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A Comparative Analysis of Weak and Semi-Strong Form Efficiency of Nigerian and South African Foreign Exchange Market

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ABSTRACT: Foreign exchange market is said to be efficient if all available information are reflected in its exchange rates. An efficient foreign exchange translates to absence of profitable and exploitable trends which means that it is impossible for market participants or private agents to outperform the market. This study investigated the weak and semi-strong form efficiency of Nigerian and South African foreign exchange market to determine the significance of past exchange rates in predicting the present rate which is the test of weak form efficiency and it examined the co-integration relationships between selected pairs of exchange rate to determine the semi-strong efficiency.

The secondary data used in this study were sourced mainly from the Central Bank of Nigeria Statistical Bulletin, the South African Reserve Bank Bulletin and the oanda exchange rate websites. The data used were the inter-bank spot exchange rates of Naira and Rand to Swiss Franc, Euro, Pounds, Dollar and Yen for the period of January 2010 to December 2017. The Augmented Dickey Fuller (ADF) test and the Phillip Peron (PP) test were employed to determine the weak form efficiency while the Variance Decomposition, Granger Causality and Co-integration tests were used to determine the semi-strong form efficiency of both countries.

The results of the study revealed that the Nigerian foreign exchange market is efficient in the weak and semi-strong form at 5% level of significance while the weak form efficiency of South African foreign exchange market revealed mixed results. The market is efficient in the weak form except for the case of Rand to Dollar and Rand to Yen which showed inefficiency. The market is equally efficient in semi-strong form.

The study concluded that market participants cannot make exploitable profits by trading in both markets because all past and publicly available information are already incorporated in the prices of exchange rates. It was therefore recommended that the inter-bank market in both countries should be well monitored and managed by the regulatory authorities so as to promote the effective and efficient smooth functioning of the foreign exchange market as well as achieving a stable and realistic exchange rates.

1.0 INTRODUCTION

Market efficiency as explained by Fama (1970) is the characteristics of a market such that the market prices of assets fully and instantaneously reflect all relevant information in an unpredictable pattern. The Efficient Market Hypothesis postulates that a market is considered to be efficient if all possible available information is reflected in the prices of assets traded in such market thereby making it impossible for market participants to use such information to outperform the buy and hold strategy (Oloyede, 1999).

Efficient Market Hypothesis (EMH) according to Fama (1970) has three forms of efficiency depending on the information set; the weak form efficiency, the semi-strong form efficiency and the strong form efficiency. The weak form efficiency states that past prices and volume of historical data information has already been incorporated in the current security prices thereby making it impossible for participants or investors to outperform the market or make abnormal profit through chart reading, tape watching or any other trading device (Okpara, 2010). The semi-strong form of market efficiency states that current asset prices reflect all publicly available information that is relevant to the market as a whole (i.e. information about stock splits, earnings forecast, exchange rate of another currency, etc.) while the strong form states that asset prices reflect all available information both past and present including insider or privileged information (Olowe, 1999).

The efficiency or inefficiency of a foreign exchange market has policy implications of great importance to both the government and private sectors in formulating adequate intervention policies in the foreign exchange market (Pilbeam, 1992). A foreign

exchange market that is efficient needs minimal government intervention and its participants cannot make abnormal gains from foreign exchange transactions (Wickremasinghe, 2005). This implies that all available information are incorporated or reflected in foreign exchange prices, thereby making it difficult and impossible for private agents or market operators to trade on such information to make abnormal gain or outperform the market. Government and policy makers usually take the price in an efficient market as the best reflection of information about the market and condition underlying the determination of exchange rates, intervention therefore by the government will not be necessary (Chiwira & Muyambiri, 2012).

With the continuous heavy interventions of the Central Bank of Nigeria (CBN) in the foreign exchange market, it may suggests that the market is inefficient which means that there is a failure of the market forces of demand and supply to set equilibrium prices. On the other hand, the South African foreign exchange market can be adjudged efficient because the intervention of the South African Reserve Bank in the market is to bring about foreign exchange reserve accumulation and managing domestic liquidity as the exchange rate in the market is constantly being determined by the market forces of demand and supply (BIS, 2012). It is not an understatement to say that huge government resources and time are spent on the interventions of the foreign exchange markets by both countries. Therefore, testing the efficiency of both markets in this study will further justified the need for government interventions or refute it and then encourage the focus on market forces of demand and supply to determine exchange rates.

To arrive at foreign exchange market efficiency of both Nigeria and South Africa, the questions that were addressed in this study include: to what extent can past prices of foreign exchange rate be used to predict current prices in Nigerian and South African foreign exchange market? What is the nature of long run equilibrium relationship between selected pairs of foreign exchange rates in both countries? Lastly, to what extent do series of exchange rates in both countries follow the Random Walk with intercept and deterministic trend Model.

The broad objective of this study is to conduct a comparative analysis of the weak and semi-strong form efficiency of Nigerian and South African foreign exchange market while the specific objectives are to: test the weak and semi-strong form efficiency of both the Nigerian and South African foreign exchange market using the spot market rate, assess whether the series of exchange rates in both countries follow the Random Walk with intercept and deterministic trend Model.

The next section of this study reviewed relevant conceptual, theoretical and empirical literature while section three discussed the research method. Section four presented the results, discussions, summary and implications of findings and the paper was completed with conclusions and recommendations in section five.

2.0 LITERATURE REVIEW

2.1 Conceptual Literature

According to Fama (1970), an efficient financial market is one in which prices always fully reflect all available information in an un-biased manner. Also, market efficiency connotes that a market has taken into account all information and the market prices reflect this information. However, market efficiency does not simply occur by itself or because information is freely available in the market (Azeez & Sulaiman, 2012). Market efficiency implies that the market price of a security or currency represents all the participants in the markets consensus value of such security or currency. An efficient market must instantaneously and properly incorporate all available information into the prices of securities. This connotes that investors are unable to achieve abnormal gains on a consistent basis as the financial markets does not under or over price securities. If empirical evidence shows that foreign exchange markets are not efficient, then risk adjusted profit opportunities are being missed and private agents can formulate strategies to engage in them.

When foreign exchange markets are not efficient, exchange rate policies that outperform the forecasts in the present market prices can be formulated. A failure to find market efficiency is probably the most tantalizing possibility that private agents hope to encounter. Policy makers would interpret a lack of foreign exchange market efficiency as a failure of market forces of demand and supply to set equilibrium prices in the market. On the other hand, if empirical evidence shows that markets are efficient, then private enterprises can take market prices as the best possible reflection of the market and excessive profit making will be difficult, as prices accurately capture all the available information. Therefore, out-performing the market will be difficult, as prices accurately caption all the available information.

Tobin (1984) identified four efficiency types that could be present in a financial market. The first is the Information Arbitrage Efficiency where asset prices fully reflect all of the privately available information (the least demanding requirement for efficient market, since arbitrage includes realizable, risk free transaction). Arbitrage involves taking advantage of price similarities of financial instruments between two or more markets by trading to generate profit. This involves only risk-free transactions and the

information used for trading is obtained at no cost. Therefore, the profit opportunities are not fully exploited, and it can be said that Arbitrage is a result of market inefficiency. This reflects the semi-strong efficiency of market hypothesis.

The second type is the Fundamental Valuation Efficiency where asset prices reflect the expected past flow payments associated with holding the assets (i.e. if profit forecasts are correct, they will attract investors). Fundamental valuation involves lower risk and less profit opportunities. It refers to the accuracy of the predicted returns on the investment. Financial markets are characterized by predictability and inconsistent misalignments that force the prices to always deviate from their fundamental valuations. This reflects the weak from efficiency.

The third type is the Full Insurance Efficiency which ensures continuity of the delivery of good and services in all contingencies and lastly is the Functional/Operational Efficiency where the products and services available at the financial market are provided for the least cost and are directly useful to the participants.

2.2 Theoretical Literature

The theory of market efficiency was originally developed and applied to capital markets and its development was pioneered by Fama (1970), who defined an efficient market as a market where prices of its assets fully reflect all available information. Random walk theory which is also one of the theories of market efficiency was first introduced by Kendall (1953) and Cootner (1964). The theory was later expanded upon by Malkiel (1973). The theory is concerned with the international efficiency of the capital Market. In the literature of capital markets, the term markets efficiency is used to illustrate and explain the relationship between information and share prices. It was first introduced and defined by Fama in 1970, where he defined market efficiency as the efficiency in stock markets when the security prices in that market adjust rapidly to the introduction of new information. Hence, in any efficient market, current prices of securities should reflect all the information useful for price prediction of securities in the stock market and there is no way to earn excess profit by trading with this information. This depends upon the extent to which the information is absorbed, the time taken for absorption and the type of information absorbed. The price of the security reflects the present value of its expected future cash flows, which incorporates many falters such as volatility, liquidity and risk of bankruptcy. However, while the prices are rationally based, changes in prices are expected to be random and unpredictable, because of the fact that new information is unpredictable by its very nature. Therefore, stock prices are said to follow a random walk.

2.3 Review of Empirical Studies

Wickremasinghe (2004) tested the weak and semi-strong form efficiency of the foreign exchange market in Sri Lanka using the average monthly nominal spot exchange rates for Japanese Yen, UK Pound, US Dollar, French Franc, Indian Rupee and German Mark for the period January 1986 to November 2000. The weak form efficiency was tested using unit root tests while the semi-strong form was examined using the co-integration, Granger causality and variance decomposition analysis. The results indicated that the Sri Lankan foreign exchange market is consistent with the weak form of the efficient market hypothesis while the result for Semi-Strong provides evidence against the EMH. The study further recommended that government should make informed decisions on exchange rates, take actions to reduce exchange rate volatility and evaluate the consequences of various economic policies for exchange rates.

Kuhl (2010) investigated the market efficiency on the foreign exchange market since the introduction of the Euro by applying the co-integration analysis and Engle and arranger approach to exchange rates. The study employed a bivariate co integration analysis in order to evaluate if the introduction of a new currency has resulted in inefficient markets. The empirical analysis predominantly draws on the Johansen (1988, 1991) approach and the Gregory-Hansen (1996) approach. The outcome of the study showed that the foreign exchange market is broadly consistent with the market efficiency hypothesis. The study concluded a long run relationship between the exchange rate Pairs of EUR/USD and GBP/USD with the no arbitrage condition satisfied.

Chiou and Williems (2012) studied the behaviour of three daily exchange rates of US dollar/ Brazilian Real, US dollar/ Canadian dollar, and US dollar/ Mexican Peso using daily exchange rate over the period January 1999 to December 2011. The study employed two popular non-parametric tests of randomness which are Runs up and Down Tests and Runs above and below central point test. The major findings of the study are: (1) each exchange rate is not normally distributed. (2) each exchange rate does not follow a random walk in the runs up and down test and (3) each exchange rate does not follow a random walk in the runs above and below a central point test. The study therefore suggested that non-Euro currencies, exchange rate overshoots or undershoots and government intervention may play a role in market efficiency.

Chaudhry and Javid (2012) examined both the weak and semi-strong form of efficiency of four of the seven foreign exchange market of South Asia which are Pakistan, India, Sri Lanka and Bangladesh using three bilateral foreign exchange rates of US dollar, British Pound and Japanese Yen for the period January 1995 to December 2010. The weak form efficiency was examined using

unit root test while semi-strong form efficiency was tested using co-integration and granger causality tests. The results of the study indicated that all four foreign exchange markets are consistent with the weak form of the efficient market hypothesis while the result provided evidence against the semi-strong version of the efficient market hypothesis.

Bonga-Bonga (2012) tested the weak form efficiency in the South African stock exchange using the time varying GARCH model and weekly data from March 1995 to December 2007, and January 2008 to December 2009. In addition, the study compared the out-of-sample forecast performance of the time varying and fixed parameter GARCH models in predicting stock returns in in the Johannesburg Stock Exchange (JSE) making use of MSE-F statistics for nested models. The findings of the study showed that the two models provided the same conclusion that the JSE has been weak form efficient in the periods of the analysis.

Mukela and Johannes (2014) examined the weak form efficiency in foreign exchange Market in Namibia using the traditional unit root tests on monthly data for the period of 1993 to 2011. The results from the study showed that there exists weak form efficiency in the Namibia's foreign exchange market which suggested that the past values cannot be used to predict the current values. This suggests that the market is efficient in the weak form and this can be attributed to its correlation with the Johannesburg stock exchange because the Namibian foreign exchange reserve is denominated in the South African Rand. The study therefore recommended that Namibia would need to develop its own financial markets that would create investment opportunities in order to retain funds in the country and address the issue of this-trading for it to optimally realize full benefits that came along with an efficient foreign exchange market.

Fapetu and Oloyede (2014) examined the foreign exchange management and the Nigeria economic growth from 1970 to 2012. The study adopted the Ordinary Least Square (OLS) estimation technique within the error correction model (ECM) framework and the Johansen co-integration test to test for the presence of a long run relationship between the dependent variables. The result of the co-integration test revealed that trace statistics and maximum Eigen values were greater than the critical values at 5% level of significance. The result also further revealed that export and foreign direct investment were statistically significant in determining economic growth at 5% and 10% level of significance respectively, but exchange rate, import and inflation were found to be statistically non-significant. It was therefore recommended that effort be made to increase the consumption of made in Nigeria goods which includes the usage of raw materials that can be sourced locally by Nigerian industries in order to increase foreign exchange earnings.

Otapo (2016) investigated the weak and semi-strong form of exchange market efficiency in Nigeria using the spot and monthly official exchange rate series of Naira to Dollar, Pounds, Yen, Swiss Franc and CFA Franc between January, 1986 and December, 2015. The study employed the Autocorrelation Function and the Unit Root tests to decide the weak form efficiency while the Johansen Co-integration and Granger Causality tests were employed to determine the semi-strong form. The findings revealed that the exchange market in Nigeria is efficient in both weak and semi-strong forms for the period studied. The study therefore recommended that a more liberalized flexible exchange rate regime with policies that would provide more liquidity, transparency and depth in the Nigerian forward market should be established.

Akbar (2016) examined the weak and semi-strong form efficiency of the Nigerian foreign exchange rate of Naira against the US Dollar, Pound Sterling, Australian Dollar, French Franc, and Japanese Yen For the period 2001 to 2013. The monthly exchange rate was used from April 1994 to August 2013 while the yearly sample covers the period 1960 to 2012. The time series analysis was employed by examining unit root test, Johansen co-integration test, Wald test and Impulse response function and variance decomposition analysis. The results of the study revealed that the Nigerian foreign exchange market is weak form efficient but inefficient in the semi-strong form. The study therefore suggested that government should look into making the market more transparent and accountable, which would not only abandon excess return from the market but will also support export-oriented industries in the economy.

Fusthane and Kapingura (2017) examined the weak form market efficiency of the Johannesburg stock exchange for the period 2005 to 2016 with several methodologies which include unit root tests, autocorrelation test and variance ratio test. The empirical results from the various tests indicated that the null hypothesis of a random walk could not be rejected. The study concluded that irrespective of the few instances which represent inefficiency of the market, to a greater extent, there is evidence of the market being weak form efficient.

Most of the empirical work reviewed only concentrated on testing for the weak form efficiency of the foreign exchange market especially in the developing countries with monthly official exchange rates except Wickremasinghe (2004) and Chaudhry and Javid (2012) that tested both weak and semi-strong form. In Nigeria, only Akbar (2016) and Otapo (2016) studied both the weak and semi-strong form of the Nigerian foreign exchange market with monthly and official market rates. While Otapo (2016) concluded that the exchange market in Nigeria is efficient in both the weak and semi-strong form, Akbar (2016) concluded that the Nigeria

foreign exchange is weak form efficient but inefficient in the semi-strong form. Also, Mukela and Johannes (2014) reported that the Namibian foreign exchange market is efficient in the weak form because it is denominated in the South African Rand. In the light of the above findings, this paper will go a step further to examine both the weak and semi-strong form of market efficiency in Nigeria and South Africa with weekly and inter-bank market rates and the outcome of the study will be used to validate the findings of Akbar (2016), Otapo (2016) and Aron (1997) or otherwise.

The choice of Nigeria and South Africa was based on the fact that they share similar economic and financial structure. With an economic growth rate of the two countries towering above 10 percent (World Bank, 2015), South Africa and Nigeria remained the strongest economies in Africa in 2015. While Nigeria has about 60 percent of human and material resources in Africa, South Africa possesses 65 percent of advanced technology in the continent (Raji & Adekeye, 2015). Also, both countries are within the same continent and they both operate a flexible exchange rate system.

3.0 RESEARCH METHOD

3.1 Model Specification

The theoretical framework underpinning this study is based on the theory of market efficiency as stated by Fama (1970) who defined an efficient market as a market where prices of its assets fully reflect all available information.

To test the weak and semi-strong form efficiency of both the Nigerian and South African foreign exchange market, the research adopted the Random Walk Model to test the stationarity of exchanges as previously used by Ibrahim *et al.* (2011) and Krishnaveni *et al.* (2014) which was stated as:

$$Y_t = \mu_2 + P_{y-1} + \varepsilon_t \qquad 3.1$$

where:

μ and p are parameters and ε_t is assumed to be white noise.

Y is a stationery series if -1<p<1. If p = 1, y is a non-stationery series (a random walk with drift); if the process is started at some point, the variance of y increase steadily with time t and goes to infinity.

This model is employed with minor modifications to suit the spot exchange market of both countries and thus written as:

Model I: Random Walk without Drift

$$S_t = \beta_2 + PS_{t-1} + \varepsilon_t \qquad 3.2$$

Model II: Random Walk with Drift

$$S_t = \delta + \beta_2 PS_{t-1} + \varepsilon_t \qquad 3.3$$

Model III: Random Walk with Drift and Deterministic Trend

$$S_t = \delta + \beta_1 + \beta_2 S_{t-1} + \varepsilon_t \qquad 3.4$$

Model IV: Co-integration Model

Model 3.5 is used to test for the semi-strong form efficiency of both Nigerian and South African foreign exchange markets. The model is stated as:

$$S_t = \alpha_0 + \alpha_1 X + \varepsilon_t \qquad 3.5$$

where S_t is the spot exchange rate at time *t*, S_{t-1} is the spot exchange rate in the immediate preceding period and ε_t is the random error term. μ and p are parameters while α_0 and α_1 are coefficients. The spot exchange rate change, $\Delta S_t = S_t - S_{t-1}$ is simply ε_t which is the white noise, is assumed to be unpredictable from previous exchange rate changes.

3.2 Description of Variables

In the Random Walk Models

S_t is the spot exchange rate in the current period

S_{t-1} is the spot exchange rate in the immediate past period

t is time, the trend parameter

β_1 and β_2 are the coefficients

ε_t is the white noise error term with zero mean and constant variance

In the Co-integration Model,

X and Y are any two stochastic variables (exchange rates of any two currencies) integrated of order one I (1).

$\alpha_{1\ and}\ \alpha_2$ are the coefficients

ε_t is the white noise error term with zero mean and constant variance

ε_{t-1} is the immediate past value of the error term.

3.3 Estimation Techniques

The weak form of both the Nigerian and South African foreign exchange market was examined through testing for stationarity of the residuals using the Augmented Dickey Fuller (ADF) 1981 test. In addition to this traditional unit root test, the Phillips-Peron (PP) 1988 is used to establish the weak form of efficiency of both markets. Ultimately, these unit root tests provide evidence on whether the exchange rates follow a random walk or not. The semi strong form of efficiency on the other hand was examined using the Johansen co-integration, Granger causality and the variance decomposition analysis. In determining which of the random walk models that the foreign exchange rates in both countries conform to, the coefficient of determination as contained in the unit root analysis were used to determine the model with the best fit. All these tests were carried out using the E-View statistical package.

3.4 Sources of Data

This study focuses on deploying time series data with no exogenous independent variables in analyzing the efficiency of both Nigerian and South African foreign exchange market using unit root and co-integration test to examine both the weak and semi-strong form of both markets. Secondary data sources were employed in this study. The data were sourced from the Central Bank of Nigeria (CBN) statistical bulletin 2017, the South African Reserve Bank (SARB) bulletin and oanda website on interbank average exchange rates.

4.0 RESULTS AND DISCUSSIONS

4.1 Test of Weak Form Efficiency

This was addressed by a test of stationarity using the unit root tests. The weak form efficiency of both Nigerian and South African foreign exchange market was carried out using the Augmented Dickey Fuller (ADF) and the Phillips Peron (PP) tests. The summary of the results are contained in Table 4.1 and Table 4.2 respectively.

Table 4.1: Summary of Unit Root Test of Exchange Rates in Nigeria and South Africa using Augmented Dickey Fuller Method @ 5% level of significance

Variable	Model	R^2 (%)	Test statistics	Critical value	Probability
NCHF	Constant	0.09	0.617978	-2.868252	0.9901
	Constant Linear.	0.8	-1.106439	-3.420636	0.9256
	None	0.09	2.039086	-1.941585	0.9904
NEURO	Constant	0.4	1.335654	-2.868319	0.9988
	Constant Linear.	9	-1.127125	-3.421154	0.9220
	None		1.381548	-1.941621	0.9584
NPOUNDS	Constant	9.4	0.445466	-2.868336	0.9846
	Constant Linear.	10	-1.493099	-3.420768	0.8307
	None	9.4	1.616053	-1.941594	0.9744
NUSD	Constant	0.3	1.186539	-2.868319	0.9981
	Constant Linear.	1.1	-0.837691	-3.420741	0.9602
	None	0.2	2.488827	-1.941592	0.9971
NYEN	Constant	12.8	0.087220	-2.868285	0.9645
	Constant Linear.	13.3	-0.756658	-3.420688	0.9674
	None	12.8	1.359533	-1.941589	0.9566
RCHF	Constant	0.4	-1.332566	-2.868252	0.6155
	Constant Linear.	0.8	-1.625338	-3.420636	0.7816
	None	-0.17	0.840976	-1.941585	0.8920
REURO	Constant	2.6	-1.163563	-2.868268	0.6913
	Constant Linear.	3.7	-2.489545	-3.420662	0.3332
	None	2.2	0.513417	-1.941587	0.8262
RPOUNDS	Constant	0.3	-1.262566	-2.868252	0.6481
	Constant Linear.	0.4	-1.146017	-3.420636	0.9187
	None	-0.08	0.442898	-1.941585	0.8093

RSUD	Constant	50.1	-20.42049	-2.868252	0.0000*
	Constant Linear.	50.2	-20.51825	-3.420636	0.0000*
	None	49.99	-20.39567	-1.941585	0.0000*
RYEN	Constant	44.6	-18.28542	-2.868252	0.0000*
	Constant Linear.	48.5	-19.72597	-3.420636	0.0000*
	None	43.7	-0.825683	-1.941598	0.3578

Source: Author's Computation (2019)

***** Indicates that the test is significant at 5%.

In Nigeria, the test is not significant in all the exchange rates since the probability is above 5% level of significance. The result therefore failed to reject the null hypothesis of the presence of unit root, meaning that past prices do not have any significant effect on present prices which is an evident of market efficiency in the weak form. This suggests that past prices of foreign exchange market cannot be used to predict the present prices thereby making an excessive or abnormal gain. However in South Africa, the unit root test revealed mixed results. In the case of RCHF, REURO and RPOUNDS, the tests are not significant, that is there is the presence of unit root in the series which is an evidence of market efficiency. However in the case of Dollars and Yen, the tests are significant, that is, the series are stationary at level. Hence, there is an evidence of market inefficiency in the case of Dollar and Yen in South Africa, past prices have significant effect on present prices, and a trend exists that can be exploited for profit.

This result is corroborated by the unit root results using the Philip Peron as presented in Table 4.2. The coefficient of determination (R^2) is highest when Random Walk with intercept and linear trend is fitted in all cases. This is an evidence that exchange rate series in the two countries conform to the Random Walk model with intercept and linear trend.

Table 4.2: Unit Root Analyses of Exchange Rates in Nigeria and South Africa at Level, Using Phillip Peron (PP) Method.

Variable	Model	R^2 (%)	Test statistics	Critical value	Probability
NCHF	Constant	0.09	0.428236	-2.868252	0.9840
	Constant Lin.	0.83	-1.311404	-3.420636	0.8836
	None	0.09	1.840257	-1.941585	0.9845
NEURO	Constant	0.4	0.875763	-2.868319	0.9952
	Constant Lin.	1.4	-0.884918	-3.420741	0.9954
	None	0.26	1.742795	-1.941592	0.9806
NPOUNDS	Constant	0.21	0.848205	-2.868252	0.9948
	Constant Lin.	1.1	-1.271227	-3.420636	0.8932
	None	0.15	1.889843	-1.941585	0.9862
NUSD	Constant	0.3	0.770040	-2.868319	0.9935
	Constant Lin.	1.1	-1.123977	-3.420741	0.9226
	None	0.29	2.019735	-1.941592	0.9900
NYEN	Constant	0.31	-0.386318	-2.868252	0.9085
	Constant Lin.	0.98	-1.252012	-3.420636	0.8975
	None	0.1	1.068026	-1.941585	0.9257
RCHF	Constant	0.42	-1.309194	-2.868252	0.6265
	Constant Lin.	0.80	-1.686274	-3.420636	0.7559
	None	-0.17	0.943743	-1.941585	0.9084
REURO	Constant	0.25	-1.118860	-2.868252	0.7096
	Constant Lin.	1.02	-2.325258	-3.420636	0.4188
	None	-0.80	0.606037	-1.941585	0.8469
RPOUNDS	Constant	0.38	-1.300444	-2.868252	0.6306
	Constant Lin.	0.45	1.270309	-3.420636	0.8934
	None	-0.80	0.397222	-1.941585	0.7979
RUSD	Constant	50.1	-20.42049	-2.868252	0.0000*
	Constant Lin.	50.42	-20.51934	-3.420636	0.0000*
	None	49.99	-20.39567	-1.941585	0.0000*

RYEN	Constant	44.62	-19.40771	-2.868252	0.0000*
	Constant Lin.	48.45	-19.79429	-3.420636	0.0000*
	None	7.08	-5.160332	-1.941585	0.0000*

Source: Author's Computation (2019)

* indicates that the test is significant at 5%.

4.2 Test of Semi-strong Form Efficiency

Table 4.3: ADF Unit Root Test at Level and First Differences Using Random Walk with Constant and Linear Trend.

Variable	**Level: critical value @5%**		**First difference: critical value @ 5%**		**Comments**
	Test statistics	**Probability**	**Test statistics**	**probability**	
NCHF	-1.311404	0.8836	-19.59804	0.0000	I(1)
NEURO	-0.884918	0.9954	-7.070873	0.0000	I(1)
NPOUNDS	-1.271227	0.8932	-7.498880	0.0000	I(1)
NUSD	-1.123977	0.9226	-18.70798	0.0000	I(1)
NYEN	-1.252012	0.8975	-20.34805	0.0000	I(1)
RCHF	-1.625338	0.7816	-16.45804	0.0000	I(1)
REURO	-2.489545	0.3332	-17.43789	0.0000	I(1)
RPOUNDS	-1.146017	0.9187	-18.81731	0.0000	I(1)
RUSD	-20.51825	0.0000	-	-	I(0)
RYEN	-19.72597	0.0000	-	-	I(0)

Source: Author's Computation (2019)

According to Table 4.3, all the exchange rates in Nigeria became stationary at first difference. This suggests the use of unrestricted Vector Autoregressive Model. However, in the case of South Africa, all the series are not integrated of the same order. While RCHF, REURO and RPOUNDS are I(1), RSUD and RYEN are I(0). According to Gujarati (2004), this suggests testing whether the series are co-integrated. The researcher will adopt the Autoregressive Distributed Lag Bound Test for the co-integration test.

4.2.1: Variance Decomposition Test for Exchange Rate Series in Nigeria

From the VAR estimation results for Nigeria exchange rates, the variance decomposition, Granger causality, and co-integration test are contained in tables 4.4, 4.5, and 4.6 respectively.

Table 4.4: Variance Decomposition of USD

Variance Decomposition of NUSD:						
PERIOD	S.E.	NUSD	NPOUNDS	NEURO	NCHF	NYEN
1	4.683945	100.0000	0.000000	0.000000	0.000000	0.000000
2	6.973285	99.61800	0.214697	0.011558	0.142271	0.013476
3	8.407024	99.70582	0.156133	0.010536	0.108986	0.018526
4	9.880767	99.44532	0.160064	0.152119	0.224726	0.017775
5	11.23488	99.27031	0.163966	0.243042	0.301325	0.021353
6	12.39689	99.16877	0.187784	0.273242	0.322321	0.047887
7	13.47333	99.07499	0.216231	0.285965	0.352138	0.070675
8	14.48266	99.01019	0.242122	0.288138	0.375680	0.083871
9	15.41254	98.95720	0.271805	0.281639	0.391866	0.097490
10	16.28155	98.89666	0.307117	0.269579	0.413719	0.112929

Source: Author's Computation (2019)

The variance decomposition test for Naira to US Dollar in Table 4.4 revealed that in the short and long run, innovations in NUSD are caused by its own shocks to the extent of 99.61% and 98.89% for lag 1 and lag 10 respectively. This suggested that changes (shocks) in other exchange rate series do not lead to significant innovations in the NUSD. This is an evidence of semi strong form efficiency in the Nigerian foreign exchange market.

4.2.2 The Granger Causality Test

Table 4.5: Granger Causality Test for Nigerian Exchange Rate Series

Dependent variable: NUSD			
Excluded	Chi-sq	Df	Prob.
NPOUNDS	7.135424	4	0.1289
NEURO	0.606708	4	0.9623
NCHF	5.060572	4	0.2811
NYEN	1.042743	4	0.9032
All	14.90710	16	0.5315

Source: Author's Computation (2019)

In Table 4.5, individual exchange rates do not granger cause the NUSD rate, in addition, jointly, the series do not also granger cause NUSD with a probability of 0.5315. This confirms efficiency of the exchange rate series in the semi-strong form of the Nigerian foreign exchange market.

4.2.3 The Co-Integration Test

Table 4.6: Co-integration Test for Nigerian Exchange Rate Series.

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.049091	39.97619	69.81889	0.9480
At most 1	0.029665	20.39514	47.85613	0.9888
At most 2	0.016217	8.680821	29.79707	0.9937
At most 3	0.005927	2.320610	15.49471	0.9894
At most 4	2.07E-05	0.008064	3.841466	0.9280
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.049091	19.58105	33.87687	0.7850
At most 1	0.029665	11.71432	27.58434	0.9436
At most 2	0.016217	6.360211	21.13162	0.9747
At most 3	0.005927	2.312546	14.26460	0.9817
At most 4	2.07E-05	0.008064	3.841466	0.9280

Source: Author's Computation (2019)

Table 4.6 indicated that at all the hypothesized number of co-integrating equations (0 to 4), the tests are not significant because the probabilities are all above 5% level of significance which means the result failed to reject the null hypothesis of no co-integration. Thus, both the trace statistics and the maximum Eigen value statistics conclude the absence of no co-integrating equations. This is a proof of semi- strong form efficiency in the exchange rate series in Nigeria.

4.2.4 Semi Strong Form Test in South Africa Exchange Rate Series

From the VAR estimation results for South Africa exchange rates, the variance decomposition, granger causality and the co-integration test are as presented in tables 4.7, 4.8 and 4.9 respectively below.

Table 4.7: Variance Decomposition for South Africa Exchange Rate Series

Variance Decomposition of RUSD:						
Period	S.E.	RUSD	DRPOUNDS	DREURO	DRCHF	RYEN
1	64940.85	100.0000	0.000000	0.000000	0.000000	0.000000
2	65007.02	99.79711	0.030276	0.030243	0.114757	0.027615
3	65008.36	99.79304	0.030646	0.032664	0.114768	0.028879
4	65008.40	99.79290	0.030758	0.032671	0.114789	0.028881
5	65008.40	99.79290	0.030759	0.032674	0.114790	0.028881
6	65008.40	99.79290	0.030759	0.032674	0.114790	0.028881
7	65008.40	99.79290	0.030759	0.032674	0.114790	0.028881
8	65008.40	99.79290	0.030759	0.032674	0.114790	0.028881
9	65008.40	99.79290	0.030759	0.032674	0.114790	0.028881
10	65008.40	99.79290	0.030759	0.032674	0.114790	0.028881

Source: Author's Computation (2019)

The variance decomposition test from Table 4.7 revealed that the Rand to US Dollar exchange rate in successive periods is caused by shocks in itself significantly. This is seen in the percentage of RUSD in 10 successive periods ranging between 100% in the first period and 99.79% in the tenth period. This strongly reveals that changes or shocks or information about other exchange rates do not significantly cause any change or innovations in the RUSD exchange rate. All publicly information about other exchange rates have been incorporated in the in the RUSD. This is a strong indication of semi strong efficiency in the South Africa exchange rate.

4.2.5 The Granger Causality Test

Table 4.8: Granger Causality Test for South Africa Exchange Rate Series

Excluded	Chi-sq	Df	Prob.
DRPOUNDS	0.344936	1	0.5570
DREURO	0.038327	1	0.8448
DRCHF	0.487538	1	0.4850
RYEN	0.114996	1	0.7345
All	0.850865	4	0.9315

Source: Author's Computation (2019)

From Table 4.8, the individual exchange rates are not significant at 5% level of significance in granger causing RSUD in South Africa. The individual probability values failed to reject the null hypothesis of no granger causality. Hence, it means that information and changes in other exchange rates do not affect the RUSD exchange rate in South Africa. Furthermore, the collective probability values for all the exchange rates do not also significantly affect the South African exchange rate to US Dollar. With a probability value of 0.9315, it has failed to reject the null hypothesis of the other exchange rates not granger causing the RUSD. This is also a sign denoting that the South African exchange rate is efficient in the semi strong form.

4.2.6 The Co-integration Test

Table 4.9: Co-integration Test for South Africa Exchange Rate Series

ARDL Bounds Test				
Test Statistic	Value	K		
F-statistic	1.990535	4		
Critical Value Bounds				
Significance	I0 Bound	I1 Bound		
10%	2.45	3.52		
5%	2.86	4.01		
2.5%	3.25	4.49		
1%	3.74	5.06		

Source: Author's Computation (2019)

Table 4.9 showed that the test statistics at 1.99 is lower than the critical value bands at I(0) of 2.86 and I(1) of 4.01. This result has failed to reject the null hypothesis of no long-run equilibrium relationship among the exchange rates in South Africa. This corroborates the results of granger causality and variance decomposition tests in South Africa. In conclusion therefore, the result revealed that the exchange rate market is efficient in the semi-strong form.

4.3 Implications of Findings

The comparative study of the Nigerian and South African foreign exchange market showed that the Nigerian foreign exchange market is efficient in the weak and semi-strong form. This implies that all past and publicly available information are already incorporated in the market prices of exchange rates, thereby making it impossible for investors and market participants to outperform the market by making abnormal gains. The South African foreign exchange market is semi-strong efficient and also weak form efficient except in the case of Rand to Dollar and Rand to Yen. This implies that there exist exploitable trends that market participants can use to make profits by formulating trading technique that can be used to predict future movements of exchange rate from its past values. This result conforms to the findings of Otapo (2016) which concluded that the Nigerian exchange market is efficient in both weak and semi-strong form. The South African market is also efficient in the weak form except for the case of Rand to Dollar and Rand to Yen which showed inefficiency but efficient in the semi-strong form.

This suggests that market participants in Nigerian exchange market would not be able to device some rules or techniques that can be used to predict future movements of exchange rates from its past values. It also connotes that all available information both in past and publicly available information have been incorporated in the prices of exchange rates, thereby making it impossible for market participants to make abnormal gains. This is also true for the South African foreign exchange market except in the case or Rand to Dollar and Rand to Yen which may give opportunity for market participants to make gains by predicting the future movements of these rates from their past values.

5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

This study examined the weak and semi-strong form efficiency of Nigerian and South African foreign exchange market using the inter-bank spot exchange rates of Naira to CHF, EURO, POUNDS, USD and YEN compared to the exchange rates of Rand to CHF, EURO, POUNDS, USD and YEN for the period of January 2010 to December 2017. The Augmented Dickey Fuller (ADF) and the Phillip Peron (PP) tests were carried out to test for the weak form efficiency of both countries while the co-integration, granger causality and variance decomposition tests were used to determine the semi-strong form efficiency of both countries. The study revealed that the Nigerian foreign exchange market is efficient in both weak and semi-strong form, and the South African foreign exchange market is also efficient in the weak form except for the cases of Rand to Dollar and Rand to Yen which indicated inefficiency but efficient in the semi-strong form.

The study concluded that market participants in Nigerian exchange market would not be able to device some rules or techniques that can be used to predict future movements of exchange rates from its past values. The South African foreign exchange market is also efficient except in the case or Rand to Dollar and Rand to Yen which revealed inefficiency. It is therefore recommended that the flexible exchange rate regime adopted in Nigeria should be liberalized and more of the clean float and government intervention should be minimal since the market is efficient in both weak and semi-strong form. The market forces of demand and supply should be allowed to set equilibrium prices as in the case of South African foreign exchange market.

Also, the inter-bank market in both countries should be well monitored and managed by the regulatory authorities so as to promote effective and efficient smooth functioning of the foreign exchange market as well as achieving a stable and realistic exchange rates in both countries.

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