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The Sensitivity of Sector Stock Returns to Exchange Rate Risks in Nigeria

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Cover Page Footnote

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The Sensitivity of Sector Stock Returns to Exchange Rate Risks in Nigeria

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Abstract

Exchange rate exposure has been identified in the literature as one of the standard metrics for measuring the performance of stock returns in both advanced and developing economies. This study adopts the capital market approach in investigating the effects of exchange rate exposure on stock returns in Nigeria, using monthly data spanning 2009 to 2018. The findings show that three sector stock returns, namely the NSE30, pension and banking indices, were significantly vulnerable to nominal effective exchange rate and bilateral exchange rates shocks. The non-significance of energy sector, proxied by the oil and gas, to exchange rate risk, is puzzling, but was consistent with the findings of Xie (2011) for the Japanese economy. Results from the bilateral estimates indicated that the NSE30 was most sensitive to the euro exchange rate risk, while positive exposure was evident for the pension sector for all currencies. The study recommended the need to sustain the central bank's current exchange rate policies, which had resulted in the convergence of rates in the market.

Keywords: Exchange Rate Exposure, Sector Stock Returns, Nominal Effective Exchange Rate, Bilateral Exchange Rate, Capital Market

JEL Classification: *F31, G12*

I. Introduction

The conduct of monetary and fiscal policies and the performance of domestic economies in today's open economies are increasingly under intense influence and pressure from external shocks. This is underscored primarily by the continued integration of regional and world markets, and the adoption of financial liberalisation policies. Others are the implementation of flexible exchange rate regimes, reduction in cross-border transport cost as a result of the elimination of trade barriers/restrictions, and the sophistication of the financial market, characterised by freer capital mobility across countries (Akay and Cifter, 2014). The result did not only boost cross-border trade, but also brought to the fore the prominent role of exchange rate, both as the conduit for transmitting external impulses to the domestic economy and the metric for measuring and evaluating the state of health of the economy. Against this background, therefore, a change in exchange rate (depreciation or appreciation) portends direct and/or indirect economy-wide repercussions,

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especially on the activities and value of economic agents, operating in the economy.

In the literature, several analyses on exchange rate exposure have been conducted, especially from the 1980s, following increased international trade activities, arising from globalisation and regional integration of markets. Generally, the concept of exchange rate exposure has been viewed differently in the literature. To Hodder (1982), it is the relationship between returns of firms' assets and exchange rate movements. Heckman (1983) refers to it as the influence of exchange rate changes on foreign investment or the sensitivity of a firm's economic value or stock price to exchange rate changes. The study by Choi (1986) expresses it as the present value of future cash flow of firms' exposure to exchange rate risk. However, the most generally acceptable definition of exchange rate exposure is that proffered by Adler and Dumas (1984:42), where it is defined as the "degree to which the value of a firm is affected by changes in exchange rate". The key feature of this definition is the possibility of linking exchange rate exposure to stock returns or cash flow of firms, quantitatively.

According to Aggarwal and Harper (2010), the effects of exchange rate movements are not limited to economic agents, but traverse all economic sectors, including cross-border multinational corporations, trading partners and governments. This extends the impact of exchange rate shocks beyond influencing firms' decision making processes and future cash flows, to encompass international asset pricing and valuations (Jacque, 1996; Hsu et al., 2009; and Lin, 2011). Exchange rate risk has also been associated with performance of countries' bilateral trade, capital flows, value of domestic and foreign competitive firms, and the general price level. Others are the level of market competitiveness, profitability of domestic firms, and major macroeconomic uncertainties (Frankel and Rose, 2002; Hsu et al., 2009; Shapiro, 1975; Bodnar and Gentry, 1993; and Jacque, 1996). However, such exposure has been found to vary according to the nature of exchange rate regime (fixed or floating) a country operates. Dominiguez and Tesar (2006), for instance, noted that the cash flows of firms in economies with floating exchange rate are conventionally more susceptible to wide and high volatility in exchange rate than those in fixed or managed regimes. For developing economies, such as Nigeria, exchange rate fluctuations are compounded by the inherent internal complexities and structural rigidities, coupled with weak external trade balances.

Though exchange rate movement has been noted as a critical driver and determinant of stock market performance and business cycles, empirical

findings on the nexus between stock returns and exchange rate exposure are mixed. For instance, studies by Jorion (1990), Griffin and Stulz (2001) and Amihud (1994) found a weak and insignificant exposure for US firms. In contrast Doigbe, et al., (2000), He and Ng (1998), Chow, et al., (1997), Walsh (1994) and Chue and Cook (2008) observed strong positive sensitivity of stock returns to exchange rate exposure for Japanese firms. In terms of direction, Chow and Chen (1998) demonstrated the negative response of Japanese firms and the accompanying decline in equity returns to a depreciation in the yen. This is dissimilar to the positive correlation observed by Dominguez (1998) for the same economy.

The literature on exchange rate exposure in Nigeria is growing, with focus at various segments of the markets. Isaac (2015) and Offiong et al., (2016), for instance, examined the banking sector exposure to exchange rate volatilities; Olufemi (2011) investigated exchange rate risk exposure of 117 listed firms at the Nigerian stock market, while Agbeja et al., (2016) scrutinised the impact of exchange rate exposure on commercial banks' profits. None of these studies documented the issue from the sectoral perspective. The implication is that previous studies had only approached the issue in silos, treating each sector independent of others in disregard to the heterogeneous (interrelationships and interdependence) nature that exist between the sectors. This, thus, suggest that policy recommendations were sector specific, which denies policy makers of the holistic view and dynamics that interplay at the sectoral levels. This, thus, forms the crux of this study, which is aimed at investigating exchange rate exposure at the sectoral levels, as well as, measuring the sensitivities of these sectors to the movements in currencies of Nigeria's major trading partners. The study adopted the traditional definition of exchange rate exposure, as the statistical significance between sector stock returns and changes in exchange rate returns, in testing the exposure of sector level returns to exchange rate risks.

The objectives of this study are two-fold. First, it attempts to measure the direction and magnitude of the exposure of seven sector stock returns to exchange rate innovations in Nigeria, using monthly data spanning 2009:1 and 2018:3. The choice of this period and sectors is guided by the availability of sector level data. Second, the study investigates the exposure of sector returns to exchange rate fluctuations in the currencies of selected Nigeria's major trading partners, namely the British pound, the Chinese Yuan, the US dollar and the euro. The purpose is to ascertain the concentration of exchange rate exposure in the market to a currency, and empirically elicit additional information on sector returns exposure to exchange rate risk. This is expected to help in assessing the prospects and implications of the recent currency swap agreement between Nigeria and China.

This study is divided into five Sections. Following the introduction, Section 2 briefly reviews the conceptual and empirical literature on exchange rate exposure and sector stock returns; while Section 3 highlights exchange rate management practices and evolution in Nigeria. Section 4 discusses data and methodology employed in the estimation, as well as assesses data properties, while the empirical result is presented in Section 5. Section 6 concludes the paper.

II. Brief Review of Conceptual and Related Empirical Literature

Empirical studies on the relationship between exchange rate exposure and stock returns are gaining popularity, gradually. In the financial economics literature, foreign exchange exposure is generally classified into the transaction, economic and translation exposures (Shapiro, 1996; Eun and Resnick, 1998; Madura, 1989; and Al-Shboul and Anwa, 2014). The transaction exposure component or short-term economic exposure of foreign exchange rate connotes the unexpected risk associated with a firm's contract, denominated in currencies other than the domestic currency. In other words, it is a risk associated with firms' contractual transaction that generates inflow or outflow of foreign currency. In this case whether the firm is on the buying or selling side of the transaction, it is naturally exposed to movements in the exchange rate of its trading partners, relative to its domestic currency.

The economic exposure, also referred to as the operating exposure, is the long-term effect of transaction exposure, where the firm's expected future operating cash flows in foreign currency is affected by changes in foreign exchange rate. Economic exposure impacts on the market value and profitability of the firms and could take place where the future cash flows of domestic firms denominated in local currency are unduly exposed to foreign competition. For instance, exchange rate fluctuation exposure weakens the expected cash flow and, to a large extent, the net present value of domestic firms, as the position of foreign competitors' strengthens vis-à-vis domestic firms. Exchange rate exposure, therefore, affects firms' operations, relative to its competitive position, revenues (domestic sales and exports) and operating expenses (cost of domestic input and imports).

The translation component of exchange rate exposure refers to losses or gains arising from the consolidated financial statements, especially of multilateral corporations with international subsidiaries. This exposure arises from the year-end conversion or consolidation of financial statements of subsidiaries located in other countries. The reporting of combined operations of the firm (headquarter and subsidiaries) in the domestic currency could potentially result

in losses or gains because of the different currencies involved. These exposures are not mutually-exclusive but strongly influence the firms' cash flows and, by extension, the value of the firm.

Several factors have been identified as determinants of exchange rate risk. The seminal work of Kenen (1966) attributed the increased exchange rate risks to the abrogation of the Bretton Woods system; the introduction of flexible exchange rate regime; and the intense relaxation of exchange rate controls, following globalisation and liberalisation policies, especially in the early 1980s. Other factors include the prevalent financial and economic conditions that propelled many firms to engage in international or cross-border transactions, as they sought for expanded markets, low labour cost, natural resources and ultimately higher returns.

Kenen's (1966) postulation was tested by Jorion (1990) and Choi and Prasad (1995) in the case of the US multinationals; He and Ng (1998) for Japanese multinationals; Glaum et al., (2000) for Germany; Erb et al., (1998) for the Asian economies; and Abdalla and Murinde (1997) for the four Asians economies of India, Korea, Pakistan and the Philippines. The findings were mixed, as some studies observed innovations in exchange rate impacting on the stock prices significantly, while others did not.

Dominguez and Tesar (2006) examined the exchange rate exposure of publicly-listed firms in selected industrialised and emerging economies and found a coefficient of 0.5 per cent exposure for the sampled economies, while the direction of exposure varied, over time. Evidence of positive effect of exchange rate on money supply was observed by Hsing (2006); while foreign exchange rate exposure estimated by Lin (2011), for six Asian countries, showed that a 1.0 per cent appreciation of the Indian Rupee decreased market returns by 6.99 per cent. For a sample of 15 emerging market economies, including India, Chue and Cook (2008) found only 5.0 per cent of the firms exposed to exchange rate risk. Similarly, Jorion (1990) and Choi and Prasad (1995) equally found positive relationship between exchange rate exposure and foreign operating profits and sales of assets. Although He and Ng (1998) associated firm's exposure of exchange rate to its level of exports ratio and firm size, Allayanis and Ofek (2001) and Dominguez and Tesar (2001) failed to obtain similar outcomes for firms in eight emerging economies.

The exposure of economies to exchange rate risks for Africa was examined by Beatrice (2001) for Zambia, Faulkner and Makrelor (2008) for South Africa, Chowdhury (1999) for Papua Guinea, Takaendea (2006) for Angola, Sangay

(2015) for Kenya and Adamgbe (2006) and Isaac (2015) for Nigeria. These studies unanimously found exchange rate exposure affecting major macroeconomic indicators, such as terms of trade, investment, inflation rate, fiscal deficits, real interest rate, and domestic credit. Empirical evidence by Odedokun (1997) indicated that stock returns, along with other macroeconomic indicators in Nigeria, were positively correlated with exchange rate exposure. The study by Isaac (2015), which focused on exchange rate risk in the banking sector of the Nigerian economy, using auto-regression conditional model, showed that exchange rate exposure affected the performance of banks and financial institutions, significantly. While the study noted a positive relationship between real exchange rate and terms of trade and real interest differential, a negative correlation for capital account liberalisation, risk and per capita income was observed. This study intends to contribute to the extension of the frontiers of literature from the Nigerian perspective and provide holistic and dynamic insight on the relative exposure conditions of sectors to exchange rate shocks. This motivation is distinct, compared with the hitherto single-sector approach of previous studies.

III. Brief Synopsis of Exchange Rate Management in Nigeria

Exchange rate management in Nigeria is a complex and daunting task. Prior to the adoption of the Structural Adjustment Programme (SAP) in 1986, the fixed exchange rate framework was in operation, based on the Exchange Control Act of 1962. The regime focused on controlling international capital flows, eliminating trade imbalance and stabilising the domestic exchange rate through controls. Under this approach, the domestic currency was pegged, first to the British pound and later to the US dollar, and then to a basket of currencies, and administrative controls were employed to determine exchange rate of the local currency. However, owing largely to the collapse of the Bretton Wood institution, coupled with its inability to account for market fundamentals, the fixed regime was jettisoned and replaced with flexible or floating exchange rate regime.

The adoption of the flexible framework allowed the exchange rate to be influenced by, as well as respond to, market dictates and dynamics. The framework was expected, theoretically to: ensure the efficient allocation of resources; moderate domestic price level; widen the fiscal space; promote export competition; build investor confidence; and improve the balance of payment position of the economy. The transition to flexible exchange rate was also intended to eliminate the macroeconomic distortions associated with a misaligned exchange rate, such as the inhibition of export growth, the negative

impact on investment decisions and slow per capita output. It was, therefore, expected that the "new" structure would enthrone economic stability and ensure internal balance, consistent with the developmental objectives of the nation.

In reality, the outcomes of the flexible exchange rate framework were far from the expectation resulting in the incessant tinkering of policy to reflect the economic realities, ameliorate the effects of the spikes and volatilities in the exchange rate, and curb the depreciation of the naira. Some of such policies included: the introduction of the Second-tier foreign exchange market (SFEM) in 1986; the unified official market in 1987; the autonomous foreign exchange market (AFEM) in 1995; the Inter-bank foreign exchange market (IFEM) in 1999; the enlarged foreign exchange market (FEM); and the retail and wholesale Dutch auctions system (rDAS and wDAS) in 2006. The Bureau-de-Change (BDC) segment of the market was introduced in 1989, with a view to granting access to small users of foreign exchange, as well as, to deepen the market.

Several of these policy measures, however, failed to achieve the primary objective of dampening the excess demand for foreign exchange, due, largely, to the high appetite for imports in the face of lean and declining export earnings. This mismatch, over the decades, exacerbated the demand pressure in the foreign exchange market and sustained the persistent depreciation of the local currency. With a view to tackling the perennial mounting exchange rate pressure, occasioned by plummeting oil price (the primary source of foreign exchange earnings for Nigeria), excess demand and depleting external reserves, the country now operates exchange rate windows to further deepen the market and create multiple streams of foreign exchange flows, especially from the investors and exporters (I&E) window.

As one of the measures, the Central Bank of Nigeria, in November 2014, devalued the naira amidst the rapid decline in crude oil prices, leading to wide fluctuations in interbank rate. In 2015, the bi-weekly sale of foreign currency, through the retail Dutch auction system (rDAS) and the wholesale Dutch auction system (wDAS), was discontinued to narrow the then existing wide disparity in exchange rates, as well as conserve the country's foreign exchange reserves. The precipitous fall in the value of the naira once again resurrected the critical issues of currency fluctuations and the risk it poses on businesses engaged in transactions involving foreign currencies. It is against this background that this study seeks to highlight the implications of exchange rate risks on the performance of sector stock returns in Nigeria.

IV. Data and Methodology

IV.1 Data

The study employed monthly weighted Nigerian Stock Exchange (NSE) market all share index (ASI) and sector stock returns (SSR) index data. These were sourced from the NSE, while the data on exchange rate were sourced from the Central Bank of Nigeria database. The stock returns were composites indices, consisting of average stocks of many firms' stock prices in the sector. The indices, were useful indicators to tracking the changes in the price levels of the entire stock market or sector (Watada and Wen, 2010) and are suitable statistical parameters of overall market performance. In line with the Global Industry Classification Standard (GICS), developed by the Morgan Stanley Capital International (MSCI) and the Standards and Poor's (S&P), the NSE reforms of 2009 re-classified the market from 33 into 12 activity sectors. However, only the banking, insurance, oil and gas, consumer goods, industry, pension and NSE30 stock returns are published by the Exchange, which inform their use in the study.

In the analysis of the industry level stocks to exchange rate exposure, two broad exchange rates components were used, namely: the trade weighted exchange rate, also known as the nominal effective exchange rate (NEER) and the bilateral exchange rate. The trade weighted exchange rate was measured as the average price of the domestic goods, relative to the average price of goods of trading partners, using the share of trade with each country as a weight for that country (Xie, 2011). It is an interactive index used to compare domestic currency with trading partners' currencies, which reflects the importance of these currencies in the international trade and transactions with the domestic economy. Though the trade weighted exchange rate analysis is well received in the literature, it, however, has the limitation of smoothening out the effect of huge changes in exchange rate between currencies. This suggest that while trade weighted exchange rate might remain unchanged, there are possibilities of wide variations between domestic currency and other currencies, thus, underestimating the actual effect of exchange rate exposure (Salsifu et al., 2007).

To remedy the drawback associated with the trade weighted exchange rate, the bilateral exchange rate was introduced to measure the exchange rate of domestic currency, compared with other foreign currency. This is intended to reveal the true sensitivity of sectors to exchange rate risks and to understand the various sensitivities to exchange rate changes. In the study, four currencies were considered, namely: the UK pound sterling; the Chinese Yuan; the US dollar; and the euro. The adoption of the two broad rates enabled us to identify which of

the currencies the sectors were more vulnerable or sensitive to and to investigate whether monetary policy impulses fed to these exposures. In the study, exchange rate was expressed as the number of units of naira price per unit of the foreign currencies in the basket (in the case of the trade weighted exchange rate) and number of naira per unit of the foreign currency (the bilateral exchange rate). The bilateral rate captured better, the amplitudes and responses of the stock market to exchange rate innovations. In this study, the NEER and bilateral exchange rates were used to measure the stock returns exposure to exchange rate innovations.

Market and sector stock returns, including exchange rate, were computed as log differences to allow for ease of analysis and the changes interpreted as elasticities or percentage. For the trade weighted exchange rate, an increase in the exchange rate (positive sign) connotes a higher purchasing power (appreciation of the local currency vis-à-vis the basket of foreign currencies) or currencies of the trading partners. A decrease indicates depreciation, which requires more domestic currency to settle for imports from trading partners. Finally, the market index was included to account for the movements in the market and control for correlation between disturbances.

IV.2 Methodology

IV.2.1 Computing Exchange Rate Exposure

The computation of exchange rate exposure in the literature follows two broad traditional approaches, namely: the cash flow and the capital market approaches. The cash flow approach, introduced by Dumas (1978), and popularised by Hodder (1982) and Heckman (1983), among others, measures exposure as the impact of exchange rate changes on current cash flows. This is anchored on the perspective of the firms' internal operations. The traditional cash flow model was specified as:

$$CF_{i,t} = \beta_{i,0} + \beta_{i,1} EX_t + \varepsilon_{i,t} \qquad (1)$$

where $CF_{i,t}$ represents changes in cash flow (profitability) of firm i in period t, EX_t is the change in exchange rate in period t, $\beta_{i,0}$ is the intercept, ε_t is the error term, and $\beta_{i,1}$ measure the exchange rate exposure.

Though the approach provides in-depth analysis of firms' exposure to exchange rate innovation, it, however, has the limitation of non-availability of firm-specific

and competitor-specific data (Bodner and Wong, 2003). To circumvent this limitation, Adler and Dumas (1984) introduced the capital market approach, in which exchange rate exposure was defined as "the effect of exchange rate fluctuations on the value of an asset" (Xie, 2011:14). This measures the exposure from the perspective of investors and stock analysts, and was specified as:

$$R_{i,t} = \alpha_i + \delta_i EX_t + \varepsilon_{i,t} \quad (2)$$

where $R_{i,t}$ represent stock market return of firm i period t, EX_t is the rate of change of domestic currency vis-à-vis foreign currency, $\varepsilon_{i,t}$ independently and identically distributed error and δ_i is the total exposure of firm i to exchange rate change. According to Xie (2011), δ_i measures the part of firm i's stock returns variance that is correlated to exchange rate fluctuations. This total exposure has two components, viz: the average change in the present value of the firm component caused by exchange rate change and the non-exchange rate related component that influence macroeconomic effects that affect the valuation of firms (Bodner and Wong, 2003).

To control for market portfolio movements or macroeconomic influence in the economy, Jorion (1992) and Bodnar and Wong (2003) modified Equation 2 to include market portfolio returns (ASI), consistent with the traditional multifactor model. Nydahl (1998) adjudged the market index as suitable true representation of the returns of all the sectors in the market. This modification reduced largely the residual variance and greatly improved the measurement of the exposure estimates. The modified Bodner and Wong (2003) model, which included stock market portfolio, was specified as:

$$R_{i,t} = \beta_{0,i} + \beta_{m,i} mkt_{m,t} + \beta_{x,i} neer_{x,t} + \varepsilon_{i,t} \quad (3)$$

where $R_{i,t}$ represented the stock returns in local currency (the naira) of sector i at time t, $mkt_{m,t}$ denoted the returns of market portfolio at period t and $neer_{x,t}$ captured the monthly fluctuations or the change in nominal effective exchange rate at period t.

The study focused on sector-level analysis, rather than firm-level. According to Xie (2011), sector analysis gives a broader overview of exposure condition,

provides sector-wide exchange rate exposure risk and helps identify export- and import-intensive sectors in the economy more than the firm-level analysis. This study adopted the capital market approach in the computation of the exchange rate exposure in line with Kanagaraj and Sikarwar (2011) and Dominguez and Tesar (2006).

Two models were constructed to investigate the effects of exchange rate risk on sector returns, using the trade weighted exchange rate and on bilateral exchange rates. The separate analysis allows for comparison between trade-weighted and bilateral exchange rate exposure. The first model, which focused on estimating the sensitivity of the sector stock returns to exchange rate fluctuation, adopted Equation 3. In the second model, the sensitivity of the stock returns to the selected (bilateral) currencies was estimated. The introduction of bilateral currencies, as regressor, was intended to capture the sensitivity of individual sector returns influenced, largely, by the respective currencies (Nshom, 2007). This overcomes the drawback associated with the trade weighted exchange rate, which tended to smoothen out domestic currency response to bilateral currency movements, as the trade weighted exchange rate remain unchanged even in the face of huge fluctuations among currencies. To achieve this objective, Equation (3) was modified, by replacing $neer_{x,t}$ with $X_{x,t}$, such that:

$$R_{i,t} = \beta_{0,i} + \beta_{m,i} mkt_{m,t} + \beta_{x,i} X_{x,t} + \varepsilon_{i,t} \quad (4)$$

where $X_{x,t}$ represented the vector of the change in bilateral currencies, namely the pound sterling, the euro and the Chinese Yuan exchange rates at period t. Including all the three currencies in a single model would theoretically introduce multicollinearity, arising from the possibility of high correlation between the market and exchange rate factors, hence the substitution and estimation of the models for each currency. The coefficients $\beta_{m,i}$ and $\beta_{x,i}$ measured the sensitivity or degree of responsiveness of stock returns i to market risk and to changes in exchange rate values at time t, respectively, while $\varepsilon_{i,t}$ connoted the disturbance term. The stock returns for sector i in period t is obtained as $R_{i,t} = \ln(P_{i,t} - P_{i,t-1})$ where $R_{i,t}$ is the log returns of sector i at time t, while $P_{i,t}$ and $P_{i,t-1}$ represent the contemporaneous and lagged values of

sector price indices. Similarly, the percentage change in nominal effective exchange rate at time t was obtained as $neer_t = \ln(NEER_t - NEER_{t-1})$.

Estimating a two-factor model of this nature has been found in the literature to be associated with the problem of multicollinearity (Xie, 2011). To correct for this shortcoming, Bris, *et al* (2004) and Kiymaz (2003) suggested a two-step procedure of orthogonalising the exchange rate factor. The first involves regressing the market portfolio on the change in exchange rate algebraically, expressed as:

$$mkt_t = \rho_0 + \rho_1 neer_{x,t} + \varepsilon_t \quad (5)$$

From Equation (5) the orthogonal market portfolio return component was derived by regressing

$$mp_{m,t} = mkt_{m,t} - (\rho_0 + \rho_1 neer_{x,t}) \quad (6)$$

Exchange rate exposure was, thus, computed by regressing the individual sector stock returns on the orthogonal market portfolio component (as shown in Equations 6) and the changes in the exchange rate. The final equations estimated were specified as

$$SSR_{i,t} = \alpha_i + \beta_{m,i} mp_{m,t} + \beta_{x,i} neer_{x,t} + v_{i,t} \quad (7)$$

and

$$SSR_{i,t} = \alpha_i + \beta_{m,i} mp_{m,t} + \beta_{x,i} X_{x,t} + v_{i,t} \quad (8)$$

Where $SSR_{i,t}$ represented the stock returns of sector i in period t, $mp_{m,t}$, indicated the estimated orthogonal component of the market portfolio (mkt), while all other variables were as defined earlier. As previously stated, the $\beta_{m,i}$ and $\beta_{x,i}$ coefficients measured the individual sector exposure or sensitivity to market and foreign exchange rate innovation. The level and direction of exposure to exchange rate fluctuation were indicated by the statistical significance of the coefficients and the associated signs. For the trade weighted exchange rate, an increase in the index implies higher purchasing power for the local currency against trading partners' currency. A positive coefficient theoretically indicates an increase in stock returns, when the currency

appreciates against other currencies in the basket of currencies, while a lower index signifies depreciation, where more of the domestic currency would be needed to pay for imports.

For the second model that used bilateral exchange rates, the orthogonal market portfolios were computed by substituting the trade weighted exchange rate index with the individual bilateral exchange rates and then estimated. Thus, an increase (decrease) in the bilateral exchange rate coefficients implies depreciation (appreciation) of the local currency against the foreign currency. A positive coefficient connotes depreciation and has a positive effect on sector stock returns, suggesting that the sectors are export-oriented.

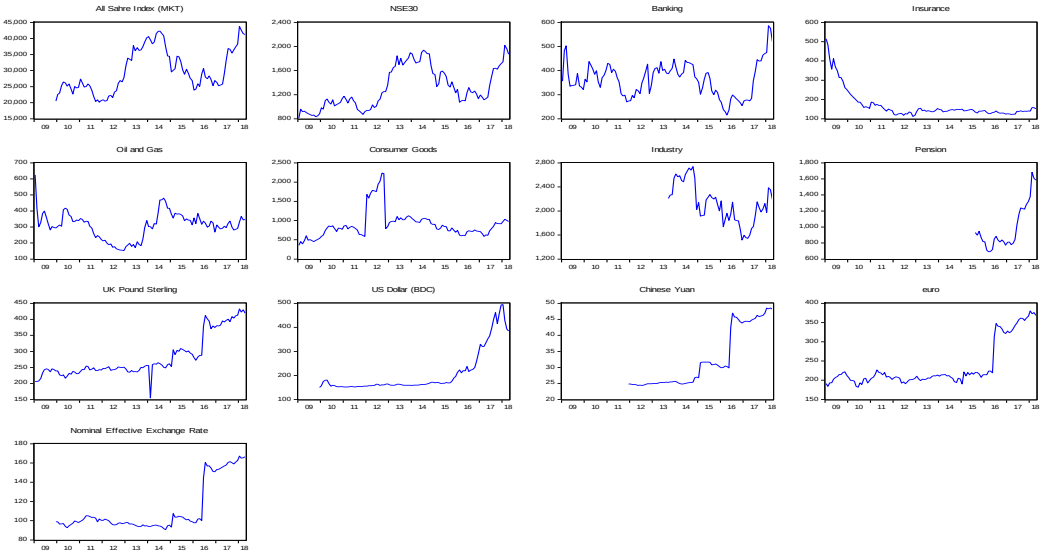
To avoid estimator bias, and ensure stability and reliability of estimates, preliminary diagnostics, such as stationarity, multicollinearity, autocorrelation and heteroscedasticity tests, were conducted. The ADF was used to test for unit root in all variables, while the Newey-West test procedures were used to correct for autocorrelation and heteroscedasticity in the regression, where found. The orthogonalisation of the exchange rate corrected the multicollinearity in the regression.

V. Empirical Estimation and Discussion of Results

V.1 Test of Stationarity

Macroeconomic data, especially stock market data, had been found to be inherently non-stationary. To purge the non-stationarity feature of the series, the percentage changes were computed before the model was estimated. A bird's eye view of the non-stationarity properties of the series is presented in Figure 1, which shows the graphical plots of the NEER, the bilateral exchange rates, and the market and sector stock returns. It is observed that the graphs exhibited significant fluctuations and were not mean reverting.

Figure 1: Graphical Representation



To further ascertain the stochastic properties of the series, the traditional Augmented Dickey –Fuller (ADF) test was employed to test for the presence of unit root with the Phillips and Perron (PP) test conducted as a confirmatory test. The result of the transformed or changes in the series is presented in Table 1. The test was conducted with the inclusion of trend only.

Table 1: Unit Root Tests

Variable	ADF	PP	Order of Integration
Weighted Exchange Rate (NEER)	-8.876***	-8.852***	I(0)
BDC Exchange Rate (US$)	-7.367***	-7.321***	I(0)
British Pound Sterling (£)	-15.138*	-20.179*	I(0)
Chinese Yuan (¥)	-7.380*	-7.391*	I(0)
The euro (€)	-10.57*	-10.574*	I(0)
Market Portfolio	-8.424***	-8.403***	I(0)
NSE30	-8.558***	-8.540***	I(0)
Banking Index	-9.518***	-9.527***	I(0)
Insurance Index	-7.246***	-9.384***	I(0)
Oil and Gas	-9.072***	-9.035***	I(0)
Food Beverages and Tobacco	-8.854***	-8.889***	I(0)
Pension	-3.978*	-3.989*	I(0)

Note: ***statistically significant at 1.0 per cent using critical values by Mackinnon (1996).

The null hypothesis of the presence of unit root was rejected for the weighted and bilateral exchange rates, market and sector stock returns, implying stationarity and statistical significance at 1 per cent, using a one-tailed test. The ADF and PP test results in Table 1 showed the coefficients of all variables being statistically significant at 1.0 per cent level.

V.2 Descriptive Statistics

The descriptive statistics of the full sample of the non-transformed exchange rate and stock returns indices was presented in Table 2. Evidence from the Table showed that the average exchange rate of the naira, at the BDC segment of the market, during the sample period, stood at ₦304.43, approximately twice as much as the NEER (₦140.59), but below the ₦365.69 value of the British pound. Similarly, the minimum and maximum values of BDC were higher, compared with the NEER rate. Expectedly, the mean of the NSE30 far outweighed the sector averages, ostensibly because the NSE30 comprised the 30 most significant key players in their market. The standard deviation, used here to measure the variability or volatility of the series, showed significant instability in all the series from their respective means (or from zero), with the Chinese Yuan, exhibiting the least volatility (7.25 per cent), followed by the NEER (27.41 per cent).

Table 2: Descriptive Statistics

	Mean	Minimum	Maximum	Std. Dev.	Skewness	Kurtosis
Market (ASI)	30910.39	23916.15	43773.76	5946.72	0.80	2.31
NSE30	1377.58	1074.47	2019.76	269.73	0.92	2.71
Banking	340.10	215.47	586.16	103.47	0.99	2.77
Insurance	135.36	122.91	157.52	8.91	0.74	3.36
Oil and Gas	321.55	268.28	383.93	27.21	0.12	2.38
Cons. Goods	766.15	588.35	1032.79	128.91	0.59	2.25
Industry	1941.66	1516.12	2384.93	240.29	-0.12	2.08
pension	989.76	691.92	1682.28	281.01	1.11	3.07
UK Pound	365.69	272.27	432.41	53.11	-0.64	1.79
Chinese Yuan	41.07	29.86	48.52	7.25	-0.75	1.72
US Dollar	304.43	168.64	494.70	103.59	0.37	1.77
Euro	307.84	207.82	380.25	62.69	-0.65	1.70
NEER	140.59	97.76	167.13	27.41	-0.77	1.72

This suggests, intuitively, that sector stocks were more exposed to fluctuations in exchange rate movements. The positive kurtosis indicated fat tail for all series. All the currencies, except the US dollar, were negatively skewed, while, among the sectors, only the industry sector exhibited negative skewness.

V.3 Discussion of Results

In this section, the sensitivity of the sector stock returns to changes in the trade weighted exchange rate index was examined. The βmp represented the beta or risk parameter for market, while $\beta neer$, βukx $\beta chnx$ and $\beta eurx$, denoted the risk parameters for nominal effective exchange rate, the UK pound, the Chinese Yuan and the euro exchange rates, respectively. Our methodology follows the two-step approach proposed by Bris, et al. (2004) and Kiymaz (2003) in estimating exchange rate exposure. This approach has also been applied by Kanagarai and Sikarwar (2011), Xie (2011), and Akay and Cifter (2014), with satisfactory results.

V.3.1 Trade Weighted Exchange Rate Model: The Findings

The result on trade weighted exchange rate regression, which measures the degree of exposure of the sectors to exchange rate innovation, was reported in Table 3. The Table showed that out of the seven sectors, the NSE30, the banking and the pension sectors (representing 42.86 per cent of the sample), were significantly exposed to exchange rate risk at 1.0 per cent level. This finding far exceeded the 28.51 per cent reported by Jorion (1990) and Bodnar and Gentry (1993), for the US, and the 26.0 per cent reported by Nydahl (1998), for Sweden. The outcome was also consistent with the fundamentals when benchmarked against the fact that the NSE30 index comprised the 30 largest corporations across the market, irrespective of the sector they belong. These are usually multinational conglomerates (parent companies) with several subsidiaries. Because their demand for foreign exchange is high and frequent, fluctuations in exchange rate significantly expose the conglomerates to higher risks. The result confirmed, according to Nance *et al.,* (1993), the intense involvement of these companies in international trade activities, which accounted for their high exposure to exchange rate risk. Though the other four sectors' risk betas were not statistically significant, they were, however, positive, suggesting better stock returns performance when naira appreciates against the trading partners' currency.

The sensitivity of the banking sector to exchange rate risk was consistent with the findings by Adebiyi et al., (2009) and Abeng (2018) and explained, largely, by the intermediary role of the sector in the economy and its involvement in rent seeking and currency speculative activities (round tripping) at the foreign exchange market. Theoretically, under the flexible exchange rate regime (market forces), the monetary authority is expected to have minimal role in stabilising the rate in the market. However, holding on this rule would have

greatly altered the fortunes of Nigeria, hence the frequent interventions in the foreign exchange market by the Central Bank of Nigeria. This has minimised the incentives for arbitrage (speculative activities) by private banks and investors, and increased the supply of credit to the real sector of the economy; thereby supporting growth and development.

The sensitivity of the pension index to NEER was borne out of the quantum of funds in this sector, which stood at ₦4.537 trillion, as at 2016, arising from the full implementation of the uniform contributory pension scheme for both private and public sectors. The 2004 Pension Reform Act, as amended by the 2014 Act, required that pension funds be invested in bonds, securities, debentures, investment certificates of closed-end investment funds or hybrid investments funds listed on the Stock exchange. This implied that the impulses, magnitude and direction of exchange rate risk on the stock market are transmitted to the pension sector, and, by extension, influence their portfolio adjustment, accordingly.

Table 3: Model Results

	Trade Weighted Exchange Rate Model		**Bilateral Currency Regression Models**							
	βmp	$\beta neer$	βmp	βukx	βmp	$\beta chnx$	βmp	$\beta eurx$	βmp	$\beta usdx$
NSE30	**1.036*** (0.000)	**0.137*** (0.000)	**1.035*** (0.000)	**0.038*** (0.007)	**1.047*** (0.000)	**0.122*** (0.000)	**1.035*** (0.000)	**0.186*** (0.000)	**1.035*** (0.000)	**0.097*** (0.001)
Banking	**0.788*** (0.000)	**0.305***** (0.074)	**0.799*** (0.000)	0.085 (0.291)	**0.699*** (0.000)	0.299 (0.126)	**0.794*** (0.000)	0.215 (0.157)	**0.806*** (0.000)	0.014 (0.944)
Insurance	**0.323*** (0.002)	0.027 (0.710)	**0.326*** (0.013)	-0.052 (0.108)	**0.241*** (0.016)	0.017 (0.889)	**0.326*** (0.001)	0.020 (0.791)	**0.328*** (0.000)	-0.117 (0.328)
Oil and Gas	**0.441*** (0.002)	0.086 (0.405)	**0.447*** (0.001)	-0.052 (0.281)	**0.375*** (0.014)	0.103 (0.348)	**0.451*** (0.002)	0.015 (0.898)	**0.466*** (0.001)	-0.034 (0.788)
Cons. Goods	**0.641*** (0.000)	0.267 (0.170)	**0.651*** (0.000)	0.075 (0.353)	**0.493*** (0.003)	0.189 (0.442)	**0.642*** (0.000)	0.220 (0.250)	**0.656*** (0.000)	0.029 (0.876)
Industry	**-0.072*** (0.003)	0.119 (0.338)	**0.059***** (0.070)	0.023 (0.631)	-0.068 (0.691)	0.109 (0.576)	-0.080 (0.569)	0.107 (0.429)	-0.049 (0.769)	-0.215 (0.291)
Pension	**0.318***** (0.078)	**0.447*** (0.000)	**0.306***** (0.093)	**0.486*** (0.000)	**0.315***** (0.083)	**0.479*** (0.000)	**0.298***** (0.091)	**0.458*** (0.000)	**0.375**** (0.044)	-0.045 (0.871)

Notes: *, **, and *** represents 1, 5 and 10 per cent significance, respectively.

The trade weighted model was estimated with the sector indices regressed against the trade weighted exchange rate (nominal effective exchange rate, NEER), while in the bilateral currency regression model, the NEER was substituted with the British pound sterling (UKX), the Chinese Yuan (CHNX), the US dollar (USDX) and the euro (EURX) in the estimation.

It is noted that though only three of the sectors in the sample were sensitive to exchange rate shocks, all the sector coefficients were positive. The positive parameters indicated an appreciation of the domestic currency against the basket of trading partners' currencies. This implied that domestic investors needed less domestic currency to pay for imports, resulting in a positive effect on sector stock returns. In other words, these sectors benefited from the appreciation of the naira. All the sectors stock returns, except industry, were positive and sensitive to market beta or risk at different levels of statistical significance. This was not surprising since the indices were all nested in the market index. This showed that an increase in market risk invariably exposed sector stock returns to risks, while the inverse would hold for the industry sector, though not statistically significant in the model. The negative coefficient indicated that industry returns were adversely exposed to market risk.

The findings on small number of firms exposed to exchange rate risk were consistent with the findings by Cheu and Cook (2008) and Lin (2011) for the emerging economies, and Xie (2011), for the Indian economy. According to Lin (2011), the detection of foreign exchange exposure was difficult, especially in emerging and developing economies, where the central banks intervene intermittently in the market (injection and withdrawal of foreign currencies) to keep the rate stable. This ostensibly explains the case for Nigeria where government frequently and intermittently intervenes at the foreign exchange market to keep the rate stable to promote and support growth and development.

V.3.2 Bilateral Currency Exchange Rate Model: The Findings

In the previous section, the trade weighted exchange rate index (NEER) was used to evaluate the exposure of the sectors to exchange rate risks. However, given the heterogeneous nature of the sectors, there are possibilities that individual sectors in the market could be exposed differently to bilateral currencies of their trading partners. Thus, in this section, the exposure of the various sector stock returns to the bilateral exchange rates of selected Nigeria's most significant trading partners, namely; the UK pound sterling, the Chinese Yuan, the US dollar and the euro, was analysed. Theoretically, it is expected that

the risk coefficients should be strongly significant and high, given that the Nigerian economy depends predominantly on import from these countries. Ironically, the bilateral exchange rate results generally mimicked the trade weighted results in various aspects in terms of significance and direction, indicating the similarities in the risk of exposure to both, except for the banking sector.

Results from the model showed that only the NSE30 sector, which comprised the 30 largest conglomerates in the market, and the pension sector, were found to be statistically significant and positively related to changes in the exchange rate of all the currencies, except the pension sector that is negatively related to the US dollar. This represented 28.57 per cent significance beta and implied that only two sectors benefited from the appreciation of the naira, and, hence an improvement in the sector indices. These finding were consistent with the observations of Xie (2011), which noted that the speculative attacks on the foreign exchange market, was higher for conglomerates than small-sized companies, owing to arbitrage that was cash-based.

The NSE30 sector was found to be more exposed to the euro exchange risk (0.19 per cent), followed by the Chinese Yuan (0.12 per cent), the US dollar (0.10 per cent), and the British pound sterling (0.04 per cent). The positive beta indicated a lower purchasing power (depreciation) of the naira vis-à-vis the trading partner's currencies. The exposure of the conglomerates sector was plausibly explained by their international network, given their huge volume of exports and imports. In an inefficient exchange rate regime, these conglomerates exposure to exchange rate risk should be more pronounced and significant. The pension sector demonstrated equal positive exposure to all the currencies, except the US dollar at an approximate average of 0.38 per cent.

Evidence from the estimate also showed that only the insurance and oil and gas sectors exhibited negative outcomes to the British pound and the US dollar, though not statistically significant. This implied that the appreciation of these foreign currencies was found to negatively expose the sectors to exchange rate risks and, thus, weakened their competitiveness, as more domestic currency was required to finance the import of raw and intermediate materials, as well as expertise for the operations of the firms. The insignificance of the sectors to the US dollar is puzzling but could be accounted for by several factors, including, but not limited to the entering into trade agreement, such as: the currency swap agreement with the Chinese government that reduce dependence on the dollar; the sourcing of foreign exchange by large entities from the central bank's official window at much reduced or concessionary rates; and government

concerted effort to narrow the spread between the BDC and I&E window. Similar to the trade weighted exchange rate outcome, the sensitivity of the stock returns to market coefficient was negative and insignificant to all currencies, except the UK pound where a 10 per cent level of significance was recorded.

VI. Conclusion

This study was set to determine the degree of sector stock exposure to trade weighted and bilateral exchange rate risks, using capital market approach. Inference from the study indicated an evidence of relationship between stock returns and changes in exchange rate for some sectors in the sample. The study showed that only the NSE30 and the pension indices were significantly exposed to shocks to the trade weighted and bilateral exchange rates, while the banking sector was exposed only to the NEER but insignificant to changes in the sampled bilateral currencies. These results have some implications. For instance, the findings indicated that the appreciation of the naira impacted positively on stock returns of these sectors, which suggested, intuitively, that they were export-oriented sectors.

The insignificance of the energy sector, represented by the oil and gas, was a puzzle but consistent with the findings of Xie (2011), where the energy sector exposure to exchange rate risk was insignificant for the Japanese economy. The capital intensity of the sector, coupled with high foreign component in operations and partnerships, gave them access to foreign capital, and hence less-exposed to exchange rate shocks. Premised on the above findings, it could be inferred that significant difference existed in the measurement of exchange rate exposure of stock returns, using the weighted and bilateral measures of exchange rate in the Nigerian economy.

These results have economy-wide implications. The significant impact of exchange rate risk on the NSE30, banking and pension sectors' performance is very instructive and intuitive. These sectors are key drivers of employment and economic growth. It, therefore, goes to suggest that a stable exchange rate is capable of spurring the performance of these sectors with the potential to generate employment and improve economic output. The opposite will hold in the case of exchange rate risk spike. More so, the positive beta of the sectors on bilateral basis, suggest a worsening outcome for sector performance and further underscore the need for the efficient management of exchange rate in the economy. If the Central Bank of Nigeria has to achieve its low inflation rate and high economic output, it is, therefore, recommended that the central bank sustain and improve on its exchange rate policies, which had resulted in the

convergence of rates in the market. This will go a long way to achieving its overarching objective of low and stable inflation rate consistent with the growth objectives of the government. Though Nigeria is not an exchange rate targeting economy, the current emphasis by the Central Bank of Nigeria on maintaining a stable exchange rate, though at a moderately high cost, must be sustained, given that the economy is largely dependent on the import of petroleum products and other necessities to bridge the ever-yawning supply gaps in the economy.

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