's computation

Table-11.

Wald Test:			
Equation: Untitled			
Test Statistic	**Value**	**Df**	**Probability**
F-statistic	0.135317	(10, 338)	0.9993
Chi-square	1.353170	10	0.9993
Null Hypothesis: C(22)=C(23)=C(24)=C(25)=C(26)=C(27)= C(28)=C(29)=C(30)=C(31)=0			
Null Hypothesis Summary:			

Source: author's computation

Table-12.

Breusch-Godfrey Serial Correlation LM Test: RSPR to REXR			
F-statistic	**1.343619**	**Prob. F(2,336)**	**0.2623**
Obs*R-squared	2.927748	Prob. Chi-Square(2)	0.2313
Breusch-Godfrey Serial Correlation LM Test: REXR to RSPR			
F-statistic	**0.255659**	**Prob. F(10,328)**	**0.9897**
Obs*R-squared	2.853914	Prob. Chi-Square(10)	0.9847

Source: author's computation

Table-13.

VAR Residual Serial Correlation LM Tests		
Null Hypothesis: no serial correlation at lag order h		
Included observations: 374		
Lags	**LM-Stat**	**Prob**
1	0.359359	0.9857
2	2.093904	0.7185
3	2.621104	0.6231
4	3.878116	0.4228
5	1.327488	0.8567
6	1.921916	0.7501
7	3.802195	0.4334
8	7.283304	0.1217
9	7.058256	0.1328
10	1.070702	0.8989
11	2.712496	0.6070
12	6.829731	0.1452
13	0.476842	0.9757
14	1.981896	0.7391
15	4.111755	0.3911

Source: author's computation